FINAL (Revision 1)
HUMAN HEALTH RISK ASSESSMENT

SMOKEY MOUNTAIN SMELTERS
KNOX, KNOX COUNTY, TENNESSEE

PREPARED FOR:

U.S. ENVIRONMENTAL PROTECTION AGENCY

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REGION 4
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PREPARED BY:

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ASSOCIATES, INC.

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Acronyms and Abbreviations

ABS_{GI}	fraction of contaminant absorbed in the gastrointestinal tract
ADAF	age dependent adjustment factors
ADD	average daily dose
AF	adherence factor
AI	adequate intake
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
BCA	bias-corrected accelerated
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BW	body weight
CA	air concentration
CLT	central limit theorem
cm^2	square centimeter
COPC	contaminant of potential concern
CSF	cancer slope factor
CSF_d	dermal cancer slope factor
CSF_o	oral cancer slope factor
CSM	conceptual site model
CTE	central tendency exposure
DA_{event}	absorbed dose per event
E	inhalation exposure per shower

Acronyms and Abbreviations

EA	exposure area
ED	exposure duration
EF	exposure frequency
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
EV	event frequency
FI	fraction ingested
ft	feet
g/day	grams per day
GI	gastrointestinal tract
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	hazard index
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic model
IR	inhalation rate
IRF	fish ingestion rate
IRIS	integrated risk information system
IRS	soil ingestion rate
IRW	water ingestion rate
JMWA	J.M. Waller and Associates
kg	kilogram

Acronyms and Abbreviations

KM	Kaplan-Meier
L/min	liters per minute
L/day	liter/day
LADD	lifetime average daily dose
µg/dL	micrograms per deciliter
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
mg/cm^2	milligrams per square centimeter
mg/day	milligrams per day
mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mg^3/kg	cubic milligrams per kilogram
MOA	mode of action
MRL	minimal risk level
MVUE	minimum variance un-biased estimators
NCEA	National Center for Environmental Assessment
ND	non-detect
NHL	non-Hodgkin's lymphoma
PAHs	polycyclic aromatic hydrocarbons
PAR	pathway analysis report
PCB	polychlorinated biphenyl

PEF	particulate emission factor
PPRTV	provisional peer review toxicity values
QAPP	quality assurance project plan
RAGS	Risk Assessment Guidance for Superfund
RDA	recommended daily allowance
RfC	reference concentration
RfD_d	dermal reference dose
RfD_o	oral reference dose
RGO	remedial goal option
RME	reasonable maximum exposure
RSL	regional screening level
SA	exposed skin surface area
SMS	Smokey Mountain Smelters
SVOC	semi-volatile organic compound
t_{event}	event frequency
TCDD	tetrachlorodibenzo-p-dioxin
TCE	trichloroethene
TEQ	toxic equivalency
THQ	target hazard quotient
TR	target risk
UCL	upper confidence limit
URF	unit risk factor

Acronyms and Abbreviations

VOC	volatile organic compound

1. INTRODUCTION

J.M. Waller and Associates, Inc. (JMWA) was tasked by the U.S. Environmental Protection Agency (EPA) to perform a human health risk assessment (HHRA) for Smokey Mountain Smelters (SMS) in Knoxville, Knoxville County, Tennessee. The risk assessment was performed under Contract No. EP-S4-08-03, Task Order No. 19.

As shown in Figure 1-1 (Facility Location), SMS is located at 1508 Maryville Pike in Knoxville, Knox County, Tennessee, in the eastern portion of the state. The 13-acre property is bordered by mixed residential and commercial properties to the north; the Montgomery Village apartment complex situated approximately 200 feet (ft) to the east; an undeveloped wooded area to the south; and both residential and commercial properties to the west. In addition, active railroad lines, owned by Norfolk-Southern and CSX Transportation border the property to the east and west, respectively. The majority of the residential areas that border SMS are low density with large areas that are wooded and undeveloped. Figure 1-2 shows the overall facility layout.

The HHRA was developed to characterize the potential exposure and risks associated with exposure to contaminants of potential concern (COPCs) at the SMS Site (the Site). The HHRA was based on the receptors and exposure parameters presented in the Pathways Analysis Report (PAR) (JMWA, 2012), and considers the current and future-use exposure pathways by which individuals may be exposed to contaminated media. Exposure pathways were identified based on consideration of the sources and locations of contaminants, the likely environmental fate of the contaminants, and the location and activities of the potentially exposed populations.

During the preparation of this HHRA, the JMWA team reviewed the available information pertaining to the Site. Members of the JMWA team also visited the Site to gain a firsthand understanding of potential human exposures. This information was applied to the development of the PAR and the exposure assessment presented in this document.

The HHRA was developed in accordance with EPA Guidance set forth in the following documents:

- Specific risk assessment guidance from EPA Region 4.

- *Risk Assessment Guidance for Superfund (RAGS): Human Health Evaluation Manual, Part A* (EPA, 1989).
- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (EPA, 1991).
- *Guidelines for Exposure Assessment* (EPA, 1992).
- *Exposure Factors Handbook: 2011 Edition* (EPA, 2011a).
- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part D* (EPA, 2001).
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (EPA, 2002).
- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. Final* (EPA, 2004).
- *Child-Specific Exposure Factors Handbook* (EPA, 2008).
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment. Final* (EPA, 2009a).
- *Draft Final Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment Bulletins* (EPA, 2014a).
- *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (EPA, 2014b).

1.1 REPORT OVERVIEW

There are five major components of the HHRA process for the SMS Site:

- Hazard Identification – Describes the available site data, the data usability and validation, and the guidelines for data reduction for risk assessment purposes; outlines the data evaluation approach; and identifies the COPCs (Section 2);

- Toxicity Assessment – Describes and identifies the cancer and noncancer toxicity factors that were used to evaluate the risks associated with exposure to COPCs (Section 3);

- Exposure Assessment – Describes the exposure setting and local land and water uses. Presents a conceptual site model (CSM) for human exposures that describes the source of contamination, the affected media, and the exposure scenarios and their associated exposure pathways. Methods for estimating the exposure point concentrations (EPCs) are also presented along with the scenario-specific exposure parameters (Section 4);

- Risk Characterization – Integrates the toxicity assessment and the exposure assessment to characterize potential cancer risks and noncancer health effects and presents an overall summary of the potential risks based on exposure to the affected media (Section 5); and

- Uncertainty Analysis – Identifies the important uncertainties in the risk assessment process and describes the potential impact of these uncertainties on the overall estimate of risk (Section 6).

2. HAZARD IDENTIFICATION

The hazard identification presents the data available to assess site risks, outlines the approach used to summarize the data, and identifies the COPCs. The hazard identification process involves the following tasks:

- Review of available data;

- Evaluation of the data usability and data validation;

- Establishment of guidelines for data reduction;

- Evaluation of data for use in the risk assessment; and

- Selection of the COPCs.

2.1 REVIEW AVAILABLE DATA

Due to interim remedial measures, the historical data is no longer reflective of current site conditions and was therefore not incorporated in the HHRA. Additionally, as presented in the *Final Trip Report, Integrated Assessment Sampling Event* (Tetratech, 2009), volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) within the apartment complex and waste piles soil samples were either not detected or detected at levels below the EPA RSL. Therefore, it was determined that further characterization of VOCs and SVOCs in the areas outside of the capped areas was not necessary. Therefore, there is no VOC and SVOC data for these on-site areas included in the HHRA. It was assumed that these areas pose no risk from VOC and SVOC contaminant exposure to human health. Furthermore, data within the capped areas (i.e.,

subsurface soil) is included in the HHRA in order to fully characterize the human health risks at the SMS site. The uncertainties associated with these assumptions are discussed below in Section 6.

2.2 DATA USABILITY AND DATA VALIDATION

Data usability is defined as the process of ensuring that the quality of the data meets the intended use. Data usability involves assessing the analytical quality, sampling methodology, and field errors that may be inherent in the data. Factors evaluated include the level of validation and data quality indicators such as completeness, comparability, precision and accuracy, and analytical detection limits. All data were reviewed in accordance with the approved project Quality Assurance Project Plan (QAPP) (JMWA, 2011).

As per longstanding EPA risk assessment guidance (e.g., the 1989 Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual (Part A) page 5-15 and the 1992 Guidance for Data Useability in Risk assessment (Part A) page 113), J-qualified concentrations are used the same way as unqualified data within a dataset. Although there are reliability issues with J-qualified values, for risk assessment purposes, they are used as-is at the qualified concentration with the appropriate weight given to the value in any conclusions and subsequent decision-making process. The most important uncertainties associated with the use of J-qualified data include: 1) potentially eliminating a chemical as a COPC when it should be evaluated, if the maximum positive detection is J-qualified and the value is estimated low; and 2) potentially retaining a chemical as a COPC when it should be eliminated if the maximum positive detection is J-qualified and the value is estimated high. Data validation reports are presented in the draft RI/FS report (JMWA, 2015).

2.3 GUIDELINES FOR DATA REDUCTION

The following guidelines for data reduction were used to produce the data summaries for the soil, groundwater, fish tissue, surface water, and soil gas evaluated in the HHRA. These approaches are consistent with *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation (Part A)* (EPA, 1989).

- If an analyte was not positively identified in any sample in a given medium, because it was reported as a non-detect (indicated by a "U" qualifier), because it was present as a result of blank contamination, or because it was rejected by the data validator (indicated by an "R" qualifier), it was not addressed in that medium.
- All analytical data with "J" qualifiers were assumed to be positive identifications. "J" indicates that the numerical value is an estimated concentration (e.g., is reported below the minimum confident detection limit).
- The treatment of field duplicates was as follows to arrive at the appropriate sample measurement for use in the HHRA:
  - If both samples (primary and field duplicate) indicated that the analyte was detected, the maximum of the two detected concentrations was used in the HHRA;
  - If both samples were non-detect (ND), the maximum of the sample quantitation limits was used in the HHRA; and
  - If one sample was detected and the other was ND, the detected concentration was used in the HHRA.

2.4 DATA EVALUATION

The data evaluation summarizes the available soil, groundwater, fish tissue, surface water, and soil gas data for use in the HHRA. The summary tables present the following information:

- List of detected contaminants.
- Range of detected concentrations.
- Locations of maximum detected concentrations.
- Frequency of detection.
- Range of detection limits.
- Screening toxicity values.
- Whether or not the compound is a COPC and the reason for selection or deletion.

Summaries for two soil data groupings were presented: one for the surface soil (0 to 1 ft below ground surface [bgs]) and one for the surface/subsurface soil (0 to 10 ft bgs), hereafter referred to as "total soil." Surface soil data were used to evaluate those receptors that are not expected to routinely contact soil at a depth greater than 1 ft bgs. Total soil data were used to evaluate future construction workers who may contact the total soil as a result of the mixing of soils from 0 to 10 ft bgs, which may occur during construction activities.

Tables 1R (surface soil) and 2R (total soil) present the data summaries for both the on-site and Flenniken Branch soils. Detected analytes include pesticides, polycyclic aromatic hydrocarbons (PAHs), dioxin/furans, polychlorinated biphenyl (PCB) compounds, and inorganics.

Table 3R presents the data summaries for groundwater. Detected analytes include VOCs, SVOCs, and inorganics.

Table 4R presents the data summaries for fish tissue (carp, largemouth bass, and all species combined) collected from Knob Creek. Detected analytes include one VOC (benzaldehyde), dioxin/furans, PCBs, and inorganics.

Table 5 presents the data summaries for soil gas collected on-site. Detected analytes include thirteen VOCs.

The data summary and results for the surface water evaluation for Knob Creek Embayment are presented and discussed further in Appendix A.

Figures 2-1 through 2-5 present sample locations for all of the media evaluated in the HHRA.

2.5 SELECTION OF CONTAMINANTS OF POTENTIAL CONCERN

The COPC selection process was conducted to identify a subset of contaminants that were detected in the soil, groundwater, fish tissue, and soil gas that could pose a potential risk to human receptors who might contact the affected media. The COPC screening process was conducted in accordance with EPA Region 4 guidance (EPA, 2014a). The criteria that were used to determine if a contaminant was a COPC included:

- Non-detection - if a contaminant was not detected in any samples, it was not evaluated as a COPC.
- A comparison of the maximum detected concentrations to health-based screening criteria - The EPA Regional Screening Levels (RSLs) (EPA, 2015a) were used as the screening criteria to select COPCs. For screening purposes, a target hazard quotient (THQ) for noncancer based RSLs of 0.1 was used. This was done to account for the potential additive effects of multiple contaminants impacting similar target organs. A target risk (TR) for cancer-based RSLs of one-in-a-million (expressed as $1x10^{-6}$) was used. In cases where a contaminant had cancer and noncancer criteria, the lower (i.e., more stringent) of the two values was used for COPC screening. When an analyte did not have a screening criterion available, a suitable surrogate analyte was identified and the screening value for the surrogate analyte was used in the COPC selection process. The analytes for which surrogate screening values were used are noted on the COPC screening tables. There were cases where a suitable surrogate could not be identified for an analyte and a comparison to screening criteria could not be performed. These analytes were not carried forward in the risk assessment. The uncertainty associated with not evaluating these analytes is discussed further in the Uncertainty Analysis. If the maximum detected concentration was less than the RSL, the analyte was eliminated from further consideration in the HHRA. If the maximum concentration exceeded the RSL, the contaminant was identified as a COPC. Further, any member of a contaminant class (e.g., carcinogenic PAHs) that has other members identified as COPCs was also retained as a COPC (EPA, 2014a).
  - The following presents justification for the selection of surrogate screening values:
    - Pyrene was used as a surrogate for both benzo(g,h,i)perylene and phenanthrene because its reference dose (RfD) is in the mid-range of RfDs for other non-carcinogenic PAHs, as well as structure-activity considerations.
    - For conservatism and/or for lack of chromium speciation (as is the case for soil) hexavalent chromium was selected as a surrogate for total chromium.
    - Chlordane was selected as a surrogate for gamma-chlordane due to similar structural properties.

- Methylmercury is the only form of mercury that accumulates appreciably in fish and was therefore used for the mercury screening level in fish tissue.

- Soil: The COPCs in soil were identified by comparing the maximum detected concentrations to the residential soil RSLs (EPA, 2015a).
- Groundwater: The COPCs in groundwater were identified by comparing the maximum detected concentrations to the tap water RSLs (EPA, 2015a).
- Fish Tissue: The COPCs in fish tissue were identified by comparing the maximum detected concentrations to the fish ingestion RSLs (EPA, 2014c).
- For metals considered to be essential nutrients (calcium, magnesium, potassium, and sodium), as well as conventionals presented on Table 3R, the maximum concentrations in soil and groundwater were used to calculate a maximum daily intake for children. The maximum intake levels were compared to Recommended Daily Allowances (RDAs) and Adequate Intakes (AIs). If the maximum intake of the essential nutrient was greater than the RDA or AI, it is discussed further in the Uncertainty Analysis.

2.5.1 Soil

Tables 1R and 2R present the COPC selection process for the analytes that were detected in the surface and total soil, respectively. The following table summarizes those analytes that exceeded their respective screening criteria:

Soil COPCs			
On-Site (Surface Soil)	**Flenniken Branch (Surface Soil)**	**On-Site (Total Soil)**	**Flenniken Branch (Total Soil)**
2,3,7,8-TCDD TEQ	Benzo(a)anthracene	Benzo(a)anthracene	Benzo(a)anthracene
Aluminum	Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene
Arsenic	Benzo(b)fluoranthene	Benzo(b)fluoranthene	Benzo(b)fluoranthe
Chromium	Benzo(k)fluoranthene	Benzo(k)fluoranthene	Benzo(k)fluoranthe
Cobalt	Chrysene	Chrysene	Chrysene
Copper	2,3,7,8-TCDD TEQ	Indeno(1,2,3-cd)pyrene	2,3,7,8-TCDD TEQ
Iron	Aluminum	PCB-1232	Aluminum
Manganese	Arsenic	Aluminum	Arsenic
Vanadium	Chromium	Arsenic	Chromium

Soil COPCs			
On-Site (Surface Soil)	**Flenniken Branch (Surface Soil)**	**On-Site (Total Soil)**	**Flenniken Branch (Total Soil)**
Thallium	Cobalt	Chromium	Cobalt
Zinc	Cyanide	Cobalt	Cyanide
	Iron	Copper	Iron
	Manganese	Iron	Manganese
	Thallium	Manganese	Thallium
		Thallium	
		Zinc	
		Vanadium	

Because of the carcinogenic PAH exceedances of the residential soil RSL (with the exception of on-site surface soil), all of the detected carcinogenic PAHs that did not exceed the residential RSL were also selected as COPCs (EPA, 2014a). These included benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene (on-site total soil only).

No toxicity values were available to evaluate the presence of essential nutrients (calcium, magnesium, potassium, and sodium). The presence and possible exposures to these inorganic compounds in soil were evaluated as essential dietary nutrients. The maximum intakes were compared to RDAs or AIs. The results of this comparison are presented in Table 8 and indicate that the nutrient-based reference values are substantially greater than the intake that could occur as a result of ingesting soil with the maximum detected concentrations. As a result, these compounds are unlikely to contribute significantly to total risks and no further evaluation of these compounds was performed.

2.5.2 Groundwater

Table 3R presents the COPC selection process for the analytes that were detected in groundwater. The following table summarizes those analytes that exceeded their respective screening criteria:

Groundwater COPCs	
Shallow	**Deep**
1,2,4-Trimethylbenzene	1,2-Dichloroethane
2,4-Dinitrotoluene	2,4-Dinitrotoluene
4,4-DDD	2,6-Dinitrotoluene
Benzene	Benzene
Bis(2-ethylhexyl)phthalate (BEHP)	BEHP
Bromodichloromethane	Bromomethane
Bromomethane	Chloroform
Chloroform	Dieldrin
Dibenzofuran	Heptachlor Epoxide
Dieldrin	Naphthalene
Ethylbenzene	Pentachlorophenol
Naphthalene	TCE
Pentachlorophenol	Aluminum
Phenol	Arsenic
Tetrachloroethene	Beryllium
Trichloroethene (TCE)	Cadmium
(m- and or p-)Xylene	Chromium
Aluminum	Cobalt
Antimony	Copper
Arsenic	Cyanide
Beryllium	Iron
Cadmium	Lead
Chromium	Manganese
Cobalt	Mercury
Copper	Molybdenum
Cyanide	Nickel
Iron	Selenium
Lead	Strontium
Manganese	Thallium
Mercury	Vanadium
Molybdenum	Zinc
Nickel	
Selenium	
Strontium	
Thallium	
Vanadium	
Zinc	

No toxicity values were available to evaluate the presence of essential nutrients (calcium, chloride, magnesium, potassium, and sodium) and conventionals (ammonia, chloride, fluoride, nitrate, nitrite, orthophosphate, sulfate, and sulfide). The presence and possible exposures to these compounds in groundwater were evaluated separately by comparing maximum intakes to RDAs or AIs. The results of this comparison are presented in Table 8 and indicate that the reference values for magnesium, potassium, orthophosphate, and sulfide are substantially greater than the intake that could occur as a result of ingesting groundwater with the maximum detected concentrations. As a result, these compounds are unlikely to contribute significantly to total risks and no further evaluation of these compounds was performed. However, reference values for calcium, chloride, fluoride, nitrate, nitrite, sodium, and sulfate are exceeded by site concentrations and are discussed further in the Uncertainty Analysis.

For those shallow groundwater COPCs identified as VOCs, maximum detected concentrations were compared against EPA Target Groundwater Concentrations for potential vapor intrusion concerns (EPA, 2015a) (see Table 3R). Target groundwater concentrations were derived using EPA's VISL Calculator at a TR of 1E-06 and a THQ of 1.0 last updated in May 2014 (EPA, 2014d). These values were updated to reflect those changes made in the January 2015 RSL update (EPA, 2015a).

2.5.3 Fish Tissue

Table 4R presents the COPC selection process for the analytes that were detected in fish tissue. The following table summarizes those analytes that exceeded their respective screening criteria:

Fish Tissue COPCs		
Carp	**Largemouth Bass**	**All Species**
2,3,7,8-TCDD TEQ	2,3,7,8-TCDD TEQ	2,3,7,8-TCDD TEQ
PCB Dioxin-Like Congener TEQ	PCB Dioxin-Like Congener TEQ	PCB Dioxin-Like Congener TEQ
PCB-1260	PCB-1260	PCB-1260
Arsenic	Chromium	Arsenic
Chromium	Mercury	Chromium

Fish Tissue COPCs		
Carp	**Largemouth Bass**	**All Species**
Lead		Lead
		Mercury

2.5.4 Soil Gas

Table 5 presents the COPC selection process for the analytes that were detected in soil gas. The following table summarizes those analytes that exceeded their respective screening criteria:

Soil Gas COPCs
1,1-Dichloroethane
1,2,4-Trimethylbenzene
1,2-Dichloroethane
Benzene
Chloroform
Chloromethane
Ethylbenzene

3. TOXICITY ASSESSMENT

The toxicity assessment describes and identifies the toxicity values for the COPCs used in the estimation of potential cancer risks and noncancer health effects. It also provides a description of the terms that were used to estimate toxic effects along with the applicable data sources. Summary tables (Tables 9 through 12) are included that present the toxicity values for each of the COPCs in RAGS Part D format (EPA, 2001).

3.1 CANCER EFFECTS

For cancer effects, the toxicity values are expressed as oral cancer slope factors (CSF_o) in units of per milligrams of COPC per kilogram per day $(mg/kg\text{-}day)^{-1}$ or as inhalation unit risk factors (URF) in units of per micrograms of COPC per cubic meter $(\mu g/m^3)^{-1}$. The use of a toxicity value depends on the route of exposure being evaluated. The CSF_o is used to evaluate exposure from

ingestion routes (e.g., drinking water) and the URF is used to evaluated inhalation exposures (e.g., inhaling VOCs while showering).

EPA has assigned each COPC a "weight-of-evidence" category that represents the likelihood of it being a human carcinogen (EPA, 1989). Six weight-of-evidence categories exist:

- A – Human carcinogen;
- B1 – Probable human carcinogen, limited human data are available;
- B2 – Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans;
- C – Possible human carcinogen;
- D – Not classifiable as to human carcinogenicity; and
- E – Evidence of non-carcinogenicity for humans.

EPA revised the weight-of-evidence categories to include the following five cancer hazard descriptors (EPA, 2005a):

- Carcinogenic to humans;
- Likely to be carcinogenic to humans;
- Suggestive evidence of carcinogenic potential;
- Inadequate information to assess carcinogenic potential;
- Not likely to be carcinogenic in humans.

COPCs that are classified in categories A through C following the 1989 weight-of-evidence classification and in the first three categories according to the 2005 classification system are generally carried through the risk characterization step if CSFs or URFs have been developed.

For carcinogens that act with a mutagenic mode of action (MOA) for carcinogenesis (e.g., trichloroethylene [TCE], vinyl chloride, and hexavalent chromium), EPA recommends application of Age-Dependent Adjustment Factors (ADAFs) to the CSF/URF to address early lifetime exposures and the increased susceptibility of children to carcinogens (EPA, 2005b). This approach was followed in the HHRA and is discussed further in Section 5.1.

3.2 NONCANCER EFFECTS

Noncarcinogens refer to contaminants that cause toxic effects other than cancer. Noncancer effects can include, for example, central nervous system damage, reproductive effects, and other systemic effects. For noncancer effects, the toxicity values are expressed as oral reference doses (RfD_o) in units of mg/kg-day and reference concentrations (RfCs) in units of milligrams per cubic meter (mg/m^3). The premise of noncancer toxicity values is that there is an exposure level below which deleterious noncancer effects are not expected to occur. As with the cancer toxicity values, the use of a noncancer toxicity value depends on the route of exposure being evaluated; the RfD_o is used to evaluate exposure from ingestion routes and the RfC is used to evaluate exposure from inhalation.

3.3 SOURCES OF TOXICITY VALUES

The toxicity values used in this risk assessment were obtained from the following sources in the order presented (EPA, 2003):

- Tier 1 – Integrated Risk Information System (IRIS) (EPA, 2015b).
- Tier 2 – EPA's Provisional Peer Review Toxicity Values (PPRTVs) as presented in the EPA RSL Table (EPA, 2015a).
- Tier 3 – Other Toxicity Values - can include the National Center for Environmental Assessment (NCEA) values presented on the RSL Table, the Health Effects Assessment Summary Tables (HEAST), California EPA values, and the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs).

3.4 DERMAL EXPOSURE

Toxicity values have not been developed for the dermal absorption pathway. Dermal toxicity values were derived from the oral toxicity values as described in EPA's dermal risk assessment guidance (EPA, 2004). In general, the CSF_os and RfD_os are expressed as administered doses (i.e., the amount of a chemical administered per unit time and weight). Conversely, exposures resulting from the dermal pathway are expressed as absorbed doses. Therefore, it is necessary to adjust the oral toxicity value to account for the contaminant-specific absorption efficiency.

The fraction of a COPC that is absorbed in the gastrointestinal tract, also known as ABS_{GI}, is a critical factor when adjusting from an administered to an absorbed dose. The ABS_{GI} values used in this risk assessment were obtained from the EPA RSL table (2015a). The CSF_os and RfD_os were adjusted to an absorbed dose using different methods. The dermal CSF (CSF_d) was derived by dividing the CSF_o by the ABS_{GI} as shown in Equation 1.

Equation 1

$$CSF_d = \frac{CSF_o}{ABS_{GI}}$$

Where:

CSF_d	=	Dermal cancer slope factor $(mg/kg\text{-}day)^{-1}$
CSF_o	=	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
ABS_{GI}	=	Fraction of contaminant absorbed in the gastrointestinal tract (unitless)

The dermal reference dose (RfD_d) was derived by multiplying the RfD_o by the ABS_{GI} as shown in Equation 2.

Equation 2

$$RfD_d = RfD_o \times ABS_{GI}$$

Where:

RfD_d	=	Dermal reference dose (mg/kg-day)
RfD_o	=	Oral reference dose (mg/kg-day)
ABS_{GI}	=	Fraction of contaminant absorbed in the gastrointestinal tract (unitless)

3.5 LEAD

Lead was identified as a COPC in groundwater (shallow and deep). EPA has not assigned verified or provisional toxicity values (i.e., CSFs and RfDs) to lead because the toxicity data available to date are inadequate for evaluation by the current methodology. Therefore, lead risk was not evaluated using the conventional risk assessment approach. EPA's Integrated Exposure Uptake Biokinetic model (IEUBK) (EPA, 2010) was used to characterize lead risk to children, the most susceptible receptor (see Section 5.3).

4. EXPOSURE ASSESSMENT

The objective of the exposure assessment is to estimate the nature, extent, and magnitude of potential exposure of humans to COPCs considering both current and future uses. The exposure assessment involves several steps, which are listed below:

- Evaluating the exposure setting, including describing current and future land and water uses and identifying potentially exposed human populations.
- Developing the conceptual site model including sources, release mechanisms, transport and receiving media, exposure media, exposure scenarios, exposure routes, and potentially exposed populations.
- Calculating EPCs for each of the exposure scenarios and routes of exposure.
- Identifying the exposure scenarios, models, and parameters with which to calculate exposure doses.

To provide a range of exposure and risks, the reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios were evaluated (EPA, 1992). The RME, an estimate of the high-end exposure in a population, is based on a combination of average and high-end estimates of exposure parameters typically representing the 90th percentile or greater of actual expected exposure. The CTE represents an estimate of the average exposure in a population and is based on central estimates of exposure parameters. Both the RME and CTE were evaluated for each exposure scenario.

4.1 EXPOSURE SETTING

4.1.1 Current and Future Land Uses

The HHRA evaluated potential risks associated with the current and reasonably anticipated future uses of SMS. Current land uses formed the basis for the evaluation of existing (i.e., baseline) conditions. Future land uses formed the basis for the evaluation of risks associated with future use of SMS.

Based on current zoning restrictions (currently zoned for commercial/industrial use), the presence of active and historical industrial properties nearby, as well as the likely future use of SMS, future residential development is unlikely. Although unlikely, it was conservatively assumed that SMS could be developed for residential or recreational purposes in the future. Therefore, an estimate of the upper-bound limits of the potential risks associated with human health was considered.

4.2 CONCEPTUAL SITE MODEL

A CSM describes the contaminant sources, the release and transport mechanisms, the receiving media, the exposure media, the exposure routes, and the potentially exposed populations. The primary objective of the CSM is to identify complete and incomplete exposure pathways. A complete exposure pathway has all of the above-listed components, whereas an incomplete pathway is missing one or more. Figure 4-1 illustrates the CSM that was developed for the SMS site as part of the *Preliminary Conceptual Site Model Technical Memorandum* (JMWA, 2012). Each component of the CSM is examined in detail in the following sections.

4.2.1 Source of Contamination, Release and Transport Mechanisms, and Receiving Media

As presented in the *Preliminary Conceptual Site Model Technical Memorandum* (JMWA, 2012), sources of contamination at SMS are related to the former operations on site, specifically the former fertilizer plant and secondary aluminum smelter operations. Specific source areas on site based on the historical data include the following: former waste pile area, former settling ponds, former transformer pad, former process building, railroad spur, and recovered underground storage tanks. Within the former process building, specific targeted source areas are the stacks and floor

drains. In addition, prior to the time-critical removal action in 2011, the stockpiles of aluminum dross and salt cake were also potential source areas.

The following release and transport processes affecting the fate and effect of contaminants within the SMS site have been identified:

- Surface runoff and drainage during and after precipitation events;
- Wind erosion;
- Leaching and infiltration to groundwater;
- Migration through the vadose zone; and
- Bioaccumulation within the food chain.

4.2.2 Exposure Areas (EAs)

Because of the various land and water uses throughout the SMS site, the HHRA was evaluated based on three separate EAs. These included the on-site EA, Flenniken Branch, and Knob Creek Embayment.

4.2.3 Primary Exposure Media

Based on the review of the current and potential land and water uses, the following primary exposure media are of potential concern to humans at the SMS site:

- Soil (on-site).
- Sediment (on-site, Flenniken Branch, and Knob Creek Embayment).
- Groundwater (on-site).
- Fish (Knob Creek Embayment).
- Soil Gas (on-site).
- Surface water (on-site, Flenniken Branch, and Knob Creek Embayment).

4.3 IDENTIFICATION OF EXPOSURE PATHWAYS

The following sections describe the possible receptors and exposure pathways considering both current and potential future land and water uses. An identified pathway does not imply that exposures are actually occurring, only that the potential exists for the pathway to be complete.

4.3.1 Soil Exposure

Direct contact with on-site surface and subsurface soil (soil ingestion and dermal absorption) and inhalation of VOCs and particulates are all potential exposure pathways for current and future populations, which include on-site workers, trespassers, recreational users, construction workers, and hypothetical future residents. Based on the anticipated future use of the SMS site, future residential development is unlikely. However, it was conservatively assumed that the SMS site could be developed for residential purposes in the future in order to estimate the upper-bound limit of the potential risks associated with human health.

4.3.2 Sediment and Surface Water Exposure

There is the potential for surface water and sediment exposure to both current and future populations at all three EAs. However, consistent with EPA Region 4 guidance, direct contact with sediment in underwater areas (e.g., Flenniken Branch and Knob Creek Embayment) was not quantitatively evaluated in the HHRA because of infrequent contact by human receptors. When sediments are in underwater areas, receptors will infrequently, if at all, come in contact with sediment. Therefore, the sediment exposure pathway was not evaluated at SMS. In order to account for portions of the year when sediments may be dry, sediments were treated as surface soil. Based on the minimum likelihood of human health exposure to surface water on-site and along Flenniken Branch, it was assumed that the surface water contact exposure scenarios for these EAs would be eliminated from consideration in the HHRA. To account for potential human health exposure to surface water in the Knob Creek Embayment, a risk-based surface water screening evaluation was conducted and is presented in Appendix A. Based on the low levels observed in the available surface water data from Knob Creek, the surface water contact exposure scenarios for this EA were also eliminated from consideration. A risk-based surface water screening evaluation supporting this decision is provided in Appendix A.

4.3.3 Groundwater Exposure

Future potable use of on-site groundwater could result in potential exposure to contaminants to a current/future on-site worker through ingestion and a hypothetical future resident through ingestion and dermal contact. If VOCs are present in the groundwater, there is the additional potential for inhalation exposure to the future on-site worker or the hypothetical future adult resident. Based on the depths of shallow groundwater samples included in the HHRA (13 ft bgs to 43 ft bgs), a construction worker would not come into direct contact with groundwater during excavation activities (typically up to 10 ft bgs). Therefore, this receptor pathway was not evaluated in the HHRA.

4.3.4 Fish Consumption

Recreational fishing in the Knob Creek Embayment is known to occur and potential fish ingestion exposure to anglers is a potential exposure pathway for current and future populations.

4.3.5 Soil Gas/Indoor Air Exposure

There is the potential for future on-site workers and hypothetical future residents to be exposed to VOCs through the inhalation of indoor air. This potential was evaluated through the evaluation of soil gas samples taken on-site.

4.3.6 Exposure Point Concentrations

EPCs are the COPC concentrations that a receptor is assumed to contact during exposure to site COPCs. The subsections below present the methods used to calculate the EPCs using EPA's ProUCL software program, Version 5.0.00 (EPA, 2013). The list below presents the process for determining the EPCs.

- If less than 8 samples were collected within a data grouping, the EPC is the maximum detected concentration. Full detection limits were used as values for the non-detected samples in these small data sets. For clarification, the full detection limits for non-detects were not incorporated in the data sets as a substitution for detected concentrations. Rather, nondetects at their full detection limits were imported into ProUCL as part of the full dataset and were treated as nondetects. ProUCL then used the detection limits in order to

use the regression on order (ROS) and Kaplan-Meier (KM) methods for estimating population parameters (i.e., mean and standard deviation). These estimations were then used to calculate the appropriate parametric or non-parametric UCL.

- If 8 or more samples were collected within a data grouping and the data set contains at least 4 detects, but the data set contains less than 50% detects, a nonparametric-based UCL EPC is considered. The nonparametric-based value is derived using either Kaplan-Meier (KM) or bootstrapping estimation procedures, unless there are fewer than 10 detects. If there are fewer than 10 detects, the bootstrapping estimates are not considered.

- If 8 or more samples were collected within a data grouping and the data set contains at least 50% detects, the appropriate distribution of the data set are determined and upper confidence limits (UCLs) EPCs are selected as guided by the ProUCL supporting documentation. If the recommended UCL exceeds the maximum detected concentration, a Chebyshev-based UCL is selected as the EPC if possible. If the Chebyshev-based UCL is still higher than maximum detected concentration, the maximum concentration is selected as the EPC.

ProUCL calculates 95% UCLs using 15 different computation methods, 5 parametric and 10 non-parametric. Parametric methods rely on the estimation of parameters (such as the mean or the standard deviation) describing the distribution of the variable of interest in the population; non-parametric methods do not. The five parametric UCL computation methods include:

- Student's-t UCL.

- Approximate gamma UCL using chi-square approximation.

- Adjusted gamma UCL (adjusted for level significance).

- Land's H-UCL.

- Chebyshev inequality based UCL (using Minimum Variance Un-biased Estimators (MVUEs) of parameters of a lognormal distribution).

The 10 non-parametric methods included in ProUCL are:

- The central limit theorem (CLT) based UCL.
- Modified-t statistic (adjusted for skewness) based UCL.
- Adjusted-CLT (adjusted for skewness) based UCL.
- Chebyshev inequality based UCL (using sample mean and sample standard deviation).
- Jackknife method based UCL.
- UCL based upon standard bootstrap.
- UCL based upon percentile bootstrap.
- UCL based upon bias - corrected accelerated (BCA) bootstrap.
- UCL based upon bootstrap-t.
- UCL based upon Hall's bootstrap.

Supporting documentation (ProUCL outputs) for the calculation of the UCLs is presented in Appendix B. The soil, groundwater, fish, and soil gas EPCs used in the HHRA are presented in Tables 13R, 14R and 15 through 17.

4.4 EXPOSURE PARAMETERS

The following sections present the exposure parameters for the receptors that were evaluated in the HHRA.

4.5 COMMON EXPOSURE PARAMETERS

This section presents the exposure parameters that were used to quantify exposure in terms of contaminant intake (exposure dose). Tables 18 through 26 present the exposure parameters for each receptor by media. The formulas used in estimating exposure intakes are also shown on these tables.

The following exposure parameters values were constant for all of the exposure scenarios:

Body Weight (BW)

The average BW values for the child (1 through 6 years) and the adult was 15 kilograms (kg) and 80 kg, respectively (EPA, 2014b). For the adolescent (7 through 16 years), the BW was 45 kg (EPA, 2008). These values were used in the RME and CTE evaluations and are constant across all scenarios.

Averaging Time (AT)

The cancer-based AT was based on a 70-year lifetime for all age groups and equates to 25,550 days (70 years x 365 days/year) (EPA, 1989). The noncancer AT for each of the scenarios was based on the receptor- and scenario-specific exposure duration (ED) in years multiplied by 365 days/year. The noncancer-based AT is constant across all of the scenarios in that it is always the ED multiplied by 365 days/year.

4.6 ON-SITE WORKER EXPOSURE PARAMETERS

Adult on-site workers may be exposed to contaminants in surface soil at the SMS site via incidental soil ingestion, dermal contact and absorption, and inhalation of VOCs and particulates released from the soil, as well as groundwater ingestion. Tables 18 through 20 present the on-site worker exposure parameters and models that were used to estimate the exposure to soil, groundwater, and soil gas.

RME

An ED value of 25 years was used in the RME evaluation for the on-site worker (EPA, 2014b). An exposure frequency (EF) of 250 days/year was used (EPA, 2014b). The on-site worker was assumed to spend 8 hours per day on-site. The default worker soil ingestion rate (IRS) of 100 milligrams per day (mg/day) was assumed (EPA, 2014b). For soil and groundwater ingestion, a fraction ingested (FI) value of 1.0 was used. This assumes that the exposed individual receives 100% of their daily soil intake while working on-site. The exposed skin surface area (SA) value was 3,470 square centimeters (cm^2) (EPA, 2014b) and assumes that the head, hands, and forearms are exposed. The soil-to-skin adherence factor (AF) value of 0.12 milligrams per square centimeter

(mg/cm^2) was assumed (EPA, 2014b). The particulate emission factor (PEF), which relates the concentration of a contaminant in soil to the concentration of dust particles in air, was assumed to be the default value of 5.7E+09 cubic meters per kilogram (m^3/kg) for the Atlanta region (climate zone VI) (EPA, 2002).

An adult water ingestion rate (IRW) of 2.5 liters per day (L/day), representing the amount of water that is ingested on a daily basis, was assumed for the RME evaluation (EPA, 2014b).

CTE

The RME values for IRS, SA, PEF, and IRW were also used for the CTE evaluation. An ED value of 12 years was used in the CTE evaluation for the on-site worker (half of the RME value) (EPA, 2002). An EF of 125 days/year was used based on professional judgment (half of the RME value). The on-site worker was assumed to spend half of the RME evaluation at 4 hours per day on-site. For soil and groundwater ingestion, a FI value of 0.5 was used. This assumes that the exposed individual receives 50% of their daily soil or groundwater intake while working on-site. The AF value of 0.02 mg/cm^2 was assumed (commercial/industrial groundskeeper) (EPA, 2004).

4.7 TRESPASSER EXPOSURE PARAMETERS

Site adolescent trespassers may be exposed to contaminants in surface soil at the SMS site via incidental soil ingestion, dermal contact and absorption, and inhalation of VOCs and particulates released from the soil. Table 21 presents the trespasser exposure parameters and models that were used to estimate the exposure to soil.

RME

Based on the assumed age range of the adolescent trespasser, an ED value of 10 years was used in the RME evaluation (EPA, 2002). An EF of 104 days/year based on exposure twice a week over the course of a year was used (EPA, 2002). The trespasser was assumed to spend 4 hours per day on-site. The adult residential IRS of 100 mg/day was assumed for the trespasser (EPA, 2014b). For soil ingestion, a FI value of 1.0 was used. The SA value was 5,900 cm^2 (EPA, 2004) and assumes that the head, hands, forearms, lower legs, and feet are exposed. The AF value of 0.07

mg/cm^2 was assumed (residential gardeners) (EPA, 2004). The PEF was assumed to be the default value of 5.7E+09 m^3/kg for the Atlanta region (climate zone VI) (EPA, 2002).

CTE

The RME values for IRS, ED, SA, and PEF were also used for the CTE evaluation. An EF of 52 days/year was used based on professional judgment (half of the RME value). The trespasser was assumed to spend half of the RME evaluation at 2 hours per day on-site. For soil ingestion, a FI value of 0.5 was used. The AF value of 0.01 mg/cm^2 was assumed (adult soccer player) (EPA, 2004).

4.8 RECREATIONAL USER EXPOSURE PARAMETERS

Child and adult recreational users may be exposed to contaminants in surface soil through incidental ingestion, dermal contact and absorption, and inhalation of VOCs and particulates released from the soil. Table 22 presents the recreational users exposure parameters and models that were used to estimate the exposure to soil.

RME

Residential EDs of 6 and 20 years were assumed for the child and adult recreational users, respectively (EPA, 2014b). The recreational users were assumed to be exposed for the 9 months of the year when the ground is not frozen or snow-covered (i.e., March through November). During these months, exposure is assumed to occur 3 days/week (assume 4.33 weeks per month). This equates to an EF of 117 days/year for the RME. The recreational users were assumed to spend 4 hours per day on-site for the RME evaluation. The child and adult IRS values (200 mg/day and 100 mg/day, respectively) for residential exposure were used in the RME evaluation for the recreational users. For soil ingestion, a FI value of 1.0 was used. The SA values of 2,690 cm^2 (assuming head, hands, forearms, lower legs, and feet are exposed) and 6,032 cm^2 (assumes head, hands, forearms, and lowerlegs are exposed) were assumed for the child and adult recreational users, respectively (EPA, 2014b). The AF values of 0.12 mg/cm^2 and 0.07 mg/cm^2 were assumed for the child and adult recreational users RME evaluation. The PEF was assumed to be the default value of 5.7E+09 m^3/kg for the Atlanta region (climate zone VI) (EPA, 2002).

CTE

The RME values for the ED (child only), SA, and PEF were also used for the CTE evaluation. A residential ED of 9 years was assumed for the adult recreational user (EPA, 2002). An EF of 58 days/year was used based on professional judgment (half of the RME value). The recreational users were assumed to spend half of the RME evaluation at 2 hours per day on-site. The CTE IRS values were assumed to be 100 mg/day and 50 mg/day for the child and adult recreational users, respectively. For soil ingestion, a FI value of 0.5 was used. The AF values of 0.04 mg/cm^2 (teen soccer player, moist conditions) and 0.01 mg/cm^2 (adult soccer player) were assumed for the child and adult recreational users CTE evaluation.

4.9 CONSTRUCTION/UTILITY WORKER EXPOSURE PARAMETERS

Construction/utility workers may be exposed to contaminants in surface and subsurface soil (total soil) at the SMS site via incidental soil ingestion, dermal contact and absorption, and inhalation of VOCs and particulates released from the soil. Table 23 presents the construction/utility worker exposure parameters and models that were used to estimate the exposure to soil.

RME

An ED value of 1 year was used in the RME evaluation for the construction/utility worker (EPA, 2002). An EF of 250 days/year was assumed (EPA, 2014b). The construction/utility worker was assumed to spend 8 hours per day on-site. The construction worker IRS of 330 mg/day was assumed (EPA, 2002). For soil ingestion, a FI value of 1.0 was used. The SA value was 3,470 cm^2 (EPA, 2014b) and assumes that the head, hands, and forearms are exposed. The 95th percentile AF value of 0.3 mg/cm^2 for construction workers was assumed (EPA, 2004). The PEF was assumed to be the default value of 5.7E+09 m^3/kg for the Atlanta region (climate zone VI) (EPA, 2002).

CTE

The RME values for ED, SA, and PEF were also used for the CTE evaluation. An EF of 125 days/year was used based on professional judgment (half of the RME value). The construction/utility worker was assumed to spend half of the RME evaluation at 4 hours per day on-site. The outdoor worker IRS of 100 mg/day was assumed for the CTE evaluation (EPA, 2002).

For soil ingestion, a FI value of 0.5 was used. The geometric mean AF value of 0.1 mg/cm^2 was assumed (EPA, 2004).

4.10 RESIDENTIAL EXPOSURE PARAMETERS

Although residential development is unlikely at the SMS site, a hypothetical future residential scenario was evaluated to determine an upper-bound estimate of the potential risks posed by chemical contamination of the site. Residents were assumed to contact surface and subsurface soil as a result of the mixing of the soil that is expected to occur during construction activities. Soil exposure pathways that were evaluated include incidental soil ingestion, dermal contact and absorption, and inhalation of VOCs and particulates released from the soil. Residential groundwater exposure was also evaluated to account for future potable groundwater use. Groundwater exposure pathways evaluated included tap water ingestion, dermal contact and absorption while showering/bathing, and inhalation of VOCs while showering (adult only). Residential exposure to VOCs through inhalation of indoor air was also evaluated. EPA's VISL Calculator was used to determine indoor air concentrations through the modeling of soil gas concentrations (EPA, 2014d). The results of these models are presented in Appendix C. Tables 24 through 26 present the exposure parameters and models that were used to estimate the residential exposure to soil and groundwater.

RME

An ED of 26 years (6 years as a child and 20 years as an adult) was assumed for the RME evaluation (EPA, 2014b). An EF of 350 days/year was assumed for the RME evaluation (EPA, 2014b). The resident was assumed to spend 24 hours per day on-site for the RME evaluation. The child and adult IRS values (200 mg/day and 100 mg/day, respectively) for residential exposure were used in the RME evaluation. For soil and groundwater ingestion, a FI value of 1.0 was used. The SA values of 2,690 cm^2 (assuming head, hands, forearms, lower legs, and feet are exposed) and 6,032 cm^2 (assumes head, hands, forearms, and lower legs are exposed) were assumed for the child and adult residents, respectively (EPA, 2014b). The AF values of 0.12 mg/cm^2 and 0.07 mg/cm^2 (residential gardeners) were assumed for the child and adult residents, respectively. The

PEF was assumed to be the default value of 5.7E+09 m3/kg for the Atlanta region (climate zone VI) (EPA, 2002).

For the RME residential exposure to groundwater evaluation, the child and adult IRWs of 0.78 L/day and 2.5 L/day were assumed, respectively (EPA, 2014b). The child and adult event frequency (EV), which represents the number of bathing/showering events per day that a receptor takes, was assumed to be once a day (EPA, 2014b). The 50th percentile SAs of 6,378 cm^2 and 20,900 cm^2 were assumed for the child and adult RME evaluations, respectively (EPA, 2014b). The child bathing time (t_{event}) of 32 minutes (0.54 hour/event) was assumed (EPA, 2014b). The RME adult showering time of 43 minutes (0.71 hour/event) was assumed (EPA, 2014b). COPC-specific values needed to calculate dermally absorbed doses were either obtained from the appropriate tables in the dermal guidance (EPA, 2004) or from the EPA RSL table (EPA, 2015a). The RME COPC-specific values along with the calculated absorbed dose per event (DA_{event}) values are presented on Table 27.

For the RME residential adult showering exposure pathway, an inhalation rate (IR) of 15 liters per minute (L/min) was assumed (Foster and Chrostowski, 1987). The inhalation exposure per shower (E) was calculated using the Foster and Chrostowski model (Foster and Chrostowski, 1987 and 2003). The exposure models and parameters used to calculate the shower exposure pathway are presented in Tables 28 through 34.

CTE

The RME values for the ED (child only), EF, IRS, SA (soil and groundwater), PEF, IRW, EV, and IR were also used for the CTE evaluation. An ED of 9 years was assumed for the adult resident (EPA, 2002). The residents were assumed to spend 16 hours per day on-site for the CTE evaluation. For soil and groundwater ingestion, a FI value of 0.5 was used. The AF values of 0.04 mg/cm^2 (teen soccer player, moist conditions) and 0.01 mg/cm^2 (adult soccer player) were assumed for the child and adult resident CTE evaluation.

For the CTE residential exposure to groundwater evaluation, the child t_{event} of 16 minutes (0.27 hours/event) was assumed (EPA, 2014b). The CTE adult showering time of 22 minutes (0.36

hours/event) was assumed (EPA, 2004). The CTE COPC-specific values along with the calculated DA_{event} values are presented on Table 35.

4.11 RECREATIONAL ANGLER EXPOSURE PARAMETERS

Adult and young child (1 through 6 years) recreational anglers may be exposed to contaminants through ingestion of fish from Knob Creek. Table 36 presents the recreational angler exposure parameters and models that were used to estimate the exposure to fish tissue.

RME

As recommended by Region 4, due to the absence of site-specific information, a default upper-bound fish ingestion rate (IRF) of 54 grams per day (g/day) was assumed (EPA, 2000). One-half (27 g/day) was assumed as a reasonable estimate of the consumption rate for the dependent child of a recreational angler. An ED of 6 and 26 years was assumed for the child and adult RME evaluations, respectively (EPA, 2014b). An EF of 350 days/year was assumed for both the child and adult anglers (EPA, 2014b). It was conservatively assumed that the recreational anglers catch and consume all of their fish from Knob Creek for the RME evaluation.

CTE

The RME values for the ED (child only) and EF were also used for the CTE evaluation. For the CTE evaluation, 50% of the RME IRF was assumed for both the child (14 g/day) and adult (27 g/day) recreational anglers. An ED of 15 years (half of the RME evaluation) was assumed for the adult recreational angler. A FI value of 0.5 was assumed for both the child and adult recreational anglers for the CTE evaluation. This assumes that the anglers receive 50% of their fish ingestion from Knob Creek.

5. RISK CHARACTERIZATION

The objective of the risk characterization is to integrate the information developed in the exposure assessment and the toxicity assessment into an evaluation of the potential risks associated with exposure to COPCs. Cancer risks were calculated for those COPCs with evidence of carcinogenicity

and for which cancer toxicity values were available. Noncancer health effects were evaluated for COPCs (i.e., including carcinogens) for which noncancer toxicity values were available.

5.1 CANCER RISK

Potential cancer risks from oral and dermal exposure were calculated by multiplying the estimated lifetime average daily dose (LADD) intake that was calculated for a COPC through an exposure route by the exposure route-specific CSF, as follows:

$$\text{Risk} = \text{LADD} * \text{CSF}$$

Where:

LADD	=	Lifetime average daily dose; intake averaged over a 70-year lifetime as mg COPC kg per day.
CSF	=	COPC- and route-specific cancer slope factor $(\text{mg kg-day})^{-1}$.

Potential cancer risks from inhalation exposure were calculated by multiplying the calculated air concentration and the URF as follows:

$$\text{Risk} = \text{CA} * \text{URF}$$

Where:

CA	=	Air concentration ($\mu g\ m^3$).
URF	=	Unit risk factor $(\mu g\ m^3)^{-1}$.

EPA's cancer risk range is an increased risk of developing cancer, based on a plausible upper-bound estimate of risk, of approximately 1-in-1,000,000 (1E-06) to 1-in-10,000 (1E-04).

<u>Carcinogens that act with a mutagenic MOA</u>

For carcinogens that act with a mutagenic MOA for carcinogenesis, EPA recommends application of ADAFs to cancer toxicity values to address early lifetime exposures and the increased

susceptibility of children to carcinogens (EPA, 2005b). The RSL table presents those COPCs exhibiting a mutagenic MOA for carcinogenesis.

The ADAFs for specific age-groups classes are presented below:

Age (years)	ADAF (unitless)
0 – <2	10
2 – <16	3
≥16	1

Potential RME and CTE risk to an adolescent trespasser (7-16 years) was assessed using the following:

Age (years)	Exposure Factors	Exposure Duration (years)	ADAF (unitless)
6 – <16	Adolescent	10	3

Total RME and CTE risk for adolescent trespasser exposure = Risk 6 – <16

Tables 37R and 38R present the results of the adolescent trespasser MOA calculations for RME and CTE soil exposure, respectively.

Potential RME and CTE risk to a child recreational user was assessed using the following:

Age (years)	Exposure Factors	Exposure Duration (years)	ADAF (unitless)
0 – <2	Child	2	10
2 – <6	Child	4	3

Total RME and CTE risk for child recreational user exposure = Risk $_{0-<2}$ + Risk $_{2-<6}$

Tables 39R and 40R present the results of the child recreational user MOA calculations for RME and CTE soil exposure, respectively.

RME residential lifetime exposure factors were divided into two age groupings: child – 0 to 6 years and adult – 6 to 26 years. CTE residential lifetime exposure factors were divided into two age groupings: child – 0 to 6 years and adult – 20 to 26 years. Potential RME risk to an individual resident was assessed using the following:

Age (years)	Exposure Factors	Exposure Duration (years)	ADAF (unitless)
0 – 2	Child	2	10
2 – 6	Child	4	3
6 – 16	Adult	10	3
16 – 26	Adult	10	1

Potential CTE risk to an individual resident was assessed using the following:

Age (years)	Exposure Factors	Exposure Duration (years)	ADAF (unitless)
0 – 2	Child	2	10
2 – 6	Child	4	3
20 – 26	Adult	6	1

Total RME risk for lifetime exposure = $\text{Risk}_{0-2} + \text{Risk}_{2-6} + \text{Risk}_{6-16} + \text{Risk}_{16-26}$

Total CTE risk for lifetime exposure = $\text{Risk}_{0-2} + \text{Risk}_{2-6} + \text{Risk}_{20-26}$

Tables 41R and 42 present the results of the residential MOA calculations for both soil and groundwater RME exposure, respectively. Tables 43R and 44 present the results of the residential MOA calculations for both soil and groundwater CTE exposure, respectively.

Potential RME and CTE risk to a child angler was assessed using the following:

Age (years)	Exposure Factors	Exposure Duration (years)	ADAF (unitless)
0 – <2	Child	2	10
2 – <6	Child	4	3

Total RME and CTE risk for child angler exposure = Risk $_{0-<2}$ + Risk $_{2-<6}$

Tables 45 and 46 present the results of the child angler MOA calculations for RME and CTE fish exposure, respectively.

TCE

As discussed in the IRIS *Trichloroethylene Assessment Summary* (EPA, 2013c), TCE is carcinogenic by a mutagenic MOA for induction of kidney tumors. There is also more limited evidence for non-Hodgkin's lymphoma (NHL) and liver carcinogenicity. In order to account for the mutagenic MOA for kidney tumors, EPA recommends applying ADAFs when estimating kidney cancer risks from early life exposure to TCE. However, NHL and liver cancer must also be accounted for in the cancer risk estimates. To accommodate all three carcinogenic effects, a cancer risk was derived for each age group (0 – <2, 2 – <6, 6 – <16, and 16 – <26), including adjusted kidney cancer potency values and unadjusted potency values for liver cancer and NHL. These risks were then summed across age groups to obtain the total risk for the exposure period of interest. Tables 47 and 48 present the results of the residential MOA calculations for TCE for both RME and CTE groundwater exposure, respectively.

5.2 NONCANCER HEALTH EFFECTS

Potential noncancer health effects from oral and dermal exposure were evaluated by the calculation of hazard quotients (HQs) and hazard indices (HIs). An HQ is the ratio of the average daily dose (ADD) through a given exposure route to the COPC-specific RfD. The HQ-RfD relationship is illustrated by the following equation:

$$HQ = ADD\ RfD$$

Where:

ADD	=	Average daily dose; estimated daily intake averaged over the exposure duration (mg kg-day).
RfD	=	Reference dose (mg kg-day).

The HQ for the inhalation pathway was calculated as follows:

$$HQ = CA\ RfC$$

Where:

CA	=	Air concentration ($\mu g\ m^3$).
RfC	=	Reference concentration ($mg\ m^3$).

HQs were summed to calculate HIs for each scenario. HIs were calculated for each exposure route, and a total HI was calculated based on exposure to the COPCs from exposure routes for each receptor. HIs of less than one indicate that adverse health effects associated with the exposure scenario are unlikely to occur.

5.3 LEAD EVALUATION

Risks from lead exposure are not evaluated using the same methodology as other contaminants. The IEUBK model estimates blood lead concentrations to address exposures to lead. Blood lead concentration is the most widely used index of internal lead body burdens associated with potential adverse health effects of lead. Studies indicate that infants and young children are extremely susceptible to adverse effects from exposure to lead. Considerable behavioral and developmental impairments have been noted in children with elevated blood lead levels. Since children are a more sensitive subpopulation than adults, exposure to lead by adults in a residential scenario is not generally evaluated and the receptor of concern for this scenario is the young child. Evaluation of the young child in a residential scenario is considered protective of adults, including pregnant women; adolescents, including trespassers; and children in a less frequent exposure scenario,

including recreational visitors. It has been determined that childhood blood lead concentrations at or above 10 micrograms per deciliter (µg/dL) present risks to children's health. The EPA risk reduction goal for contaminated sites is to limit the probability of a child's blood lead concentration exceeding 10 µg/dL to 5 percent or less.

Potential residential child exposure to lead in groundwater was evaluated using EPA's IEUBK model for lead in children (EPA, 2007 and 2010). The IEUBK model is designed to estimate blood levels of lead in children (under 7 years of age) based on either default or site-specific input values for air, drinking water, diet, dust, and soil exposure. Because the output of these models is a range of predicted blood lead concentrations, the average shallow and deep groundwater lead concentrations were used (20.6 micrograms per liter [µg/L] and 32.2 µg/L, respectively).

EPA's IEUBK model estimated that the geometric mean blood lead concentration among future residential children exposed to shallow and deep groundwater would be 4.083 µg/dL and 4.895 µg/dL, respectively. Appendix D presents the IEUBK lead model results for shallow and deep groundwater. These estimates are less than EPA's established level of concern of 10 µg/dL. The probability that the child's blood lead concentration exceeds 10 µg/dL is 2.8% for shallow groundwater and 6.4% for deep groundwater for future residential children. EPA's target probability is 5 percent or less. In conclusion, exposures to lead in shallow groundwater do not exceed EPA's target level of concern, whereas exposures to lead in deep groundwater slightly exceed EPA's 5% or less target of concern.

5.4 VAPOR INTRUSION

As discussed previously in Section 2.5, shallow groundwater COPCs were screened against EPA Target Groundwater Concentrations (EPA, 2014d) to evaluate potential vapor intrusion concerns for future receptors. Maximum detected concentrations exceeded their respective Target Groundwater Concentrations for 1,2,4-trimethylbenzene, benzene, bromomethane, chloroform, ethylbenzene, naphthalene, tetrachloroethene, TCE, and cyanide. Ratios for 1,2,4-trimethylbenzene, benzene, bromomethane, and naphthalene were only slightly higher than 1.0 (1.2, 1.6, 1.8, and 1.4, respectively). Ratios for chloroform, ethylbenzene, tetrachloroethene, TCE, and cyanide were slightly higher with ratios of 11.2, 2.0, 3.1, 8.3, and 2.2, respectively. However,

all of these exceedances are driven by concentrations from wells within the capped waste pile area (MW01A and MW02A). These results indicate that vapor intrusion in unlikely to be of concern at the SMS site. Site monitoring well locations relative to site source areas are presented on Figure 2-3.

An additional line of evidence was evaluated for the vapor intrusion pathway that included the collection of soil gas samples for evaluating potential indoor air exposure to future on-site workers and residents. This line of evidence is discussed further in Section 7.4.

5.5 RISK RESULTS

Tables 49R, 50, and 51 present summaries of the total RME and CTE cancer risks and noncancer HIs for all receptors evaluated in the HHRA. The following subsections present the cancer risks and noncancer HIs by receptor. Appendix E presents the RAGS Part D Tables 7, 9, and 10 for both the RME and CTE evaluations.

5.5.1 On-Site Worker

5.5.1.1 Soil

The total soil RME and CTE cancer risks for the on-site worker for the on-site area were within the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 1.3E-05 and 1.4E-06, respectively. The total soil RME and CTE cancer risks for the on-site worker for Flenniken Branch were within or below the EPA acceptable cancer risk range with total cancer risks of 1.0E-05 and 1.7E-06, respectively. The primary RME risk drivers were 2,3,7,8-TCDD TEQ, arsenic, and chromium.

The total soil RME and CTE noncancer HIs for the on-site worker for the on-site area were less than the noncancer benchmark with total HIs of 0.3 and 0.08, respectively. The total soil RME and CTE noncancer HIs for the on-site worker for Flenniken Branch were less than the noncancer benchmark with total HIs of 0.2 and 0.08, respectively.

See tables E-1R and E-2R for the RAGS Part D Tables 7, E-33R and E-34R for the RAGS Part D Tables 9, and E-65R for the RAGS Part D Table 10 for the on-site worker soil evaluation.

5.5.1.2 Groundwater

The total shallow groundwater RME and CTE cancer risks for the on-site worker were above or within the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 3.1E-04 and 3.7E-05, respectively. The total deep groundwater RME and CTE cancer risks for the on-site worker were above or within the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 2.7E-04 and 3.2E-05, respectively. The primary groundwater risk drivers were 2,4-dinitrotoluene, 2,6-dinitrotoluene (deep only), BEHP, chloroform (shallow only), dieldrin, heptachlor epoxide (deep only), pentachlorophenol, aluminum (shallow only), arsenic, chromium, cobalt, manganese, and thallium.

The total shallow groundwater RME and CTE noncancer HIs for the on-site worker exceeded the noncancer benchmark with total HIs of 199 and 50, respectively. The total deep groundwater RME and CTE noncancer HIs for the on-site worker exceeded the noncancer benchmark with total HIs of 132 and 33, respectively. The primary contributors to the shallow groundwater HI exceedance were cobalt, manganese, and thallium. These COPCs contributed to the nervous system, thyroid, and hair target-organ specific exceedances. The primary contributors to the deep groundwater HI exceedances were manganese and thallium which contributed to the nervous system and hair target-organ specific exceedances.

See tables E-3 and E-4 for the RAGS Part D Tables 7, E-35 and E-36 for the RAGS Part D Tables 9, and E-66 and E-67 for the RAGS Part D Tables 10 for the on-site worker groundwater evaluation.

5.5.1.3 Soil Gas

The total soil gas RME and CTE cancer risks for the on-site worker were above the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 8.3E-04 and 1.0E-04, respectively. The primary risk drivers were 1,1-dichloroethane, 1,2-dichloroethane, benzene, chloroform, and chloromethane.

The total soil gas RME and CTE noncancer HIs for the on-site worker were greater than the noncancer benchmark with total HIs of 15 and 2, respectively. The primary contributors to the HI

exceedances were 1,2-dichloroethane and chloromethane (RME only). These COPCs contributed to the nervous system target-organ specific exceedances.

See tables E-5 and E-6 for the RAGS Part D Tables 7, E-37 and E-38 for the RAGS Part D Tables 9, and E-68 and E-69 for the RAGS Part D Tables 10 for the on-site worker soil gas evaluation.

5.5.2 Trespasser

5.5.2.1 Soil

The total soil RME and CTE cancer risks for the adolescent trespasser for the on-site area were at the low end of the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 7.1E-06 and 1.7E-06, respectively. The total soil RME and CTE cancer risks for the adolescent trespasser for Flenniken Branch were either at the low end or below the EPA acceptable cancer risk range with total cancer risks of 5.9E-06 and 1.7E-06, respectively. The primary on-site risk drivers were arsenic and chromium.

The total soil RME and CTE noncancer HIs for the adolescent trespasser for the on-site area were less than the noncancer benchmark with total HIs of 0.3 and 0.06, respectively. The total soil RME and CTE noncancer HIs for the adolescent trespasser for Flenniken Branch were less than the noncancer benchmark with total HIs of 0.2 and 0.04, respectively.

See tables E-7R and E-8R for the RAGS Part D Tables 7, E-39R and E-40R for the RAGS Part D Tables 9, and E-70R and E-71R for the RAGS Part D Tables 10 for the trespasser evaluation.

5.5.3 Recreational User

5.5.3.1 Child

5.5.3.1.1 Soil

The total soil RME and CTE cancer risks for the child recreational user for the on-site area were within the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 4.3E-05 and 5.4E-06, respectively. The total soil RME and CTE cancer risks for the child recreational user for Flenniken Branch were within or below the EPA acceptable cancer risk range with total cancer

risks of 3.4E-05 and 5.4E-06, respectively. The primary risk drivers were 2,3,7,8-TCDD TEQ benzo(a)pyrene, arsenic, and chromium.

The total soil RME and CTE noncancer HIs for the child recreational user for the on-site area were 2 and 0.2, respectively. The total soil RME and CTE noncancer HIs for the child recreational user for Flenniken Branch were 1 and 0.2, respectively. Although the on-site RME HI exceeded the noncancer benchmark, none of the individual COPCs had a total HQ greater than 1.

See tables E-9R and E-10R for the RAGS Part D Tables 7, E-41R and E-42R for the RAGS Part D Tables 9, and E-72R and E-73R for the RAGS Part D Tables 10 for the recreational child evaluation.

5.5.3.2 Adult

5.5.3.2.1 Soil

The total soil RME and CTE cancer risks for the adult recreational user for the on-site area were either within or below the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 4.8E-06 and 3.2E-06, respectively. The total soil RME and CTE cancer risks for the adult recreational user for Flenniken Branch were either at the low end or below the EPA acceptable cancer risk range with total cancer risks of 2.6E-07 and 1.7E-07, respectively. The primary RME risk drivers were arsenic and chromium.

The total soil RME and CTE noncancer HIs for the adult recreational user for the on-site area were less than the noncancer benchmark with HIs of 0.2 and 0.02, respectively. The total soil RME and CTE noncancer HIs for the adult recreational user for Flenniken Branch were less than the noncancer benchmark with HIs of 0.1 and 0.01, respectively.

See tables E-11R and E-12R for the RAGS Part D Tables 7, E-43R and E-44R for the RAGS Part D Tables 9, and E-74R for the RAGS Part D Table 10 for the recreational adult evaluation.

5.5.4 Construction/Utility Worker

5.5.4.1 Soil

The total soil RME and CTE cancer risks for the construction utility worker for the on-site area were within or below the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 1.8E-06 and 1.5E-07, respectively. The total soil RME and CTE cancer risks for the construction utility worker for Flenniken Branch were below the EPA acceptable cancer risk range with total cancer risks of 1.1E-06 and 9.1E-08, respectively.

The total soil RME and CTE noncancer HIs for the construction utility worker for the on-site area were equal to or less than the noncancer benchmark with HIs of 1 and 0.08, respectively. The total soil RME and CTE noncancer HIs for the construction utility worker for Flenniken Branch were less than the noncancer benchmark with HIs of 0.8 and 0.2, respectively.

See tables E-13R and E-14R for the RAGS Part D Tables 7, and E-45R and E-46R for the RAGS Part D Tables 9 for the construction utility worker evaluation.

5.5.5 Resident

5.5.5.1 Soil

The total surface soil RME and CTE cancer risks for the age-adjusted resident for the on-site area were slightly above or within the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 1.6E-04 and 6.7E-05, respectively. The total soil RME and CTE cancer risks for the age-adjusted resident for Flenniken Branch were within the EPA acceptable cancer risk range with total cancer risks of 1.4E-04 and 5.1E-05, respectively. The primary risk drivers were benzo(a)pyrene, 2,3,7,8-TCDD TEQ, arsenic, and chromium.

The total surface soil RME and CTE noncancer HIs for the child resident for the on-site area were 5 and 2, respectively. The total soil RME and CTE noncancer HIs for the child resident for Flenniken Branch were 4 and 2, respectively. Although the on-site RME and CTE HIs exceeded the noncancer benchmark, none of the individual COPCs had a total HQ greater than 1. The

primary contributor to the total RME HI at Flenniken Branch was thallium, which contributed to a target-organ specific exceedance for hair.

The total soil RME and CTE noncancer HIs for the adult resident for the on-site area were 0.5 and 0.2, respectively. The total soil RME and CTE noncancer HIs for the adult resident for Flenniken Branch were 0.4 and 0.2, respectively.

See tables E-15R through E-20R for the RAGS Part D Tables 7, E-47R through E-52R for the RAGS Part D Tables 9, and E-75R through E-77R for the RAGS Part D Tables 10 for the residential soil evaluation.

5.5.5.2 Groundwater

The total shallow groundwater RME and CTE cancer risks were above the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 1.4E-03 and 3.7E-05, respectively. The total deep groundwater RME and CTE cancer risks were above the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 1.7E-03 and 6.5E-04, respectively. The primary shallow groundwater risk drivers were 2,4-dinitrotoluene, BEHP, chloroform, dieldrin, pentachlorophenol, trichloroethene, arsenic and chromium and the primary deep groundwater risk drivers were 1,2-dichloroethane, 2,4-dinitrotoluene, 2,6-dinitrotoluene, BEHP, dieldrin, heptachlor epoxide, pentachlorophenol, arsenic, and chromium.

The total shallow groundwater RME and CTE noncancer HIs for child resident exceeded the noncancer benchmark with total HIs of 487 and 245, respectively. The total deep groundwater RME and CTE noncancer HIs for the child resident exceeded the noncancer benchmark with total HIs of 345 and 180, respectively. The primary contributors to the shallow groundwater HI exceedances were BEHP, aluminum, arsenic, cobalt, manganese, mercury, molybdenum, nickel, thallium, and zinc. These COPCs contributed to target-organ specific exceedances for blood, liver, kidney, body weight, nervous system, skin, thyroid, and hair. The primary contributors to the deep groundwater HI exceedances were BEHP, arsenic, cobalt, manganese, molybdenum, and thallium which also contributed to target-organ specific exceedances for nervous system, blood, liver, skin, thyroid, and hair.

The total shallow groundwater RME and CTE noncancer HIs for adult resident exceeded the noncancer benchmark with total HIs of 296 and 148, respectively. The total deep groundwater RME and CTE noncancer HIs for the adult resident exceeded the noncancer benchmark with total HIs of 211 and 109, respectively. The primary contributors to the shallow groundwater HI exceedances were BEHP, aluminum, arsenic, cobalt, manganese, nickel, thallium, and zinc. These COPCs contributed to target-organ specific exceedances for blood, liver, body weight, nervous system, skin, thyroid, and hair. The primary contributors to the deep groundwater HI exceedances were BEHP, cobalt, manganese, molybdenum, and thallium which also contributed to the target-organ specific exceedances for nervous system, liver, thyroid, blood, and hair.

See tables E-21through E-26 for the RAGS Part D Tables 7, E-53 through E-58 for the RAGS Part D Tables 9, and E-78 through E-83 for the RAGS Part D Tables 10 for the residential groundwater evaluation.

5.5.5.3 Soil Gas

The total soil gas RME and CTE cancer risks for the age-adjusted resident were above the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 3.6E-03 and 1.4E-03, respectively. The primary risk drivers were 1,1-dichloroethane, 1,2-dichloroethane, benzene, chloroform, chloromethane, and ethylbenzene.

The total soil gas RME and CTE noncancer HIs for the resident were 63 and 24, respectively. The primary contributor to the total RME HI was 1,2-dichloroethane and chloromethane, which contributed to target-organ specific exceedance for nervous system.

See tables E-27 and E-28 for the RAGS Part D Tables 7, E-59 and E-60 for the RAGS Part D Tables 9, and E-84 and E-85 for the RAGS Part D Tables 10 for the residential soil evaluation.

5.5.6 Recreational Angler

5.5.6.1.1 Fish Tissue

5.5.6.2 Child

The total fish RME cancer risks for the child angler for Knob Creek were greater than the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 1.8E-03 (carp), 3.8E-04 (largemouth bass) and 1.7E-03 (all species). The total fish CTE cancer risks for the child angler for Knob Creek were greater than or within the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 4.6E-04 (carp), 9.5E-05 (largemouth bass) and 4.2E-04 (all species). The primary risk drivers were 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260, arsenic, and chromium for carp, 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260, and chromium for largemouth bass, and 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260, arsenic, and chromium for all species.

The total fish RME noncancer HIs for the child angler for Knob Creek were greater than the noncancer benchmark with HIs of 119 (carp), 15 (largemouth bass), and 122 (all species). The total fish CTE noncancer HIs for the child angler for Knob Creek were greater than the noncancer benchmark with HIs of 30 (carp), 4 (largemouth bass), and 31 (all species). The primary contributors to the total HI were 2,3,7,8-TCDD TEQ and PCB dioxin-like congener for carp, 2,3,7,8-TCDD TEQ, PCB Dioxin-like Congener TEQ, and mercury for largemouth bass and all species.

See tables E-29 and E-30 for the RAGS Part D Tables 7, E-61 and E-62 for the RAGS Part D Tables 9, and E-86 and E-87 for the RAGS Part D Tables 10 for the child recreational angler evaluation.

5.5.6.3 Adult

The total fish RME cancer risks for the adult angler for Knob Creek were greater than the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 2.5E-03 (carp), 2.7E-04 (largemouth bass) and 2.4E-03 (all species). The total fish CTE cancer risks for the adult angler for Knob Creek were greater than the EPA acceptable cancer risk range of 1E-06 to 1E-04 with total cancer risks of 6.3E-04 (carp), 6.7E-05 (largemouth bass) and 6.1E-04 (all species). The primary risk drivers were 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260, arsenic, and chromium for carp, 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260,

and chromium for largemouth bass, and 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260, arsenic, and chromium for all species.

The total fish RME noncancer HIs for the adult angler for Knob Creek were greater than the noncancer benchmark with HIs of 45 (carp), 5.8 (largemouth bass), and 11 (all species). The total fish CTE noncancer HIs for the adult angler for Knob Creek were greater than the noncancer benchmark with HIs of 11 (carp), 2 (largemouth bass), and 11 (all species). The primary contributors to the total HI were 2,3,7,8-TCDD TEQ (carp and all species only), PCB dioxin-like congener TEQ, and PCB-1260 (carp), PCB Dioxin-like Congener TEQ, and mercury (largemouth bass and all species only).

See tables E-31 and E-32 for the RAGS Part D Tables 7, E-63 and E-64 for the RAGS Part D Tables 9, and E-88 and E-89 for the RAGS Part D Tables 10 for the adult recreational angler evaluation.

Tables 49R through 51 present a summary of COC exceedances (TR greater than 1E-06 and/or THQ greater than1.0) for soil, groundwater, fish tissue, and soil gas receptors, respectively.

5.6 CUMULATIVE RISKS

Table 53R presents the cumulative cancer risks and noncancer HIs across all media for both the on-site worker and resident receptors. The remaining receptors were not evaluated for more than one exposure medium and were therefore not included in the cumulative risk summary. As shown, all of the cumulative cancer risks and noncancer HIs for the on-site worker and resident exceeded EPA's acceptable cancer risk range and noncancer threshold of 1.

5.7 REMEDIAL GOAL OPTIONS

Remedial goal options (RGOs) are site-specific long-term numerical goals used during analysis of potential remedial alternatives. According to EPA guidance, once the HHRA has been performed, RGOs should be derived from the site-specific cancer risks and noncancer HQs (EPA, 2013a). RGOs were calculated using a risk ratio method based on site specific exposure concentrations, parameters, and dose equations. The ratio between the target risk (TR)/target hazard quotient

(THQ) and the calculated cancer risk noncancer hazard quotient (HQ) due to individual contaminants of potential concern (COPCs) in a specific medium used is as follows:

Exposure Point Concentration (EPC) Cancer Risk or Noncancer HQ = RGO TR or THQ

Rearranging this equation allows for the site-specific calculation of RGOs using the follow equation and assumptions:

RGO = EPC * TR or THQ Cancer Risk or Noncancer HQ

Where:

RGO = Media-specific remedial goal option (mg kg or µg L)

EPC = COPC- and medium-specific exposure point concentration (mg kg or µg L).

TR = 10-6, 10-5, or 10-4 cancer-based

THQ = 0.1, 1.0, or 3.0 noncancer-based

Cancer Risk = COPC- and medium-specific cancer risk based on residential exposure.

Noncancer HQ= COPC- and medium-specific hazard quotient based on residential exposure.

RGOs for soil based on residential land use are presented in Table 58. RGOs for soil based on commercial industrial land use are presented in Table 59. RGOs for groundwater based on residential land use may be found in Table 60R.

6. UNCERTAINTY ANALYSIS

The goal of an uncertainty analysis in a risk assessment is to provide to the appropriate decision makers (i.e., risk managers) information about the key assumptions, their inherent uncertainty and variability, and the impact of this uncertainty and variability on the estimates of risk. The uncertainty analysis shows that risks are relative in nature and do not represent an absolute quantification. The subsections that follow identify the major uncertainties inherent in the HHRA process by report section to determine if the calculated risks may have been overestimated or underestimated, and the approximate degree to which this may have occurred.

6.1 HAZARD IDENTIFICATION

- **Incorporation of data within on-site capped areas** – As mentioned previously, in order to fully characterize the on-site area, subsurface data within the on-site capped areas is incorporated in the HHRA evaluation. The capped area soil is unlikely to ever be available for exposure to human receptors and overestimates the human health risks associated with subsurface soil exposure to a significant degree.

- **Analytes without screening values** – A number of detected analytes did not have screening values available and were not carried through the risk assessment process. Because toxicity criteria were not available for these analytes (as demonstrated by a lack of health-based screening concentrations), risks (cancer and noncancer) could not be estimated. It is possible that site risks are underestimated as a result.

- **Risks from laboratory-related BEHP –** BEHP is a carcinogen and was identified as a groundwater COPC. However, BEHP is a common laboratory contaminant and it is highly unlikely that it is present in the shallow or deep groundwater at SMS site. BEHP exposure resulted in a total RME residential cancer risk of 2.9E-04 (21.2% of total cancer risk) and 8.4E-04 (50% of total cancer risk) for the shallow and deep groundwater respectively. Total BEHP HQs for the RME child resident were 4.8 (less than 1% of total HI) and 14 (4.0% of the total HI) for the shallow and deep groundwater, respectively. It is likely that the risks from BEHP are significantly overestimated and that it is not present in the SMS groundwater at levels of concern for human health.

- **Chromium evaluation** – Hexavalent chromium results for groundwater showed three hexavalent chromium detects out of nine samples. The detected hexavalent chromium concentrations were significantly less than those of total chromium, indicating that the total chromium samples are likely not largely comprised of hexavalent chromium. However, for conservatism, the toxicity and cancer risk characterizations for total chromium were evaluated through use of hexavalent chromium CSFs and URFs as presented on the EPA RSL table (EPA, 2015a). The use of hexavalent chromium CSFs and URFs to evaluate risks from exposures to total chromium presents a conservative approach that likely overestimates risks from total chromium.

- **Essential nutrients** – As discussed in Section 2.5, nutrient-based reference values for calcium, chloride, fluoride, nitrate, nitrite, sodium, and sulfate are significantly exceeded by site concentrations. Currently, site groundwater is not used for potable water and there are no plans for future potable use. Furthermore, it is evident that hypothetical future receptors would not be able to withstand drinking the water due to its high sodium levels. At 250 milligrams per liter (mg/L), the secondary MCL for chloride (EPA, 2009b), drinking water begins to taste salty. Site levels of 30,000 mg/L far exceed this level and would eliminate any future receptors from potentially ingesting tap water.

- **Inclusion of samples MW10A and MW10B** – Groundwater monitoring wells MW10A and MW10B collected in June of 2012 were initially determined to be a

background locations due to their proximity to the site as well as being up gradient of the site. However, analytical results indicated high levels of contaminants within these wells. Therefore, MW10A and MW10B were incorporated into the on-site groundwater evaluation and a new background location was established. Resampling of these wells occurred in December of 2012, June of 2013, November of 2013, and March of 2014. The uncertainty associated with the inclusion of these samples and their implications on site-related contamination is unknown and likely overestimates groundwater risks to human health receptors.

- **Modeling of indoor air concentrations** – Indoor air concentrations were modeled based on EPA's VISL Calculator using site soil gas data. Modeling any exposure medium presents a level of uncertainty. There are no buildings currently on-site for which to sample indoor air concentrations. It is unknown whether these modeling results over- or underestimate indoor air risks to potential future receptors.

6.2 EXPOSURE ASSESSMENT

- **The selection of exposure scenarios** – It is likely that the scenarios evaluated overstate realistic exposures, and thus overestimate the actual site risks. For example, the evaluation of a future residential scenario would significantly overestimate potential site risks given the current conditions and anticipated future land uses.

- **The selection of exposure assumptions** – The exposure assumptions directly influence the calculated doses (chronic daily intakes), and ultimately the calculation of risk. The RME concept was used to estimate the exposure potential for each of the receptors that were evaluated in the HHRA. The RME is defined as the "maximum exposure that is reasonably expected to occur at the site" (EPA, 1989). In most cases, these assumptions contribute to an overestimation of plausible real-life exposures, and a resulting overestimation of risk.

- **Fish exposure assumptions** – Due to a lack of site- or regional-specific fish ingestion rates, a default of 54 g/day was used for the adult angler (27 g/day for the child angler) per EPA Region 4 guidance (EPA, 2008). The use of 54 g/day is equivalent to approximately two 6 ounce meals per week from Knob Creek. Additionally, it was conservatively assumed that the anglers catch and consume all of their fish from Knob Creek. These assumptions are likely overestimates for a recreational angler and therefore overestimate the risks associated with the adult and child angler scenarios to a significant degree.

- **Fish tissue collection** – As presented in Figure 2-4, fish tissue samples were collected well downstream of the SMS site, as well as downstream from several other potential source areas shown in Figure 6-1, land use. Furthermore, Knob Creek is largely comprised of waters received from the Tennessee River, which is potentially another large source of contamination in Knob Creek fish tissue. Given the proximity of fish tissue samples to the SMS site, the proximity of other potential source areas, and the

contribution from the Tennessee River, risks associated with the fish consumption pathway are likely not entirely attributable to the SMS site.

- **Calculation of 95% UCLs** – As presented in Section 4.3.6, where appropriate, one-sided 95% UCLs were calculated and used as the EPC. A conservative approach of using the full detection limit for NDs was followed for all COPCs in this HHRA. The resulting value represents a conservative estimate of the COPC concentration to which an individual could be exposed in any given EA during the defined exposure duration and frequency. It is likely that using the full detection limit overestimates the site risk to some degree.

- **Use of maximum detected concentrations for EPCs** – As a conservative measure, in cases where there were not enough samples to calculate a UCL, the maximum detected concentration was assumed as the EPC. The ProUCL guidance indicates that the maximum detected concentration should never be used as it is not a central tendency term and is not relatable to how receptors contact media at the site. IThe use of maximum detected concentrations for the EPC significantly overestimates receptor risks.

6.3 TOXICITY ASSESSMENT

- **The use of CSFs and RfDs** – Both cancer risks and noncancer health effects were evaluated using EPA-approved or provisional toxicity criteria. The CSFs and RfDs are derived to be health protective and tend to overestimate true toxicity in humans. Therefore, risk calculations, which are partially based on toxicity estimates, may be overstated in general. The exact degree of overestimation cannot always be determined and each COPC must be evaluated on a case-by-case basis.

- **Lack of toxicity values for dermal exposure** – Toxicity values for dermal exposures have not been developed by EPA. Oral reference doses and CSF_os were adjusted and used to assess toxicity from dermal exposures following guidelines provided by EPA. The dermal route of exposure can result in different patterns of distribution, metabolism, and excretion than occur from the oral route. When oral toxicity values for systemic effects are applied to dermal exposures, uncertainty in the risk assessment is introduced because these differences are not taken into account. Since any toxicity differences between oral and dermal exposure would depend on the specific COPC, use of oral toxicity factors can result in the overestimation or underestimation of risk. It is not possible to make a general statement about the direction or magnitude of this uncertainty.

- **Dermal carcinogenicity of PAHs** – The majority of animal and human studies of PAH exposure strongly suggest that the carcinogenic effects resulting from exposure occur at the site of contact or administration (e.g., skin tumors from dermal contact, GI tumors from oral contact) (ATSDR, 1995). There is little evidence that PAHs produce systemic tumors following dermal contact (ATSDR, 1995). In order to justify the

extrapolation of a CSF_o to a CSF_d, an assumption must be made that the type of cancer produced by oral administration is the same as that which would be expected following dermal contact (i.e., that dermal contact with PAHs would produce GI tumors). Since this is not believed to be the case, even though dermal absorption has been quantified for PAHs, extrapolation of the CSF_o to the dermal route of exposure introduces a high level of uncertainty into the analysis. Although it is unlikely that GI tumors would be produced by dermal contact with PAHs, since there is evidence that dermal contact with PAHs may cause skin cancer, the only available data (i.e., the CSF_o) was used to quantify potential cancer risk from dermal contact with PAHs. This approach introduces a high degree of uncertainty into the analysis, and may overestimate the dermal cancer risks from PAHs to a significant degree.

7. RISK SUMMARY

7.1 SOIL

As presented in Table 54, the majority of carcinogenic risks were below the EPA acceptable cancer risk range of 1E-06 to 1E-04 and the majority of noncancer HIs were below the EPA noncancer benchmark of 1.0. The on-site RME residential scenario slightly exceeded the EPA acceptable levels for chromium (cancer risk of 1.2E-04) and thallium at Flenniken Branch slightly exceeded the EPA acceptable level (noncancer HI of 1.4). As discussed previously, chromium levels are likely overestimated due to the conservative use of hexavalent chromium toxicity values. The thallium total HI of 1.4 is slightly above the noncancer benchmark. Given that the overall approach to the HHRA would tend to overestimate actual risks to a fairly significant degree, it is unlikely that soil exposure at the SMS site would result in any unacceptable health impacts for the evaluated soil receptors.

7.2 GROUNDWATER

As presented in Table 55, several shallow groundwater COPCs had total RME cancer risks or total HIs in exceedance of EPA's acceptable criteria, including BEHP, aluminum, arsenic, chromium, cobalt, manganese, mercury, molybdenum, nickel, thallium, and zinc. Similarly, deep groundwater COPCs with total RME cancer risks or total HIs in exceedance of EPA's acceptable criteria include BEHP, arsenic, cobalt, cyanide, manganese, molybdenum, and thallium. As discussed previously in the Uncertainty Analysis, risks associated with BEHP are likely due to laboratory contamination and not attributable to site-related contamination. Similarly, risks

associated with chromium are likely overestimated due to the use of hexavalent chromium toxicity values. Contributions from MW10A and MW10B, as discussed previously, further overestimate site groundwater risks. The majority of shallow groundwater risks are driven by the initial round of sampling from MW10A including aluminum, arsenic, cobalt, manganese, mercury, nickel, thallium, and zinc. The deep groundwater COPCs being driven by the first round of sampling from MW10B include BEHP.

Additionally, vapor intrusion of 1,2,4-trimethylbenzene, benzene, bromomethane, chloroform, ethylbenzene, naphthalene, tetrachloroethane, TCE, and cyanide could be a concern for potential future receptors. However, as stated previously, exceedances for 1,2,4-trimethylbenzene, benzene, bromomethane, and naphthalene only slightly exceed a ratio of 1 and are likely not a concern for vapor intrusion. Furthermore, the exceedances for the remaining VOCs are based on concentrations from wells located within the waste pile area (MW01A and MW 02A).

Shallow and deep groundwater cancer risks and noncancer HQs are also driven by samples located within the capped waste pile area including MW08A, MW07B, MW02A, and MW03B or downgradient of the waste pile area (MW11B).

Although site groundwater risks are likely overestimated for a number of reasons stated previously, there is still the potential that groundwater exposure to the above COPCs at the SMS site would result in unacceptable health impacts primarily for the future resident and to a lesser degree, the future on-site worker. It should be noted however that future groundwater use is unlikely at the SMS site. A hypothetical future residential scenario was only evaluated to determine an upper-bound estimate of site risks and the majority of groundwater risks are being driven by the conservative residential evaluation.

As discussed in Section 5.3, EPA's IEUBK model estimated that the geometric mean blood lead concentration among future residential children exposed to shallow groundwater would be less than EPA's established level of concern and the probability that the child's blood lead concentration exceeds 10 µg/dL would be less than 5% for both shallow groundwater. Although the deep groundwater shows a geometric blood lead level less than 10 µg/dL, there is a greater than 5% probability that a child's blood lead concentration exceeds 10 µg/dL. Therefore,

exposures to lead are not a concern in shallow groundwater, but may be of concern from deep groundwater at the SMS site.

7.3 FISH

Table 56 presents those COPCs in fish tissue with RME total cancer risks exceeding EPA's acceptable cancer risk range or total HIs exceeding EPA's noncancer benchmark. These COPCs include 2,3,7,8-TCDD TEQ, PCB dioxin-like congener TEQ, PCB-1260, chromium, and mercury. As discussed in the Uncertainly Analysis, risks associated with the child and adult anglers is likely overestimated due to the use of the conservative ingestion rate and fraction ingested used, the proximity of other potential source areas, and the contribution from Tennessee River. Fish ingestion risks are likely not entirely attributable to site-related activities at SMS. However, taking into account this and other conservative assumptions in the HHRA, there is still the potential for adverse health impacts to child and adult anglers at Knob Creek for the above COPCs.

7.4 SOIL GAS

Table 57 presents those COPCs in soil gas with RME total cancer risks exceeding EPA's acceptable cancer risk range or total HIs exceeding EPA's noncancer benchmark. These COPCs include 1,1-dichloroethane, 1,2-dichlroethane, and chloromethane. As discussed in the Uncertainly Analysis, risks associated with the soil gas pathway is likely overestimated due to the modeling of indoor air concentrations, rather using actual indoor air sampling results. However, taking into account this and other conservative assumptions in the HHRA, there is still the potential for adverse health impacts to potential future on-site workers and hypothetical future residents for the above COPCs. It should be noted that there are currently no buildings on-site and future development is not anticipated. In the event that future development occurs at the SMS site, the vapor intrusion pathway will need to be revisited.

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TABLES

Table 1R

Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Surface Soil

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Point: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
Surface	205992	Benzo(b)fluoranthene	0.051	0.051	mg/kg	SMS00	1/2	0.29 - 0.29	0.051	0.15 c	NO	BTL
	207089	Benzo(k)fluoranthene	0.041	0.041	mg/kg	SMS00	1/2	0.29 - 0.29	0.041	1.5 c	NO	BTL
	206440	Fluoranthene	0.04	0.04	mg/kg	SMS00	1/2	0.29 - 0.29	0.04	230 n	NO	BTL
	129000	Pyrene	0.02	0.02	mg/kg	SMS00	1/2	0.29 - 0.29	0.02	170 n	NO	BTL
	35822469	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	0.000051	0.0001	mg/kg	SMS00FL07_100		NA	0.0001	Equivalent to 2,3,7,8-TCDD TEQ		
	67562394	1,2,3,4,6,7,8-Heptachlorodibenzofuran	0.000051	0.00074	mg/kg	SMS00FH05	7/7	4.7E-06 - 4.7E-06	0.00074	Equivalent to 2,3,7,8-TCDD TEQ		
	55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	0.000001[illegible]	0.000[illegible]	mg/kg	SMS00FH05	5/5	1.0E-07 - 0.000004	0.000[illegible]	Equivalent to 2,3,7,8-TCDD TEQ		
	39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	0.000000[illegible]	0.000001	mg/kg	SMS00FH05	0/5	2.9E-07 - 2.4E-06	0.000001	Equivalent to 2,3,7,8-TCDD TEQ		
	70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	0.000000[illegible]4	0.00001	mg/kg	SMS00FH05, SMS00FL00_100	0/5	1.4E-06 - 2.5E-06	0.00001	Equivalent to 2,3,7,8-TCDD TEQ		
	57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	0.000000[illegible]5	0.000[illegible]	mg/kg	SMS00FH05	0/5	9.7E-07 - 0.000004	0.000[illegible]	Equivalent to 2,3,7,8-TCDD TEQ		
	57117449	1,2,3,6,7,8-Hexachlorodibenzofuran	0.000000[illegible]	0.000001[illegible]	mg/kg	SMS00FH05	7/7	9.5E-07 - 9.5E-07	0.000001[illegible]	Equivalent to 2,3,7,8-TCDD TEQ		
	19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	0.000000[illegible]2	0.000005	mg/kg	SMS00FH05	5/5	1.0E-06 - 1.5E-06	0.000005	Equivalent to 2,3,7,8-TCDD TEQ		
	72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	0.000000075	0.000004[illegible]2	mg/kg	SMS00FH05	4/5	9E-07 - 4.1E-06	0.000004[illegible]2	Equivalent to 2,3,7,8-TCDD TEQ		
	57117-31-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	0.000000014	0.000007	mg/kg	SMS00FL00_100	5/5	1E-07 - 2.9E-06	0.000007	Equivalent to 2,3,7,8-TCDD TEQ		
	0001746-01-6	2,3,4,7,8-Hexachlorodibenzofuran	0.000000[illegible]5	0.000000[illegible]	mg/kg	SMS00FL04	0/5	1.2E-06 - 4.2E-06	0.000000[illegible]	Equivalent to 2,3,7,8-TCDD TEQ		
	57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	0.000000[illegible]5	0.000054	mg/kg	SMS00FL04	0/5	2.9E-07 - 1.2E-06	0.000054	Equivalent to 2,3,7,8-TCDD TEQ		
	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000000045	0.000001	mg/kg	SMS00FL00_100	1/5	9E-07 - 0.0E-07	0.000001	Equivalent to 2,3,7,8-TCDD TEQ		
	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	0.000000025	0.000011	mg/kg	SMS00FL00_100	0/5	2.0E-06 - 1.1E-06	0.000011	Equivalent to 2,3,7,8-TCDD TEQ		
	3268879-7	Octachlorodibenzo-p-dioxin	0.000054	0.014	mg/kg	SMS00FL07_100		NA	0.014	Equivalent to 2,3,7,8-TCDD TEQ		
	39001020	Octachlorodibenzofuran	0.000000042	0.000011	mg/kg	SMS00FH05, SMS00FL04	7/7	3E-06 - 3E-06	0.000011	Equivalent to 2,3,7,8-TCDD TEQ		
	--	2,3,7,8-TCDD TEQ	0.000000040	0.000020	mg/kg	SMS00FL04		NA	0.000020	0.000000042 c	YES	BTL
	12674112	PCB-1016	0.045	0.045	mg/kg	SMS00FM05	1/5	0.012 - 0.056	0.045	0.4 n	NO	BTL
	11097691	PCB-1254	0.001	0.022	mg/kg	SMS00FL00	2/5	0.012 - 0.02	0.022	0.11 n	NO	BTL
	11096-82-5	PCB-1260	0.027	0.027	mg/kg	SMS00FM05	1/5	0.012 - 0.056	0.027	0.24 c	NO	BTL
	7429905	Aluminum	500	120000	mg/kg	SMS00FH07	49/49	NA	120000	7700 n	YES	BTL
	7440-38-2	Arsenic	0.9	5	mg/kg	SMS00FH12	49/49	NA	5	0.7 c	YES	BTL
	7440-39-3	Barium	29	200	mg/kg	SMS00FL00	49/49	NA	200	1500 n	NO	BTL
	7440417	Beryllium	0.5	5.7	mg/kg	SMS00FL00	49/49	0.4 - 0.55	5.7	16 n	NO	BTL
	7440-43-9	Cadmium	0.21	4.5	mg/kg	SMS00FH05	45/49	0.44 - 0.4	4.5	7.0 n	NO	BTL

Table 1R

Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Surface Soil

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
Surface Soil	7440702	Calcium	1100	170000	mg/kg	SMS-SB04	49/49	NA	170000	NUT	NO	NUT
	7440473	Chromium	11	4	mg/kg	SMS-SB03	49/49	NA	4	[illegible]	YES	ARL
	7440484	Cobalt	[illegible]	41	mg/kg	SMS-SB03, SMS-SB04	4/4	NA	41	[illegible]	YES	ARL
	7440508	Copper	7	1200	mg/kg	SMS-SB03	49/49	NA	1200	[illegible]	YES	ARL
57125	Cyanide	[illegible]	1	mg/kg	SMS-SB05	2/4	[illegible] - [illegible]	1	[illegible]	[illegible]	NO	BCL
7439896	Iron	1[illegible]000	92000	mg/kg	SMS-SB05	49/49	NA	92000	55000	[illegible]	YES	ARL
7439921	Lead	12	150	mg/kg	SMS-SB05, SMS-SB06	49/49	NA	150	400		NO	BCL
7439954	Magnesium	5[illegible]	22000	mg/kg	SMS-SB[illegible]	49/49	NA	22000	NUT		NO	NUT
7439965	Manganese	100	4400	mg/kg	SMS-SB12	49/49	NA	4400	1[illegible]	[illegible]	YES	ARL
7439976	Mercury	[illegible]17	[illegible]94	mg/kg	SMS-SB04	47/4	[illegible] - [illegible]	[illegible]94	[illegible]	[illegible]	NO	BCL
7440020	Nickel	[illegible]	1[illegible]	mg/kg	SMS-SB05	49/49	NA	1[illegible]	150	[illegible]	NO	BCL
7440097	Potassium	[illegible]40	12000	mg/kg	SMS-SB[illegible]	49/49	5[illegible] - 5[illegible]	12000	NUT		NO	NUT
77[illegible]492	Selenium	[illegible]	[illegible]5	mg/kg	SMS-SB05	[illegible]/4	[illegible] - 7	[illegible]5	[illegible]	[illegible]	NO	BCL
7440224	Silver	1	1	mg/kg	SMS-SB03	1/49	[illegible] - 17	1	[illegible]	[illegible]	NO	BCL
7440235	Sodium	1[illegible]	100	mg/kg	SMS-SB[illegible]	21/49	420 - 740	100	NUT		NO	NUT
7440280	Thallium	[illegible]	[illegible]	mg/kg	SMS-SB[illegible]	1/49	[illegible] - 42	[illegible]	[illegible]	[illegible]	YES	ARL
7440622	Vanadium	17	[illegible]4	mg/kg	SMS-SB05	49/49	NA	[illegible]4	[illegible]	[illegible]	YES	ARL
7440666	Zinc	[illegible]4	4200	mg/kg	SMS-SB05	49/49	NA	4200	[illegible]	[illegible]	YES	ARL
Pesticides/PCBs	50293	4,4'-DDT	[illegible]05	[illegible]05	mg/kg	SMS-SB04	[illegible]	[illegible]05 - [illegible]	[illegible]05	1[illegible]	NO	BCL
5655[illegible]	Endosulfan II	[illegible]51	[illegible]51	mg/kg	SMS-SB04	1	[illegible] - [illegible]	[illegible]51	[illegible]15	[illegible]	YES	ORS
50[illegible]2	Endosulfan I	[illegible]	[illegible]1	mg/kg	SMS-SB05	2	[illegible] - [illegible]	[illegible]1	[illegible]15	[illegible]	YES	ARL
2[illegible]992	Endosulfan sulfate	[illegible]	[illegible]11	mg/kg	SMS-SB05	2	[illegible] - [illegible]	[illegible]11	[illegible]15	[illegible]	YES	ORS
1[illegible]242	Endrin aldehyde	[illegible]5	[illegible]5	mg/kg	SMS-SB04	1	[illegible] - [illegible]	[illegible]5	170	[illegible]	NO	BCL
2[illegible]9	Endrin sulfate	[illegible]	[illegible]1	mg/kg	SMS-SB05	2	[illegible] - [illegible]	[illegible]1	1[illegible]5	[illegible]	YES	ORS
21[illegible]12	Chlordane	[illegible]	[illegible]	mg/kg	SMS-SB05	2	[illegible] - [illegible]	[illegible]	15	[illegible]	YES	ORS
7[illegible]20	Endrin	[illegible]	[illegible]4	mg/kg	SMS-SB04	2	[illegible]2 - [illegible]4	[illegible]4	1	[illegible]	NO	BCL
2[illegible]440	Heptachlor	[illegible]42	[illegible]14	mg/kg	SMS-SB05	[illegible]	[illegible] - [illegible]	[illegible]14	[illegible]	[illegible]	NO	BCL
50[illegible]	Methoxychlor	[illegible]	[illegible]	mg/kg	SMS-SB05	1	[illegible] - [illegible]	[illegible]	170	[illegible]	NO	BCL
12[illegible]	Aroclor	[illegible]	[illegible]15	mg/kg	SMS-SB05	[illegible]	[illegible] - [illegible]	[illegible]15	170	[illegible]	NO	BCL

Table 1R

Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Surface Soil

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)		COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
Floodplain Erosion	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	5/5	NA	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	4/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,4,7,8,9-Heptachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	1/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	1/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,6,7,8-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	1/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,6,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	4/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,7,8,9-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	2/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	1,2,3,7,8-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	2/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	2,3,4,6,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	1/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	2,3,4,7,8-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	2,3,7,8-Tetrachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	Octachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	5/5	NA	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	[illegible]	Octachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/5	[illegible] - [illegible]	[illegible]	Equivalent to 2,3,7,8-TCDD TEQ			
	--	2,3,7,8-TCDD TEQ	[illegible]	[illegible]	mg/kg	[illegible]	5/5	NA	[illegible]	[illegible]		YES	ARAR
	[illegible]	PCB-1260	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible] - [illegible]	[illegible]	[illegible]	n	NO	BKG
	[illegible]	Aluminum	4500	1[illegible]	mg/kg	[illegible]	[illegible]/[illegible]	NA	1[illegible]	[illegible]	n	YES	ARAR
	[illegible]	Antimony	[illegible]	[illegible]	mg/kg	[illegible]	5/[illegible]	[illegible] - [illegible]	[illegible]	[illegible]	n	NO	BKG
	[illegible]	Arsenic	4.1	15	mg/kg	[illegible]	[illegible]/[illegible]	NA	15	[illegible]		YES	ARAR
	[illegible]	Barium	2[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/[illegible]	NA	[illegible]	15[illegible]	n	NO	BKG
	[illegible]	Beryllium	[illegible]	1	mg/kg	[illegible]	[illegible]/[illegible]	NA	1	[illegible]	n	NO	BKG
	[illegible]	Cadmium	[illegible]	1.1	mg/kg	[illegible]	[illegible]/[illegible]	[illegible] - [illegible]	1.1	[illegible]	n	NO	BKG
	[illegible]	Calcium	2[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/[illegible]	NA	[illegible]	NOT		NO	NOT
	[illegible]	Chromium	11	4	mg/kg	[illegible]	[illegible]/[illegible]	NA	4	[illegible]		YES	ARAR
	[illegible]	Cobalt	[illegible]	15	mg/kg	[illegible]	[illegible]/[illegible]	NA	15	[illegible]	n	YES	ARAR
	[illegible]	Copper	11	[illegible]	mg/kg	[illegible]	[illegible]/[illegible]	NA	[illegible]	[illegible]	n	NO	BKG
	[illegible]	Cyanide	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/[illegible]	[illegible] - [illegible]	[illegible]	[illegible]	n	YES	ARAR
	[illegible]	Iron	1[illegible]	[illegible]	mg/kg	[illegible]	[illegible]/[illegible]	NA	[illegible]	55[illegible]	n	YES	ARAR
	[illegible]	Lead	[illegible]	75	mg/kg	[illegible]	[illegible]/[illegible]	NA	75	400		NO	BKG

Table 1R

Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Surface Soil

Smokey Mountain Smelters

Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
Residential Garden Soil	7440-02-0	Nickel	5.70	2000	mg/kg	SMS005	1/11	NA	2000	NUT	Y	NUT
	7440-05-8	Palladium	4.0	1000	mg/kg	SMS004	1/11	NA	1000	1.0 n	Y	ARL
	7440-06-4	Platinum	0.012	0.17	mg/kg	SMS00	5/10	0.0017 - 0.1	0.17	2 n	N	ESL
	7440-09-7	Potassium	5.4	45	mg/kg	SMS004, SMS004D	1/11	NA	45	150 n	N	ESL
	7440-09-7	Potassium	120	1000	mg/kg	SMS005	10/11	0.00 - 0.00	1000	NUT	N	NUT
	77-24-0	Ruthenium	1	2.1	mg/kg	SMS004	5/11	0.9 - 4	2.1	0.9 n	N	ESL
	7440-22-4	Silver	0	0	mg/kg	SMS00	1/11	0.42 - 1	0	0.9 n	N	ESL
	7440-23-5	Sodium	50	0.00	mg/kg	SMS004	12/11	90 - 90	0.00	NUT	N	NUT
	7440-24-0	Strontium	0.0	0	mg/kg	SMS00	5/5	NA	0	470 n	N	ESL
	7440-28-0	Thallium	0.9	1.1	mg/kg	SMS004	2/11	0.42 - 4.0	1.1	0.07 n	Y	ARL
	7440-31-5	Tin	2.9	2.9	mg/kg	SMS01	1/5	1.5 - 1.5	2.9	470 n	N	ESL
	7440-32-6	Titanium	1	0	mg/kg	SMS002	5/5	NA	0	NEW	N	NEW
	7440-33-7	Tungsten	12	27	mg/kg	SMS004	1/11	NA	27	0.9 n	N	ESL
	7440-55-3	Gallium	0.0	1	mg/kg	SMS00	5/5	NA	1	NEW	N	NEW
	7440-66-6	Zinc	51	450	mg/kg	SMS00	1/11	NA	450	2000 n	N	ESL

Notes:

(1) = Maximum detected concentration used for screening

(2) = Risk-based screening toxicity value obtained from the Region 3 Screening Levels (RSL) Table (January, 2015)

Screening Toxicity Value Sources:

- Fate/Transport Screening Value based on Soil Leachate Protection Standards

- Human Health Screening Value based on Noncancer

(3) = Rationale for Inclusion or Deletion

ARL = Above Screening Level

CLSS = Minimum of screening values of compounds with same or similar toxicity

ESL = Below Screening Level

NUT = Essential nutrient

NEW = Not in table

n = noncancer risk based screening value set at 1/10 of the cancer risk based screening value

c = cancer risk based screening value set at 1E-06

NA = not available

Table 2R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

[illegible]
[illegible]
[illegible]

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	[illegible]	NO	ETL
[illegible]	[illegible]	1-Methylnaphthalene	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	17	NO	ETL
[illegible]	[illegible]	1,2,4-Trimethylbenzene	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	5	NO	ETL
[illegible]	[illegible]	1,3,5-Trimethylbenzene	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	7	NO	ETL
[illegible]	[illegible]	2-Methylnaphthalene	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	24	NO	ETL
[illegible]	[illegible]	2-Nitrophenol	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	NEA	NO	NEA
[illegible]	[illegible]	4-Nitrophenol	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	NEA	NO	NEA
[illegible]	[illegible]	Acenaphthene	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	450	NO	ETL
[illegible]	[illegible]	Acetone	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	6,000	NO	ETL
[illegible]	[illegible]	Acetophenone	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	7.0	NO	ETL
[illegible]	[illegible]	Benzaldehyde	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	7.0	NO	ETL
[illegible]	[illegible]	Benzene	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	1.2	NO	ETL
[illegible]	[illegible]	Benzo(a)anthracene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	0.15	YES	ORS
[illegible]	[illegible]	Benzo(a)pyrene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	0.015	YES	ATL
[illegible]	[illegible]	Benzo(b)fluoranthene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	0.15	YES	ORS
[illegible]	[illegible]	Benzo(g,h,i)perylene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	170	NO	ETL
[illegible]	[illegible]	Benzo(k)fluoranthene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	1.5	YES	ORS
[illegible]	[illegible]	Carbazole	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	NEA	NO	NEA
[illegible]	[illegible]	Carbon disulfide	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	77	NO	ETL
[illegible]	[illegible]	Chrysene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	15	YES	ORS
[illegible]	[illegible]	Cobalt	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	6.0	NO	ETL
[illegible]	[illegible]	Dibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	7.2	NO	ETL
[illegible]	[illegible]	Fluoranthene	[illegible]	[illegible]	mg/kg	[illegible]	4/4	[illegible]	[illegible]	240	NO	ETL
[illegible]	[illegible]	Fluorene	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	240	NO	ETL
[illegible]	[illegible]	Indeno(1,2,3-cd)pyrene	[illegible]	[illegible]	mg/kg	[illegible]	2/4	[illegible]	[illegible]	0.15	YES	ORS
[illegible]	[illegible]	Isophorone	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	5	NO	ETL
[illegible]	[illegible]	Methyl Ethyl Ketone	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	20	NO	ETL
[illegible]	[illegible]	Methylene Chloride	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	2700	NO	ETL
[illegible]	[illegible]	Methyl Isobutyl Ketone	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	540	NO	ETL
[illegible]	[illegible]	Methylcyclohexane	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	NEA	NO	NEA
[illegible]	[illegible]	Naphthalene	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	4	NO	ETL
[illegible]	[illegible]	Nitrobenzene	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	1.5	NO	ETL
[illegible]	[illegible]	Phenanthrene	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	170	NO	ETL
[illegible]	[illegible]	Phenol	[illegible]	[illegible]	mg/kg	[illegible]	1/4	[illegible]	[illegible]	1,000	NO	ETL
[illegible]	[illegible]	Pentachlorophenol	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	NEA	NO	NEA
[illegible]	[illegible]	Pyrene	[illegible]	[illegible]	mg/kg	[illegible]	4/4	[illegible]	[illegible]	170	NO	ETL
[illegible]	[illegible]	Tetrachloroethene	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	1	NO	ETL
[illegible]	[illegible]	Toluene	[illegible]	[illegible]	mg/kg	[illegible]	1/2	[illegible]	[illegible]	400	NO	ETL

Table 2R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
On-Site [illegible]	[illegible]	Trichloroethene	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BSL
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,7,8,9-Heptachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,6,7,8-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,6,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,7,8,9-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,7,8,9-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,7,8-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	2,3,4,6,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	2,3,4,7,8-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	2,3,7,8-Tetrachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	2,3,7,8-Tetrachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	Octachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	[illegible]	Octachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	Evaluated as 2,3,7,8-TCDD TEQ		
	---	2,3,7,8-TCDD TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	PCB-1016	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BSL
	[illegible]	PCB-1242	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	ASL
	[illegible]	PCB-1254	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BSL
	[illegible]	PCB-1260	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	ASL
	[illegible]	Aluminum	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Arsenic	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Barium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	NO	BSL
	[illegible]	Beryllium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BSL
	[illegible]	Cadmium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BSL
	[illegible]	Calcium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NUT	NO	NUT
	[illegible]	Chromium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Cobalt	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Copper	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Cyanide	[illegible]	1	mg/kg	[illegible]	[illegible]	[illegible]	1	[illegible]	NO	BSL
	[illegible]	Iron	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Lead	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	NO	BSL
	[illegible]	Magnesium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NUT	NO	NUT
	[illegible]	Manganese	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ASL
	[illegible]	Mercury	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BSL
	[illegible]	Nickel	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	[illegible]	NO	BSL
	[illegible]	Potassium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NUT	NO	NUT

Table 2R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

[illegible]
[illegible]
[illegible]

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NUT	NO	NUT
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	ATL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NEA	NO	NEA
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	ATL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NEA	NO	NEA
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	ATL
[illegible]	[illegible]	4,4'-DDT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	CLASS
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	ATL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	CLASS
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	CLASS
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	YES	CLASS
	[illegible]	Endrin	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	1,2,3,4,6,7,8-HpCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8-HpCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,7,8,9-HpCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8,9-OCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8-OCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,6,7,8-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,7,8,9-HxCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,6,7,8-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,7,8,9-HxCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8-HpCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8-HpCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,7,8,9-HpCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8,9-OCDD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	1,2,3,4,6,7,8,9-OCDF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Exposure Is 2,3,7,8-TCDD TEQ		
	[illegible]	2,3,7,8-TCDD TEQ	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ATL
	[illegible]	PCB-1260	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	Aluminum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ATL
	[illegible]	Antimony	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NO	BTL
	[illegible]	Arsenic	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	[illegible]	YES	ATL

Table 2R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Current/Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion (3)
Floodplain Exposure Point	7440-38-2	Arsenic	2.6	90	mg/kg	[illegible]	14/14	NA	90	15.00 n	NO	ESL
	7440-41-7	Beryllium	0.46	1	mg/kg	[illegible]	14/14	NA	1	16 n	NO	ESL
	7440-43-9	Cadmium	0.25	11	mg/kg	[illegible]	7/14	0.25 - 0.41	11	70 n	NO	ESL
	7440-70-2	Calcium	2000	42000	mg/kg	[illegible]	14/14	NA	42000	NUT	NO	NUT
	7440-47-3	Chromium	11	4	mg/kg	[illegible]	14/14	NA	4	0.4 c	YES	ASL
	7440-48-4	Cobalt	7.0	15	mg/kg	[illegible]	10/10	NA	15	2.4 n	YES	ASL
	7440-50-8	Copper	11	110	mg/kg	[illegible]	14/14	NA	110	410 n	NO	ESL
	57-12-5	Cyanide	2.4	2.4	mg/kg	[illegible]	1/10	0.0 - 1.5	2.4	21 n	YES	ASL
	7439-89-6	Iron	19000	47000	mg/kg	[illegible]	14/14	NA	47000	55000 n	YES	ASL
	7439-92-1	Lead	16	75	mg/kg	[illegible]	14/14	NA	75	400	NO	ESL
	7439-95-4	Magnesium	570	2000	mg/kg	[illegible]	14/14	NA	2000	NUT	NO	NUT
	7439-96-5	Manganese	41.0	1600	mg/kg	[illegible]	14/14	NA	1600	1.0 n	YES	ASL
	7439-97-6	Mercury	0.024	0.17	mg/kg	[illegible]	5/10	0.017 - 0.1	0.17	2.4 n	NO	ESL
	7440-02-0	Nickel	5.4	45	mg/kg	[illegible]	14/14	NA	45	150 n	NO	ESL
	7440-09-7	Potassium	170	1600	mg/kg	[illegible]	10/14	0.0 - 1200	1600	NUT	NO	NUT
	77-24-0	Selenium	1	2.1	mg/kg	[illegible]	5/14	0.0 - 4	2.1	40 n	NO	ESL
	7440-22-4	Silver	4	4	mg/kg	[illegible]	1/14	0.42 - 1	4	40 n	NO	ESL
	7440-23-5	Sodium	54	1200	mg/kg	[illegible]	12/14	[illegible]	1200	NUT	NO	NUT
	7440-28-0	Thallium	0.0	44	mg/kg	[illegible]	5/5	NA	44	4700 n	NO	ESL
	7440-31-5	Tin	0.4	1.1	mg/kg	[illegible]	2/14	0.42 - 4.0	1.1	0.07 n	YES	ASL
	7440-32-6	Titanium	2.4	2.4	mg/kg	[illegible]	1/5	1.5 - 1.5	2.4	4700 n	NO	ESL
	7440-62-2	Vanadium	14	40	mg/kg	[illegible]	5/5	NA	40	NEA	NO	NEA
	7440-66-6	Zinc	12	27	mg/kg	[illegible]	14/14	NA	27	40 n	NO	ESL
	7440-55-3	Gallium	0.4	14	mg/kg	[illegible]	5/5	NA	14	NEA	NO	NEA
	7440-67-7	Zirconium	5.1	450	mg/kg	[illegible]	14/14	NA	450	2400 n	NO	ESL

Notes:

(1) Maximum detected concentration used for screening

(2) Risk-based screening value obtained from the Region 3 Screening Levels (RSL) Table (June 2015)

Screening Toxicity Values:

- Risk-based screening value for benzoic hydrocarbon and phenanthrene
- Hierarchal screening value for chromium

(3) Rationale for Selection or Deletion

ASL = Above Screening Level

CBSS = Missing or no toxicity value for compound; one of which is a COPC

ESL = Below Screening Level

NUT = Essential nutrient

NEA = No toxicity value available

n = node value of toxicity screening value selected based on 1/10 of the RfD

c = value of toxicity screening value selected based on 1/10 of the RfC

NA = not applicable

Table 3R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n c) (2, 3)	Potential ARAR TBC Value	Potential ARAR TBC Source	COPC Flag (Y N)	Rationale for Selection or Deletion	Is COPC Volatile?	Target Groundwater Concentration (µg L) (4)
Shallow	75343	1,1-Dichloroethane	0.35	0.37	µg/L	SMSMA-02A-11-13-2013	2/40	0.5 - 5	0.37	2.7 n	NA	NA	NO	BSL	NA	--
	75354	1,1-Dichloroethene	0.65	0.78	µg/L	SMSMA-02A-6-24-2014	2/40	0.5 - 5	0.78	28 n	NA	NA	NO	BSL	NA	--
	95636	1,2,4-Trimethylbenzene	0.12	3.4	µg/L	SMSMA-02A-6-24-2014	4/16	0.5 - 5	3.4	1.5 n	NA	NA	YES	ASL	YES	2.90E+00
	108678	1,3,5-Trimethylbenzene	1.6	1.6	µg/L	SMSMA-02A-11-13-2013	1/16	0.5 - 5	1.6	12 n	NA	NA	NO	BSL	NA	--
	105679	2,4-Dimethylphenol	1.9	2.1	µg/L	SMSMA-02A-11-13-2013	2/39	5 - 50	2.1	36 n	NA	NA	NO	BSL	NA	--
	121142	2,4-Dinitrotoluene	3.8	9.3	µg/L	SMSMA-11A-8-28-2013	4/39	5 - 50	9.3	0.24 c	NA	NA	YES	ASL	NO	--
	91576	2-Methylnaphthalene	1.7	1.7	µg/L	SMSMA-01A-8-27-2013	1/39	2 - 50	1.7	3.6 n	NA	NA	NO	BSL	NA	--
	95487	2-Methylphenol	1.9	2.3	µg/L	SMSMA-02A-6-26-2012	3/39	5 - 50	2.3	93 n	NA	NA	NO	BSL	NA	--
	88755	2-Nitrophenol	2	3.2	µg/L	SMSGA-106-21-5-9-2011	2/39	5 - 50	3.2	NEA		NA	NO	NEA	NA	--
	72548	4,4'-DDD	0.002	0.002	µg/L	SMSSGA-13-6-24-2014	1/10	0.009 - 0.1	0.002	0.031 c	NA	NA	YES	ASL	NO	--
	100027	4-Nitrophenol	1.9	48	µg/L	SMSGA-106-21-5-9-2011	4/39	10 - 100	48	NEA		NA	NO	NEA	NA	--
	83329	Acenaphthene	1.1	2.5	µg/L	SMSMA-01A-8-27-2013	2/39	2 - 50	2.5	53 n	NA	NA	NO	BSL	NA	--
	67641	Acetone	7.8	48	µg/L	SMSMA-07A-11-13-2013	7/38	5 - 16	48	1400 n	NA	NA	NO	BSL	NA	--
	100527	Benzaldehyde	0.71	0.71	µg/L	SMSMA-12A-3-5-2014	1/39	5 - 50	0.71	190 n	NA	NA	NO	BSL	NA	--
	71432	Benzene	0.48	2.6	µg/L	SMSMA-02A-3-5-2014	12/40	0.5 - 5	2.6	0.45 c	MCL	5	YES	ASL	YES	1.59E+00
	100516	Benzyl alcohol	2.5	2.5	µg/L	SMSMA-02A-11-13-2013	1/3	10 - 10	2.5	200 n	NA	NA	NO	BSL	NA	--
	117817	bis(2-Ethylhexyl)phthalate	5.5	23	µg/L	SMSMA-03A-6-27-2012	3/39	5 - 100	23	5.6 c	MCL	6	YES	ASL	NO	--
	75274	Bromodichloromethane	0.32	0.32	µg/L	SMSMA-10A-6-27-2012	1/40	0.5 - 5	0.32	0.13 c	MCL	80	YES	ASL	YES	8.76E-01
	74839	Bromomethane	1.9	3.2	µg/L	SMSMA-11A-8-28-2013	4/40	0.5 - 5	3.2	0.75 n	NA	NA	YES	ASL	YES	1.74E+00
	105602	Caprolactam	1.4	470	µg/L	SMSMA-01A-8-27-2013	6/32	5 - 50	470	990 n	NA	NA	NO	BSL	NA	--
	86748	Carbazole	1.2	3.2	µg/L	SMSMA-02A-3-5-2014	5/39	2 - 50	3.2	NEA		NA	NO	NEA	NA	--
	75150	Carbon disulfide	1.1	1.1	µg/L	SMSGA-106-21-5-9-2011	1/40	0.5 - 5	1.1	81 n	NA	NA	NO	BSL	NA	--
	108907	Chlorobenzene	1.5	2.2	µg/L	SMSMA-02A-6-26-2012	6/40	0.5 - 5	2.2	7.8 n	MCL	100	NO	BSL	NA	--
	67663	Chloroform	0.33	9.1	µg/L	SMSMA-01A-6-27-2012	9/40	0.5 - 5	9.1	0.22 c	MCL	80	YES	ASL	YES	8.14E-01
	74873	Chloromethane	0.96	1.7	µg/L	SMSMA-07A-11-13-2013	2/40	0.5 - 5	1.7	19 n	NA	NA	NO	BSL	NA	--
	156592	cis-1,2-Dichloroethene	1.2	1.5	µg/L	SMSMA-02A-6-24-2014	5/40	0.5 - 5	1.5	3.6 n	MCL	70	NO	BSL	NA	--
	132649	Dibenzofuran	1.6	1.6	µg/L	SMSMA-01A-8-27-2013	1/39	2 - 50	1.6	0.79 n	NA	NA	YES	ASL	YES	NA
	60571	Dieldrin	0.012	0.034	µg/L	SMSMA-12A-6-25-2014	2/10	0.02 - 0.1	0.034	0.0017 c	NA	NA	YES	ASL	NO	--
	84662	Diethyl phthalate	14	14	µg/L	SMSMA-04A-3-5-2014	1/39	5 - 50	14	1500 n	NA	NA	NO	BSL	NA	--
	100414	Ethylbenzene	0.14	6.3	µg/L	SMSMA-02A-6-26-2012	9/39	0.5 - 5	6.3	1.5 c	MCL	700	YES	ASL	YES	3.49E+00
	206440	Fluoranthene	0.79	0.79	µg/L	SMSMA-01A-8-27-2013	1/39	2 - 50	0.79	80 n	NA	NA	NO	BSL	NA	--
	98828	Isopropylbenzene	0.43	1	µg/L	SMSMA-02A-6-24-2014	6/40	0.5 - 5	1	45 n	NA	NA	NO	BSL	NA	--
	79209	Methyl acetate	1.1	70	µg/L	SMSMA-02A-8-26-2013	5/40	0.5 - 5	70	2000 n	NA	NA	NO	BSL	NA	--
	78933	Methyl ethyl ketone	3.8	3.8	µg/L	SMSGA-106-21-5-9-2011	1/39	4 - 57	3.8	5600 n	NA	NA	NO	BSL	NA	--
	108101	Methyl isobutyl ketone	1	2.9	µg/L	SMSMA-02A-3-5-2014	6/40	1 - 10	2.9	120 n	NA	NA	NO	BSL	NA	--
	75092	Methylene chloride	0.37	8.3	µg/L	SMSMA-02A-6-24-2014	12/40	0.5 - 5.9	8.3	11 n	MCL	5	NO	BSL	NA	--
	65794969	3-and/or 4-Methylphenol	6.5	13	µg/L	SMSMA-02A-11-13-2013	5/39	5 - 25	13	93 n	NA	NA	NO	BSL	NA	--
	91203	Naphthalene	0.74	6.3	µg/L	SMSMA-02A-6-26-2012	11/39	2 - 50	6.3	0.17 c	NA	NA	YES	ASL	YES	4.59E+00
	103651	n-Propylbenzene	0.43	0.43	µg/L	SMSMA-02A-11-13-2013	1/3	0.5 - 0.5	0.43	66 n	NA	NA	NO	BSL	NA	--
	95476	o-Xylene	0.09	11	µg/L	SMSMA-02A-6-26-2012	19/40	0.5 - 5	11	19 n	MCL	10000	NO	BSL	NA	--
	87865	Pentachlorophenol	1.1	4	µg/L	SMSMA-02A-11-13-2013	7/39	10 - 100	4	0.04 c	MCL	1	YES	ASL	NO	--
	85018	Phenanthrene	1	2.7	µg/L	SMSMA-01A-8-27-2013	5/39	2 - 50	2.7	12 n	NA	NA	NO	BSL	NA	--
	108952	Phenol	1.2	1000	µg/L	SMSMA-02A-6-24-2014	10/39	5 - 25	1000	580 n	NA	NA	YES	ASL	NO	--
	99876	p-Isopropyltoluene	0.76	6.6	µg/L	SMSMA-02A-11-13-2013	3/3	0.5 - 0.5	6.6	NEA		NA	NO	NEA	NA	--
	100425	Styrene	0.95	1.6	µg/L	SMSMA-02A-6-5-2013	4/40	0.5 - 5	1.6	120 n	MCL	100	NO	BSL	NA	--
	127184	Tetrachloroethene	0.18	18	µg/L	SMSMA-02A-6-26-2012	16/40	0.5 - 5	18	4.1 n	MCL	5	YES	ASL	YES	5.77E+00

Table 3R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n c) (2, 3)	Potential ARAR TBC Value	Potential ARAR TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion	Is COPC Volatile?	Target Groundwater Concentration (µg/L) (4)
Shallow groundwater	108883	Toluene	0.17	9.8	µg/L	SMSMA-024-6 26 2012	15/40	0.5 - 5	9.8	110 n	MCL	1000	NO	BSL	NA	--
	156-60-5	trans-1,2-Dichloroethene	0.19	0.26	µg/L	SMSMA-024-11 13 2013	2/40	0.5 - 5	0.26	36 n	MCL	100	NO	BSL	NA	--
	79016	Trichloroethene	0.24	4.3	µg/L	SMSMA-024-11 13 2013	10/40	0.5 - 5	4.3	0.28 n	MCL	5	YES	ASL	YES	5.18E-01
	179601231	m-Xylene & p-Xylene	0.29	26	µg/L	SMSMA-024-6 26 2012	17/40	0.5 - 5	26	19 n	MCL	10000	YES	ASL	YES	4.93E+02
	7429905	Aluminum	43	220000	µg/L	SMSMA-104-3 3 2014	36/43	200 - 7000	220000	2000 n	NA	NA	YES	ASL	NO	--
	7440360	Antimony	0.53	13	µg/L	SMSMA-024-11 13 2013	5/43	2.5 - 600	13	0.78 n	MCL	6	YES	ASL	NO	--
	7440382	Arsenic	2.7	82	µg/L	SMSMA-104-3 3 2014	17/43	5 - 100	82	0.052 c	MCL	10	YES	ASL	NO	--
	7440393	Barium	14	350	µg/L	SMSMA-014-6 27 2012	10/43	25 - 2000	350	360 n	MCL	2000	NO	BSL	NA	--
	7440417	Beryllium	7	54	µg/L	SMSMA-104-3 3 2014	5/43	5 - 210	54	2.5 n	MCL	4	YES	ASL	NO	--
	7440439	Cadmium	0.19	1400	µg/L	SMSMA-104-6 27 2012	20/43	0.5 - 25	1400	0.92 n	MCL	5	YES	ASL	NO	--
	7440702	Calcium	870	1000000	µg/L	SMSMA-04A-3 5 2014	36/43	1200 - 5000	1000000	NOT	NA	NA	NO	NOT	NA	--
	7440473	Chromium	13	270	µg/L	SMSMA-124-11 14 2013	6/43	10 - 350	270	0.035 c	MCL	100	YES	ASL	NO	--
	18540299	Chromium, Hexavalent	3	3	µg/L	SMSMA-124-3 5 2014	1/3	1 - 10	3	0.035 c	NA	NA	NO	Total Cr	NA	--
	7440484	Cobalt	0.66	2600	µg/L	SMSMA-104-6 27 2012	19/43	20 - 500	2600	0.6 n	NA	NA	YES	ASL	NO	--
	7440508	Copper	3.3	1700	µg/L	SMSMA-124-11 14 2013	23/43	25 - 700	1700	80 n	NA	1300	YES	ASL	NO	--
	57125	Cyanide	2.4	33	µg/L	SMSMA-024-6 26 2012	12/39	10 - 32	33	0.15 n	MCL	200	YES	ASL	YES	1.53E+01
	7439896	Iron	70	17000	µg/L	SMSMA-064-6 27 2012	25/43	100 - 7000	17000	1400 n	NA	NA	YES	ASL	NO	--
	7439921	Lead	3.7	77	µg/L	SMSMA-104-6 27 2012	14/43	5 - 100	77	15	MCL	15	YES	ASL	NO	--
	7439954	Magnesium	540	360000	µg/L	SMSMA-104-6 27 2012	37/43	1500 - 5000	360000	NOT	NA	NA	NO	NOT	NA	--
	7439965	Manganese	23	200000	µg/L	SMSMA-104-6 27 2012	38/43	17 - 60	200000	43 n	NA	NA	YES	ASL	NO	--
	7439976	Mercury	0.023	9.6	µg/L	SMSMA-104-6 27 2012	14/43	0.1 - 0.2	9.6	0.57 n	MCL	2	YES	ASL	YES	6.70E-01
	7439987	Molybdenum	47	120	µg/L	SMSMA-114-11 12 2013	4/7	150 - 700	120	10 n	NA	NA	YES	ASL	NO	--
	7440020	Nickel	1.3	2100	µg/L	SMSMA-104-6 27 2012	31/43	40 - 700	2100	39 n	NA	NA	YES	ASL	NO	--
	7440097	Potassium	6100	1000000	µg/L	SMSMA-014-11 14 2013	40/43	5000 - 5000	1000000	NOT	NA	NA	NO	NOT	NA	--
	7782492	Selenium	3	77	µg/L	SMSMA-104-3 3 2014	9/43	2 - 350	77	10 n	MCL	50	YES	ASL	NO	--
	7440224	Silver	1.2	2.4	µg/L	SMSMA-014-6 27 2012	4/43	10 - 350	2.4	9.4 n	NA	NA	NO	BSL	NA	--
	7440235	Sodium	94000	24000000	µg/L	SMSMA-07A-11 13 2013	43/43	NA	24000000	NOT	NA	NA	NO	NOT	NA	--
	7440246	Strontium	490	1800	µg/L	SMSMA-04A-11 13 2013	4/7	25 - 40	1800	1200 n	NA	NA	YES	ASL	NO	--
	7440280	Thallium	2.8	92	µg/L	SMSMA-104-3 3 2014	9/39	1 - 120	92	0.02 n	MCL	2	YES	ASL	NO	--
	7440326	Titanium	47	61	µg/L	SMSMA-124-11 14 2013	2/7	25 - 350	61	NEA	NA	NA	NO	NEA	NA	--
	7440622	Vanadium	5.8	23	µg/L	SMSSA-106-21-5 9 2011	2/43	20 - 500	23	8.6 n	NA	NA	YES	ASL	NO	--
	7440655	Yttrium	52	52	µg/L	SMSMA-04A-11 13 2013	1/7	12 - 210	52	NEA	NA	NA	NO	NEA	NA	--
	7440666	Zinc	11	71000	µg/L	SMSMA-104-6 27 2012	21/43	50 - 700	71000	600 n	NA	NA	YES	ASL	NO	--
	Conventional															
	7664417	Ammonia as N	55.7	507000	µg/L	SMSMA-06A-11 13 2013	26/26	NA	507000	NEA	NA	NA	NO	NEA	NA	--
	16887006	Chloride	656.00	23400000	µg/L	SMSMA-07A-6 28 2012	35/35	NA	23400000	NEA	NA	NA	NO	NEA	NA	--
	16984488	Fluoride	75	330000	µg/L	SMSMA-024-6 24 2014	26/34	1000 - 25000	330000	80 n	MCL	4000	NO	RDA	NA	--
	14797558	Nitrate as N	2600	500000	µg/L	SMSMA-014-6 25 2014	25/28	100 - 100	500000	3200 n	MCL	10000	NO	RDA	NA	--
	---	Nitrate/Nitrite as N	13.8	113000	µg/L	SMSMA-014-6 27 2012	5/6	100 - 100	113000	NEA	MCL	10000	NO	NEA	NA	--
	14797650	Nitrite as N	120	51300	µg/L	SMSMA-04A-8 28 2013	12/19	100 - 5000	51300	200 n	MCL	1000	NO	RDA	NA	--
	14265442	Orthophosphate as P	16	4500	µg/L	SMSSA-106-21-5 9 2011	20/37	1000 - 50000	4500	NEA	NA	NA	NO	NEA	NA	--
	14808798	Sulfate as SO4	5300	2600000	µg/L	SMSMA-104-6 27 2012	29/31	1000 - 1000	2600000	NEA	NA	NA	NO	NEA	NA	--
	18496258	Sulfide	100	6900	µg/L	SMSMA-024-6 24 2014	3/12	2000 - 4000	6900	NEA	NA	NA	NO	NEA	NA	--

Table 3R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Screening Toxicity Value - Future
Medium - Groundwater
Exposure Medium - Groundwater

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n c) (2, 3)	Potential ARAR TBC Value	Potential ARAR TBC Source	COPC Flag (Y N)	Rationale for Selection or Deletion	Is COPC Volatile?	Target Groundwater Concentration (µg L) (4)
Deep	75343	1,1-Dichloroethane	0.21	0.21	µg/L	SMSMA-03B-11/13/2013	1/24	0.5 - 5	0.21	2.7 n	NA	NA	NO	BSL	NA	--
Groundwater	75354	1,1-Dichloroethene	0.58	0.78	µg/L	SMSMA-03B-8/28/2013	2/24	0.5 - 5	0.78	28 n	NA	NA	NO	BSL	NA	--
	107062	1,2-Dichloroethane	0.84	1.2	µg/L	SMSMA-03B-8/28/2013	3/24	0.5 - 5	1.2	0.17 c	MCL	5	YES	ASL	YES	2.24E+00
	95636	1,2,4-Trimethylbenzene	0.15	0.15	µg/L	SMSMA-11B-11/12/2013	1/10	0.5 - 5	0.15	1.5 n	NA	NA	NO	BSL	NA	--
	121142	2,4-Dinitrotoluene	5.3	35	µg/L	SMSMA-10B-6/26/2012	10/24	5 - 15	35	0.24 c	NA	NA	YES	ASL	NO	--
	606202	2,6-Dinitrotoluene	3.3	7	µg/L	SMSMA-10B-6/26/2012	6/24	5 - 15	7	0.048 c	NA	NA	YES	ASL	NO	--
	88755	2-Nitrophenol	1.9	3.6	µg/L	SMSMA-07B-6/28/2012	3/24	5 - 15	3.6	NEA	NA	NA	NO	NEA	NA	--
	100027	4-Nitrophenol	1.7	17	µg/L	SMSMA-07B-8/27/2013	4/24	10 - 30	17	NEA	NA	NA	NO	NEA	NA	--
	67641	Acetone	17	310	µg/L	SMSMA-03B-6/28/2012	6/20	5 - 15	310	1400 n	NA	NA	NO	BSL	NA	--
	98862	Acetophenone	1.4	1.8	µg/L	SMSMA-03B-6/25/2014	2/24	5 - 15	1.8	190 n	NA	NA	NO	BSL	NA	--
	71432	Benzene	0.64	1.2	µg/L	SMSMA-11B-8/28/2013	8/24	0.5 - 5	1.2	0.45 c	MCL	5	YES	ASL	YES	1.59E+00
	100516	Benzyl alcohol	1.4	1.4	µg/L	SMSMA-03B-11/13/2013	1/4	10 - 10	1.4	200 n	NA	NA	NO	BSL	NA	--
	117817	bis(2-Ethylhexyl)phthalate	6.7	6.7	µg/L	SMSMA-10B-6/26/2012	1/24	5 - 15	6.7	5.6 c	MCL	6	YES	ASL	NO	--
	74839	Bromomethane	2.8	2.9	µg/L	SMSMA-07B-8/27/2013	2/24	0.5 - 5	2.9	0.75 n	NA	NA	YES	ASL	YES	1.74E+00
	105602	Caprolactam	4.8	4.8	µg/L	SMSMA-03B-6/25/2014	1/20	5 - 15	4.8	990 n	NA	NA	NO	BSL	NA	--
	67663	Chloroform	0.15	5.9	µg/L	SMSMA-07B-6/25/2014	5/24	0.5 - 5	5.9	0.22 c	MCL	80	YES	ASL	YES	8.14E-01
	74873	Chloromethane	0.31	5.8	µg/L	SMSMA-07B-6/28/2012	5/24	0.5 - 5	5.8	19 n	NA	NA	NO	BSL	NA	--
	60571	Dieldrin	0.005	0.005	µg/L	SMSMA-12B-6/25/2014	1/5	0.1 - 0.1	0.005	0.0017 c	NA	NA	YES	ASL	NO	--
	100414	Ethylbenzene	0.1	0.5	µg/L	SMSMA-11B-11/12/2013	2/24	0.5 - 5	0.5	1.5 c	MCL	700	NO	BSL	NA	--
	5566347	gamma-Chlordane	0.051	0.051	µg/L	SMSMA-11B-6/25/2014	1/5	0.05 - 0.05	0.051	0.22 c	MCL	2	NO	BSL	NA	--
	1024573	Heptachlor epoxide	0.054	0.054	µg/L	SMSMA-11B-6/25/2014	1/5	0.05 - 0.05	0.054	0.0036 c	MCL	0.2	YES	ASL	NO	--
	591786	Methyl butyl ketone	0.73	0.73	µg/L	SMSMA-03B-11/13/2013	1/24	1 - 10	0.73	3.8 n	NA	NA	NO	BSL	NA	--
	78933	Methyl ethyl ketone	16	42	µg/L	SMSMA-03B-6/28/2012	3/24	4 - 64	42	560 n	NA	NA	NO	BSL	NA	--
	108101	Methyl isobutyl ketone	0.35	12	µg/L	SMSMA-03B-8/28/2013	7/24	1 - 10	12	120 n	NA	NA	NO	BSL	NA	--
	75092	Methylene chloride	0.52	1.3	µg/L	SMSMA-07B-11/13/2013	3/24	0.5 - 5	1.3	11 n	MCL	5	NO	BSL	NA	--
	91203	Naphthalene	1.5	16	µg/L	SMSMA-11B-8/28/2013	2/24	2 - 15	16	0.17 c	NA	NA	YES	ASL	YES	4.59E+00
	95476	o-Xylene	0.13	0.91	µg/L	SMSMA-11B-11/12/2013	8/24	0.5 - 5	0.91	19 n	MCL	10000	NO	BSL	NA	--
	87865	Pentachlorophenol	1.1	2.5	µg/L	SMSMA-11B-8/28/2013	3/24	10 - 30	2.5	0.04 c	MCL	1	YES	ASL	NO	--
	108952	Phenol	2	61	µg/L	SMSMA-03B-6/28/2012	8/24	5 - 15	61	580 n	NA	NA	NO	BSL	NA	--
	99876	p-Isopropyltoluene	0.21	0.21	µg/L	SMSMA-11B-11/12/2013	1/5	0.5 - 0.5	0.21	NEA	NA	NA	NO	NEA	NA	--
	127184	Tetrachloroethene	0.4	0.85	µg/L	SMSMA-11B-11/12/2013	6/24	0.5 - 5	0.85	4.1 n	MCL	5	NO	BSL	NA	--
	108883	Toluene	0.29	4	µg/L	SMSMA-07B-6/28/2012	11/24	0.5 - 5	4	110 n	MCL	1000	NO	BSL	NA	--
	79016	Trichloroethene	0.17	0.58	µg/L	SMSMA-11B-11/12/2013	3/24	0.5 - 5	0.58	0.28 n	MCL	5	YES	ASL	YES	5.18E-01
	179601231	m-Xylene/p-Xylene	0.36	1.2	µg/L	SMSMA-12B-6/24/2014	8/24	0.5 - 5	1.2	19 n	MCL	10000	NO	BSL	NA	--
	7429905	Aluminum	82	27000	µg/L	SMSMA-10B-11/12/2013	18/26	200 - 10000	27000	2000 n	NA	NA	YES	ASL	NO	--
	7440382	Arsenic	2.4	15	µg/L	SMSMA-10B-11/12/2013	8/26	10 - 500	15	0.052 c	MCL	10	YES	ASL	NO	--
	7440393	Barium	24	340	µg/L	SMSMA-03B-6/28/2012	11/26	200 - 10000	340	380 n	MCL	2000	NO	BSL	NA	--
	7440417	Beryllium	1.1	4.8	µg/L	SMSMA-03B-8/28/2013	2/26	3 - 250	4.8	2.5 n	MCL	4	YES	ASL	NO	--
	7440439	Cadmium	0.84	6.6	µg/L	SMSMA-07B-6/28/2012	7/26	0.5 - 250	6.6	0.92 n	MCL	5	YES	ASL	NO	--
	7440702	Calcium	9200	6200000	µg/L	SMSMA-03B-6/28/2012	26/26	NA	6200000	NOT	NA	NA	NO	NOT	NA	--
	7440473	Chromium	6.1	96	µg/L	SMSMA-11B-6/5/2013	5/26	10 - 500	96	0.005 c	MCL	100	YES	ASL	NO	--
	18540299	Chromium, Hexavalent	5.2	19	µg/L	SMSMA-11B-6/25/2014	2/6	1 - 10	19	0.005 c	NA	NA	NO	Toxicity	NA	--
	7440484	Cobalt	1.6	30	µg/L	SMSMA-03B-6/25/2014	9/26	5 - 2500	30	0.6 n	NA	NA	YES	ASL	NO	--
	7440508	Copper	2.7	160	µg/L	SMSMA-03B-6/5/2014	7/26	10 - 500	160	80 n	MCL	1300	YES	ASL	NO	--
	57125	Cyanide	2	14	µg/L	SMSMA-07B-6/28/2012	7/23	10 - 18	14	0.15 n	MCL	200	YES	ASL	YES	1.50E+01
	7439896	Iron	31	28000	µg/L	SMSMA-10B-11/12/2013	13/26	100 - 6000	28000	1400 n	NA	NA	YES	ASL	NO	--

Table 3R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario: Future Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (n c) (2, 3)	Potential ARAR TBC Value	Potential ARAR TBC Source	COPC Flag (Y N)	Rationale for Selection or Deletion	Is COPC Volatile?	Target Groundwater Concentration (µg L) (4)
Deep	7439921	Lead	1.6	15	µg L	SMSMA-03B-6 28 2012	4 26	5 - 500	15	15	MCL	15	YES	ASL	NO	--
Groundwater	7439954	Magnesium	3100	260000	µg L	SMSMA-03B-6 28 2012	26 26	NA	260000	NUT	NA	NA	NO	NUT	NA	--
	7439965	Manganese	110	120000	µg L	SMSMA-03B-11 13 2013	26 26	NA	120000	43 n	NA	NA	YES	ASL	NO	--
	7439976	Mercury	0.026	0.91	µg L	SMSMA-07B-6 28 2012	6 26	0.1 - 0.2	0.91	0.57 n	MCL	2	YES	ASL	NO	--
	7439987	Molybdenum	200	200	µg L	SMSMA-11B-11 12 2013	1 5	10 - 800	200	10 n	NA	NA	YES	ASL	NO	--
	7440020	Nickel	1.3	240	µg L	SMSMA-03B-6 25 2014	15 26	10 - 2000	240	39 n	NA	NA	YES	ASL	NO	--
	7440097	Potassium	2300	1200000	µg L	SMSMA-07B-6 28 2012	23 26	5000 - 5000	1200000	NUT	NA	NA	NO	NUT	NA	--
	7782492	Selenium	4.4	6.8	µg L	SMSMA-10B-3 3 2014	10 26	2 - 1800	6.8	10 n	MCL	50	YES	ASL	NO	--
	7440224	Silver	0.77	6.7	µg L	SMSMA-03B-8 28 2013	4 26	5 - 500	6.7	9.4 n	NA	NA	NO	BSL	NA	--
	7440235	Sodium	44000	300000000	µg L	SMSMA-03B-6 28 2012	26 26	NA	300000000	NUT	NA	NA	NO	NUT	NA	--
	7440246	Strontium	72	8600	µg L	SMSMA-03B-11 13 2013	5 5	NA	8600	1200 n	NA	NA	YES	ASL	NO	--
	7440280	Thallium	2.1	98	µg L	SMSMA-03B-3 5 2014	4 24	1 - 120	98	0.02 n	MCL	2	YES	ASL	NO	--
	7440326	Titanium	29	100	µg L	SMSMA-10B-11 12 2013	2 5	50 - 400	100	NEA	NA	NA	NO	NEA	NA	--
	7440622	Vanadium	7.9	28	µg L	SMSMA-10B-11 12 2013	2 26	50 - 2500	28	8.6 n	NA	NA	YES	ASL	NO	--
	7440655	Yttrium	3.1	500	µg L	SMSMA-07B-11 13 2013	3 5	30 - 240	500	NEA	NA	NA	NO	NEA	NA	--
	7440666	Zinc	31	610	µg L	SMSMA-07B-11 13 2013	10 26	60 - 3000	610	600 n	NA	NA	YES	ASL	NO	--
	Conventional															
	7664417	Ammonia as N	170	670000	µg L	SMSMA-07B-3 4 2014	16 17	250 - 250	670000	NEA	NA	NA	NO	NEA	NA	--
	16887006	Chloride	56000	544000000	µg L	SMSMA-03B-6 28 2012	23 23	NA	544000000	NEA	NA	NA	NO	NEA	NA	--
	16984488	Fluoride	81	150000	µg L	SMSMA-11B-6 23 2014	10 18	1000 - 25000	150000	80 n	MCL	4000	NO	RDA	NA	--
	14797558	Nitrate as N	530	93000	µg L	SMSMA-12B-3 4 2014	16 18	100 - 100	93000	3200 n	MCL	10000	NO	RDA	NA	--
	--	Nitrate Nitrite as N	48	6760	µg L	SMSMA-07B-6 28 2012	3 3	NA	6760	NEA	MCL	10000	NO	NEA	NA	--
	14797650	Nitrite as N	44	810	µg L	SMSMA-11B-8 28 2013	3 11	100 - 100	810	200 n	MCL	1000	NO	RDA	NA	--
	14265442	Orthophosphate as P	81	1000	µg L	SMSMA-07B-11 13 2013	4 15	1000 - 25000	1000	NEA	NA	NA	NO	NEA	NA	--
	14808798	Sulfate as SO4	120000	25000000	µg L	SMSMA-03B-6 25 2014	21 21	NA	25000000	NEA	NA	NA	NO	NEA	NA	--
	18496258	Sulfide	100	2600	µg L	SMSMA-03B-3 5 2014	3 3	2000 - 2000	2600	NEA	NA	NA	NO	NEA	NA	--

Notes: Legend

(1) Maximum detected concentration used for screening

(2) Risk based screening concentration obtained from the Regional Screening Level (RSL) Table (Source: 2015)

Surrogate screening value used

- Pyrene value used for phenanthrene
- Although chromium (VI) is suitable, hexavalent chromium used for chromium for comparison
- Chlordane used for gamma-chlordane

(3) Rationale for Selection or Deletion

ASL = Above Screening Level

BSL = Below Screening Level

Total Cr = Accounted for with total chromium result

RDA = Eliminated based on recommended data allowance

NUT = Essential nutrient

NEA = No benchmark is available

(4) For the shallow groundwater COPC identified as volatile, maximum detected concentration were compared against EPA Target Groundwater Concentration for potential exposure to concern (EPA 2015). Target groundwater concentration were derived using EPA's RSL Calculator at a TR of 1E-06 and a THQ of 1.0 (Source: 2015)

n = Based on a screening value at a target risk of 1E-06

n = non based on a screening value at a target hazard quotient of 0.1

NA = not available

MCL = Maximum contaminant level

Table 4R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Fish Tissue
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Knob Creek - Carp	[illegible]	Benzaldehyde	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,6,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,7,8-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	2,3,4,7,8-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	2,3,7,8-Tetrachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	Octachlorodibenzo-p-dioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
		2,3,7,8-TCDD TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	1,1'-Biphenyl, [illegible]-heptachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	1,1'-Biphenyl, [illegible]-hexachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	1,1'-Biphenyl, [illegible]-pentachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #105	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #118	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #1[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #1[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #156 and/or 157	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #1[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #77	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
		PCB Dioxin-like congener TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	PCB-1[illegible]60	[illegible]	1	mg/kg	[illegible]	[illegible]	NA	1	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	Aluminum	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	Arsenic	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	Barium	[illegible]	1	mg/kg	[illegible]	[illegible]	NA	1	NA	1	NA	[illegible]	No	BSL
	[illegible]	Calcium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	NUT	NA	[illegible]	No	NUT
	[illegible]	Chromium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	Copper	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	Iron	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	Lead	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	Magnesium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	NUT	NA	[illegible]	No	NUT
	[illegible]	Manganese	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	Nickel	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	1	NA	[illegible]	No	BSL
	[illegible]	Potassium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	NUT	NA	[illegible]	No	NUT
	[illegible]	Selenium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	Sodium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	NUT	NA	[illegible]	No	NUT
	[illegible]	Strontium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
	[illegible]	Zinc	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	No	BSL
Knob Creek - Largemouth Bass	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,6,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	2,3,7,8-Tetrachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
		2,3,7,8-TCDD TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	YES	ASL
	[illegible]	1,1'-Biphenyl, [illegible]-heptachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	1,1'-Biphenyl, [illegible]-hexachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	1,1'-Biphenyl, [illegible]-pentachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #105	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #118	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #1[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				

Table 4R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Fish Tissue
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Knob Creek - Largemouth Bass [illegible]	[illegible]	PCB congener #126	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #156 and/or 157	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #169	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #77	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
		PCB Dioxin-like congener TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	PCB 1260	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Barium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Calcium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Chromium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Copper	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Iron	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Magnesium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Mercury	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Nickel	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Potassium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Selenium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Sodium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Strontium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Zinc	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
Knob Creek - All Species	[illegible]	Benzaldehyde	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,4,6,7,8-Heptachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	1,2,3,4,7,8-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	[illegible]-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	[illegible]-Hexachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	[illegible]-Hexachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	[illegible]-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	[illegible]-Pentachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	[illegible]-Tetrachlorodibenzofuran	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
	[illegible]	Octachlorodibenzodioxin	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	Evaluated as 2,3,7,8-TCDD TEQ				
		2,3,7,8-TCDD TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	1,1'-Biphenyl, [illegible]-heptachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	1,1'-Biphenyl, [illegible]-hexachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	1,1'-Biphenyl, [illegible]-Pentachloro	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #105	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #11[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #1[illegible]	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #126	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #156 and/or 157	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #169	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
	[illegible]	PCB congener #77	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	Evaluated as PCB TEQ				
		PCB Dioxin-like congener TEQ	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	PCB 1260	[illegible]	1	mg/kg	[illegible]	[illegible]	NA	1	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Aluminum	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Arsenic	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Barium	[illegible]	1	mg/kg	[illegible]	[illegible]	NA	1	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Calcium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Chromium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Copper	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Iron	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Lead	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]
	[illegible]	Magnesium	[illegible]	[illegible]	mg/kg	[illegible]	[illegible]	NA	[illegible]	NA	[illegible]	NA	[illegible]	[illegible]	[illegible]

Table 4R
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Fish Tissue
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
Knob Creek - All Species (cont'd)	74[illegible]965	Manganese	1.4	4	mg/kg	SMSFT[illegible]	5/1[illegible]	0.9 - 1.1	4	NA	[illegible] n	NA	CTRSR	NO	BSL
	74[illegible]976	Mercury	0.1	0.[illegible]	mg/kg	SMSFTB05	5/1[illegible]	0.09 - 0.[illegible]	0.[illegible]	NA	0.015 n	NA	CTRSR	YES	ASL
	7440020	Nickel	0.[illegible]	0.[illegible]5	mg/kg	SMSFTB01	[illegible]/1[illegible]	0.1[illegible] - 0.[illegible]	0.[illegible]5	NA	1 n	NA	CTRSR	NO	BSL
	7440097	Potassium	[illegible]	[illegible]	mg/kg	[illegible]T[illegible]01 SMSFT[illegible] SMSF[illegible]	1[illegible]/1[illegible]	NA	[illegible]	NA	NOT	NA	CTRSR	NO	NOT
	77[illegible]49[illegible]	Selenium	0.19	0.69	mg/kg	SMSFT[illegible]	1[illegible]/1[illegible]	NA	0.69	NA	0.[illegible] n	NA	CTRSR	NO	BSL
	7440[illegible]5	Sodium	510	[illegible]	mg/kg	SMSFT[illegible]05	1[illegible]/1[illegible]	NA	[illegible]	NA	NOT	NA	CTRSR	NO	NOT
	7440[illegible]46	Strontium	1.9	5.6	mg/kg	SMSFT[illegible]05	1[illegible]/1[illegible]	NA	5.6	NA	9 n	NA	CTRSR	NO	BSL
	7440666	Zinc	6.9		mg/kg	SMSFT[illegible]	1[illegible]/1[illegible]	NA		NA	46 n	NA	CTRSR	NO	BSL

Note: Source:
(1) Maximum detected concentration used for screening
(2) Risk based residential fish concentration obtained from the Regional Screening Level (RSL) Fish Ingestion Table (November 2014)
Surrogate screening value used
Methyl mercury value used for mercury
Hexavalent chromium used for chromium
c = cancer based screening value at a target risk of 1E-06
n = noncancer based screening value at a target hazard quotient of 0.1

ASL = above screening level
BSL = below screening level
c = cancer based screening value at a target risk of 1E-06
NA = not available
NBA = No benchmark available
n = noncancer based screening value at a target hazard quotient of 0.1
NOT = essential nutrient

ASL = above screening level
BSL = below screening level
NBA = no screening benchmark available

Table 5
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Soil Gas
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Air
Exposure Medium: Soil Gas

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (N/C) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion
Site	75343	1,1-Dichloroethane	18	1800	µg/m3	SMSS 3-10	3/22	7.4 - 15	1800	18 n	YES	ASL
	95636	1,2,4-Trimethylbenzene	12	56	µg/m3	SMSS 4-15	13/22	9.8 - 1100	56	7.3 n	YES	ASL
	107062	1,2-Dichloroethane	22	3300	µg/m3	SMSS 3-10	3/22	7.4 - 15	3300	1.1 n	YES	ASL
	108678	1,3,5-Trimethylbenzene	14	14	µg/m3	SMSS 4-15	1/22	8.9 - 1100	14	NEA	NO	NEA
	71432	Benzene	13	56	µg/m3	SMSS 1b	9/22	5.8 - 710	56	3.6 n	YES	ASL
	108907	Chlorobenzene	14	14	µg/m3	SMSS 3-10	1/22	8.4 - 1000	14	52 n	NO	BSL
	67663	Chloroform	12	12	µg/m3	SMSS 4-15	1/22	8.9 - 1100	12	1.2 n	YES	ASL
	74873	Chloromethane	20	10000	µg/m3	SMSS 3-10	3/22	9.4 - 19	10000	94 n	YES	ASL
	100414	Ethylbenzene	10	130	µg/m3	SMSS 4-15	6/22	7.9 - 960	130	11 n	YES	ASL
	179601231	m,p-Xylene	9.4	320	µg/m3	SMSS 4-15	18/22	8.7 - 960	320	1043 n	NO	BSL
	75092	Methylene Chloride	40	40	µg/m3	SMSS 3-10	1/22	16 - 1900	40	6.26 n	NO	BSL
	95476	o-Xylene	10	81	µg/m3	SMSS 4-15	7/22	8.7 - 960	81	104 n	NO	BSL
	108883	Toluene	11	2000	µg/m3	SMSS 3-10	18/22	7.5 - 7.5	2000	5214 n	NO	BSL

Note: none

(1) Maximum detected concentration used for screening

(2) Source/Information: Screening Level = RSL, obtained from the Thomas, 2015 Regional Screening Level (RSL) Table

ASL = above screening level

BSL = below screening level

c = screening level based on cancer risk at a target risk of 1E-06

NA = not applicable

NEA = No benchmark available

n = non-cancer based screening level at a target hazard quotient of 0.1

Table 8

Comparison of Maximum Essential Nutrient Concentrations to Recommended Dietary Allowances/Adequate Intakes
Smokey Mountain Smelters
Knoxville, Tennessee

Essential Nutrient	Maximum Detected Concentration [a]	Units	Maximum Daily Intake [b] (mg/day)	Range of RDA/AI [c] (mg/day)	Result of Comparison
Soil					
Calcium	170000	mg/kg	34	200 - 1300	Eliminate
Magnesium	22000	mg/kg	4.4	30 - 420	Eliminate
Potassium	12000	mg/kg	2.4	400 - 5100	Eliminate
Sodium	11000	mg/kg	2.2	120 - 1500	Eliminate
Groundwater					
Ammonia	670	mg/L	523	NA	---
Calcium	6200	mg/L	4836	200 - 1300	Retain
Chloride	54400	mg/L	42432	57 - 2300	Retain
Fluoride	330	mg/L	257	0.01 - 4	Retain
Magnesium	360	mg/L	281	30 - 420	Eliminate
Nitrate	500	mg/L	390	0 - 3.7	Retain
Nitrite	51.3	mg/L	40.0	0 - 0.07	Retain
Orthophosphate as P	4.5	mg/L	3.5	100 - 1250	Eliminate
Potassium	1600	mg/L	1248	400 - 5100	Eliminate
Sodium	30000	mg/L	23400	120 - 1500	Retain
Sufate	2680	mg/L	2090	260 - 1300	Retain
Sulfide	6.9	mg/L	5.4	260 - 1300	Eliminate

Notes:
[a] Maximum detected concentration based on the highest maximum detected concentration among all exposure units.
[b] Estimated based on a 200 mg/day soil ingestion rate (200 mg/day = 0.0002 kg/day) or a 0.78 L/day tapwater ingestior
[c] Sources: Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride* (The National Academies Press, 1997) and *Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate* (The National Academies Press, 2005).
AI = Adequate intake
NA = Not available
RDA = Recommended dietary allowance

Table 9
Non-Cancer Toxicity Data -- Oral/Dermal
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Dates (2)
1,1-Dichloroethane	Chronic	2.00E-01	mg/kg-dy	1.0	2.00E-01	mg/kg-dy	Kidney	3,000	PPRT	2015 RSL Table
1-Methylnaphthalene	Chronic	7.00E-02	mg/kg-dy	1.0	7.00E-02	mg/kg-dy	Respiratory System	1,000	ATSDR	2015 RSL Table
1,2-Dichloroethane	Chronic	6.00E-03	mg/kg-dy	1.0	6.00E-03	mg/kg-dy	Kidney	10,000	PPRT Append	2015 RSL Table
1,2,4-Trimethylbenzene	---	NA	---	--	NA	---	--	--	---	---
2,4-Dinitrotoluene	Chronic	2.00E-03	mg/kg-dy	1.0	2.00E-03	mg/kg-dy	Nervous System, Blood, Liver	100	IRIS	2-20-2015
2,6-Dinitrotoluene	Chronic	3.00E-04	mg/kg-dy	1.0	3.00E-04	mg/kg-dy	Spleen	10,000	PPRT Append	2015 RSL Table
4,4'-DDD	---	NA	---	--	NA	---	--	--	---	---
Benzene	Chronic	4.00E-03	mg/kg-dy	1.0	4.00E-03	mg/kg-dy	Blood	300	IRIS	2-20-2015
Benzo(a)anthracene	---	NA	---	--	NA	---	--	--	---	---
Benzo(a)pyrene	---	NA	---	--	NA	---	--	--	---	---
Benzo(b)fluoranthene	---	NA	---	--	NA	---	--	--	---	---
Benzo(k)fluoranthene	---	NA	---	--	NA	---	--	--	---	---
bis(2-Ethylhexyl)phthalate	Chronic	2.00E-02	mg/kg-dy	1.0	2.00E-02	mg/kg-dy	Liver	1,000	IRIS	2-20-2015
Bromodichloromethane	Chronic	2.00E-02	mg/kg-dy	1.0	2.00E-02	mg/kg-dy	Kidney	1,000	IRIS	2-20-2015
Bromomethane	Chronic	1.40E-03	mg/kg-dy	1.0	1.40E-03	mg/kg-dy	Gastrointestinal	1,000	IRIS	2-20-2015
Chloroform	Chronic	1.00E-02	mg/kg-dy	1.0	1.00E-02	mg/kg-dy	Liver, Blood	100	IRIS	2-20-2015
Chloromethane	---	NA	---	--	NA	---	--	--	---	---
Chrysene	---	NA	---	--	NA	---	--	--	---	---
Dibenzofuran	Chronic	1.00E-03	mg/kg-dy	1.0	1.00E-03	mg/kg-dy	Whole Body	3,000	PPRT Append	2015 RSL Table
Dieldrin	Chronic	5.00E-05	mg/kg-dy	1.0	5.00E-05	mg/kg-dy	Liver	100	IRIS	2-20-2015
Ethylbenzene	Chronic	1.00E-01	mg/kg-dy	1.0	1.00E-01	mg/kg-dy	Liver, Kidney	1,000	IRIS	2-20-2015
Heptachlor epoxide	Chronic	1.30E-05	mg/kg-dy	1.0	1.30E-05	mg/kg-dy	Liver	1,000	IRIS	2-20-2015
Indeno(1,2,3-cd)pyrene	---	NA	---	--	NA	---	--	--	---	---
Naphthalene	Chronic	2.00E-02	mg/kg-dy	1.0	2.00E-02	mg/kg-dy	Body Weight	3,000	IRIS	2-20-2015
Pentachlorophenol	Chronic	5.00E-03	mg/kg-dy	1.0	5.00E-03	mg/kg-dy	Liver	300	IRIS	2-20-2015
Phenol	Chronic	3.00E-01	mg/kg-dy	1.0	3.00E-01	mg/kg-dy	Body Weight	300	IRIS	2-20-2015
Tetrachloroethene	Chronic	6.00E-03	mg/kg-dy	1.0	6.00E-03	mg/kg-dy	Nervous System	1,000	IRIS	2-20-2015
Trichloroethene	Chronic	5.00E-04	mg/kg-dy	1.0	5.00E-04	mg/kg-dy	Cardiovascular System	10	IRIS	2-20-2015
trimethylbenzene	Chronic	2.00E-01	mg/kg-dy	1.0	2.00E-01	mg/kg-dy	Body Weight	1,000	IRIS	2-20-2015
PCB-1232 (3)	---	NA	---	--	NA	---	Eyes, Immune System	300	---	---
PCB-1260 (3)	---	NA	---	--	NA	---	Eyes, Immune System	300	---	---
PCB Dioxin-like Congener TEQ	Chronic	7.00E-10	mg/kg-dy	1.0	7.00E-10	mg/kg-dy	Developmental	30	IRIS	2-20-2015
2,3,7,8-TCDD TEQ	Chronic	7.00E-10	mg/kg-dy	1.0	7.00E-10	mg/kg-dy	Developmental	30	IRIS	2-20-2015
Antimony	Chronic	1.00E+00	mg/kg-dy	1.0	1.00E+00	mg/kg-dy	Nervous System	100	PPRT	2015 RSL Table
Antimony	Chronic	4.00E-04	mg/kg-dy	0.2	6.00E-05	mg/kg-dy	Blood	1,000	IRIS	2-20-2015
Arsenic	Chronic	3.00E-04	mg/kg-dy	1.0	3.00E-04	mg/kg-dy	Skin	3	IRIS	2-20-2015
Beryllium	Chronic	2.00E-03	mg/kg-dy	0.0070	1.40E-05	mg/kg-dy	Gastrointestinal	300	IRIS	2-20-2015
Cadmium (diet)	Chronic	1.00E-03	mg/kg-dy	0.025	2.50E-05	mg/kg-dy	Kidney	10	IRIS	2-20-2015
Cadmium (water)	Chronic	1.00E-03	mg/kg-dy	0.025	2.50E-05	mg/kg-dy	Kidney	10	IRIS	2-20-2015
Chromium (4)	Chronic	3.00E-03	mg/kg-dy	0.025	7.50E-05	mg/kg-dy	None observed	900	IRIS	2-20-2015
Cobalt	Chronic	3.00E-04	mg/kg-dy	1.0	3.00E-04	mg/kg-dy	Thyroid	3,000	PPRT	2015 RSL Table

Table 9
Non-Cancer Toxicity Data -- Oral/Dermal
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Dates (2)
Copper	Chronic	4.00E-02	mg/kg-day	1.0	4.00E-02	mg/kg-day	--	--	HEAST	1997
Cyanide	Chronic	6.00E-04	mg/kg-day	1.0	6.00E-04	mg/kg-day	Reproductive System	3,000	IRIS	2-20-2015
Iron	Chronic	7.00E-01	mg/kg-day	1.0	7.00E-01	mg/kg-day	Gastrointestinal	1.5	PPRT	2015 RSL Table
Lead	---	NA	---	--	NA	---	--	--	---	---
Manganese	Chronic	2.40E-02	mg/kg-day	0.040	9.60E-04	mg/kg-day	Nervous System	1	IRIS	2-20-2015
Mercury (5)	Chronic	3.00E-04	mg/kg-day	0.070	2.10E-05	mg/kg-day	Kidney	1,000	IRIS	2-20-2015
Methylmercury (6)	Chronic	1.00E-04	mg/kg-day	1.0	1.00E-04	mg/kg-day	Nervous System	10	IRIS	2-20-2015
Molybdenum	Chronic	5.00E-03	mg/kg-day	1.0	5.00E-03	mg/kg-day	Blood	30	IRIS	2-20-2015
Nickel	Chronic	2.00E-02	mg/kg-day	0.040	8.00E-04	mg/kg-day	Body Weight	300	IRIS	2-20-2015
Selenium	Chronic	5.00E-03	mg/kg-day	1.0	5.00E-03	mg/kg-day	Liver, Blood, Skin, Nervous System	3	IRIS	2-20-2015
Strontium	Chronic	6.00E-01	mg/kg-day	1.0	6.00E-01	mg/kg-day	Bone	300	IRIS	2-20-2015
Thallium	Chronic	1.00E-05	mg/kg-day	1.0	1.00E-05	mg/kg-day	Hair	3,000	PPRT Appendix	2015 RSL Table
Vanadium	Chronic	5.00E-03	mg/kg-day	0.026	1.30E-04	mg/kg-day	Kidney	3,000	IRIS	2-20-2015
Zinc	Chronic	3.00E-01	mg/kg-day	1.0	3.00E-01	mg/kg-day	Blood	3	IRIS	2-20-2015

(1) Source: RAGS Part E Guidance
(2) Represents date source was last searched
(3) Aroclor 1254 used as a surrogate
(4) Chromium VI slope used for concentration
(5) Mercuric chloride toxicity slope used for soil and groundwater exposure
(6) Methylmercury toxicity slope used for fish tissue exposure

Definitions:
ATSDR = Agency for Toxic Substances and Disease Registry
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = not available
PPRT = Provisional Peer-Reviewed Toxicity Value

Table 10
Non-Cancer Toxicity Data -- Inhalation
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s)	
		Value	Units			Source(s)	Dates (1)
1,1-Dichloroethane	---	NA	--	---	---	--	---
1-Methylnaphthalene	---	NA	--	---	---	--	---
1,2-Dichloroethane	Chronic	7.00E-03	mg/m3	Nervous System	3,000	PPRT	2015 RSL Table
1,2,4-Trimethylbenzene	Chronic	7.00E-03	mg/m3	Blood	3,000	PPRT	2015 RSL Table
2,4-Dinitrotoluene	---	NA	--	---	---	--	---
2,6-Dinitrotoluene	---	NA	--	---	---	--	---
4,4'-DDD	---	NA	--	---	---	--	---
Benzene	Chronic	3.00E-02	mg/m3	Blood	300	IRIS	2-20-2015
Benzo(a)anthracene	---	NA	--	---	---	--	---
Benzo(a)pyrene	---	NA	--	---	---	--	---
Benzo(b)fluoranthene	---	NA	--	---	---	--	---
Benzo(k)fluoranthene	---	NA	--	---	---	--	---
bis(2-Ethylhexyl)phthalate	---	NA	--	---	---	--	---
Bromodichloromethane	---	NA	--	---	---	--	---
Bromomethane	Chronic	5.00E-03	mg/m3	Respiratory System	100	IRIS	2-20-2015
Chloroform	Chronic	9.80E-02	mg/m3	Liver	100	ATSDR	2015 RSL Table
Chloromethane	Chronic	9.00E-02	mg/m3	Nervous System	1,000	IRIS	2-20-2015
Chrysene	---	NA	--	---	---	--	---
Dibenzofuran	---	NA	--	---	---	--	---
Dieldrin	---	NA	--	---	---	--	---
Ethylbenzene	Chronic	1.00E+00	mg/m3	Developmental	300	IRIS	2-20-2015
Heptachlor epoxide	---	NA	--	---	---	--	---
Indeno(1,2,3-cd)pyrene	---	NA	--	---	---	--	---
Naphthalene	Chronic	3.00E-03	mg/m3	Respiratory System	3,000	IRIS	2-20-2015
Pentachlorophenol	---	NA	--	---	---	--	---
Phenol	Chronic	2.00E-01	mg/m3	Gastrointestinal, Cardiovascular System, Kidney, Nervous System	100	CalEPA	2015 RSL Table
Tetrachloroethene	Chronic	4.00E-02	mg/m3	Nervous System	1,000	IRIS	2-20-2015
Trichloroethene	Chronic	2.00E-03	mg/m3	Immune System	100	IRIS	2-20-2015
Trimethylbenzene	Chronic	1.00E-01	mg/m3	Nervous System	300	IRIS	2-20-2015
PCB-1232	---	NA	--	---	---	--	---
PCB-1260	---	NA	--	---	---	--	---
PCB Dioxin-like Congener TEQ	Chronic	4.00E-08	mg/m3	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	100	CalEPA	2015 RSL Table
2,3,7,8-TCDD TEQ	Chronic	4.00E-08	mg/m3	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	100	CalEPA	2015 RSL Table
Aluminum	Chronic	5.00E-03	mg/m3	Nervous System	300	PPRT	2015 RSL Table
Antimony	---	NA	--	---	---	--	---
Arsenic	Chronic	1.50E-05	mg/m3	Developmental, Cardiovascular System, Nervous System, Lung, Skin	30	CalEPA	2015 RSL Table
Beryllium	Chronic	2.00E-05	mg/m3	Nervous System	10	IRIS	2-20-2015
Cadmium	Chronic	1.00E-05	mg/m3	Kidney	9	ATSDR	2015 RSL Table
Chromium (2)	Chronic	1.00E-04	mg/m3	Respiratory System	300	IRIS	2-20-2015
Cobalt	Chronic	6.00E-06	mg/m3	Respiratory System	300	PPRT	2015 RSL Table
Copper	---	NA	--	---	---	--	---
Cyanide	Chronic	8.00E-04	mg/m3	Thyroid	3,000	IRIS	2-20-2015
Iron	---	NA	--	---	---	--	---
Lead	---	NA	--	---	---	--	---
Manganese	Chronic	5.00E-05	mg/m3	Nervous System	1,000	IRIS	2-20-2015

Table 10
Non-Cancer Toxicity Data -- Inhalation
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s)	
		Value	Units			Source(s)	Dates (1)
Mercury (3)	Chronic	3.00E-04	mg/m3	Nervous system	30	IRIS	2/20/2015
Molybdenum	...	NA	--	...	...	--	...
Nickel	Chronic	9.00E-05	mg/m3	Respiratory system	30	ATSDR	2015 RSL Table
Selenium	Chronic	2.00E-02	mg/m3	Liver, Blood, Skin, CNS	3	CalEPA	2015 RSL Table
Strontium	...	NA	--	...	...	--	...
Thallium	...	NA	--	...	...	--	...
Vanadium	Chronic	1.00E-04	mg/m3	Respiratory system	30	ATSDR	2015 RSL Table
Zinc	...	NA	--	...	...	--	...

(1) Represents date source was searched

(2) Chromium (Particulate) also used due to the absence of chromium speciation data

(3) Elemental mercury toxicity also used

Definitions: ATSDR = Agency for Toxic Substances and Disease Registry

CalEPA = California Environmental Protection Agency

HEAST = Health Effects Assessment Summary Tables

IRIS = Integrated Risk Information System

NA = not available

PPRTV = Provisional Peer-Reviewed Toxicity Value

Table 11
Cancer Toxicity Data -- Oral/Dermal
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Dates (2)
1,1-Dichloroethane	5.70E-03	(mg/kg-day)-1	1.0	5.70E-03	(mg/kg-day)-1	C	CalEPA	2015 RSL Table
1-Methylnaphthalene	2.90E-02	(mg/kg-day)-1	1.0	2.90E-02	(mg/kg-day)-1	No information	PPRT	2015 RSL Table
1,2-Dichloroethane	9.10E-02	(mg/kg-day)-1	1.0	9.10E-02	(mg/kg-day)-1	B2	IRIS	2-20-2015
1,2,4-Trimethylbenzene	NA	--	...	NA	...	No information	...	...
2,4-Dinitrotoluene	3.10E-01	(mg/kg-day)-1	1.0	3.10E-01	(mg/kg-day)-1	B2	CalEPA	2015 RSL Table
2,6-Dinitrotoluene	1.50E+00	(mg/kg-day)-1	1.0	1.50E+00	(mg/kg-day)-1	B2	PPRT	2015 RSL Table
4,4'-DDD	2.40E-01	(mg/kg-day)-1	1.0	2.40E-01	(mg/kg-day)-1	B2	IRIS	2-20-2015
Benzene	5.50E-02	(mg/kg-day)-1	1.0	5.50E-02	(mg/kg-day)-1	A	IRIS	2-20-2015
Benzo(a)anthracene	7.30E-01	(mg/kg-day)-1	1.0	7.30E-01	(mg/kg-day)-1	B2	IRIS	2-20-2015
Benzo(a)pyrene	7.30E+00	(mg/kg-day)-1	1.0	7.30E+00	(mg/kg-day)-1	B2	IRIS	2-20-2015
Benzo(b)fluoranthene	7.30E-01	(mg/kg-day)-1	1.0	7.30E-01	(mg/kg-day)-1	B2	IRIS	2-20-2015
Benzo(k)fluoranthene	7.30E-02	(mg/kg-day)-1	1.0	7.30E-02	(mg/kg-day)-1	B2	IRIS	2-20-2015
bis(2-Ethylhexyl)phthalate	1.40E-02	(mg/kg-day)-1	1.0	1.40E-02	(mg/kg-day)-1	B2	IRIS	2-20-2015
Bromodichloromethane	6.20E-02	(mg/kg-day)-1	1.0	6.20E-02	(mg/kg-day)-1	B2	IRIS	2-20-2015
Bromomethane	NA	--	...	NA	...	D	...	...
Chloroform	3.10E-02	(mg/kg-day)-1	1.0	3.10E-02	(mg/kg-day)-1	B2	CalEPA	2015 RSL Table
Chloromethane	NA	--	...	NA	...	D	...	...
Chrysene	7.30E-03	(mg/kg-day)-1	1.0	7.30E-03	(mg/kg-day)-1	B2	IRIS	2-20-2015
Dibenzofuran	NA	--	...	NA	...	D	...	...
Dieldrin	1.60E+01	(mg/kg-day)-1	1.0	1.60E+01	(mg/kg-day)-1	D	IRIS	2-20-2015
Ethylbenzene	1.10E-02	(mg/kg-day)-1	1.0	1.10E-02	(mg/kg-day)-1	D	CalEPA	2015 RSL Table
Heptachlor epoxide	9.10E+00	(mg/kg-day)-1	1.0	9.10E+00	(mg/kg-day)-1	B2	IRIS	2-20-2015
Indeno(1,2,3-cd)pyrene	7.30E-01	(mg/kg-day)-1	1.0	7.30E-01	(mg/kg-day)-1	B2	IRIS	2-20-2015
Naphthalene	NA	--	...	NA	...	C	...	...
Pentachlorophenol	4.00E-01	(mg/kg-day)-1	1.0	4.00E-01	(mg/kg-day)-1	B1	IRIS	2-20-2015
Phenol	NA	--	...	NA	...	D	...	...
Tetrachloroethene	2.10E-03	(mg/kg-day)-1	1.0	2.10E-03	(mg/kg-day)-1	B1	IRIS	2-20-2015
Trichloroethene	4.60E-02	(mg/kg-day)-1	1.0	4.60E-02	(mg/kg-day)-1	A	IRIS	2-20-2015
Trimethylbenzene	NA	--	...	NA	...	Inadequate information	...	...
PCB-1232	2.00E+00	(mg/kg-day)-1	1.0	2.00E+00	(mg/kg-day)-1	B2	IRIS	2-20-2015
PCB-1260	2.00E+00	(mg/kg-day)-1	1.0	2.00E+00	(mg/kg-day)-1	B2	IRIS	2-20-2015
PCB Dioxin-like Congener TEQ	1.30E+05	(mg/kg-day)-1	1.0	1.30E+05	(mg/kg-day)-1	Assessment underway	CalEPA	2015 RSL Table
2,3,7,8-TCDD TEQ	1.30E+05	(mg/kg-day)-1	1.0	1.30E+05	(mg/kg-day)-1	Assessment underway	CalEPA	2015 RSL Table
Aluminum	NA	--	...	NA	...	No information	...	...
Antimony	NA	--	...	NA	...	Not selected	...	...
Arsenic	1.50E+00	(mg/kg-day)-1	1.0	1.50E+00	(mg/kg-day)-1	A	IRIS	2-20-2015
Beryllium	NA	--	...	NA	...	No information	...	...
Cadmium	NA	--	...	NA	...	B1	...	...
Chromium (3)	5.00E-01	(mg/kg-day)-1	0.025	2.00E+01	(mg/kg-day)-1	D	NJDEP	2015 RSL Table
Cobalt	NA	--	...	NA	...	No information	...	...
Copper	NA	--	...	NA	...	D	...	...

Table 11
Cancer Toxicity Data -- Oral/Dermal
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Dates (2)
Cyanide	NA	--	...	NA	...	Inadequate information	...	...
Iron	NA	--	...	NA	...	No information	...	...
Lead	NA	--	...	NA	...	B2	...	...
Manganese	NA	--	...	NA	...	D	...	...
Mercury	NA	--	...	NA	...	D	...	...
Methylmercury	NA	--	...	NA	...	D	...	...
Molybdenum	NA	--	...	NA	...	Not assessed	...	...
Nickel	NA	--	...	NA	...	No information	...	...
Selenium	NA	--	...	NA	...	D	...	...
Strontium	NA	--	...	NA	...	Not assessed	...	...
Thallium	NA	--	...	NA	...	No information	...	...
Vanadium	NA	--	...	NA	...	No information	...	...
Zinc	NA	--	...	NA	...	D	...	...

(1) Source: RAGS Part E Guidance
(2) Represents date source was accessed
(3) Chromium VI selected for consideration

Definitions: CalEPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
NJDEP = New Jersey Department of Environmental Protection
NA = not available
PPRTV = Provisional Peer-Reviewed Toxicity Value
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as human carcinogen

Table 12
Cancer Toxicity Data -- Inhalation
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Unit Risk		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units		Source(s)	Dates (1)
1,1-Dichloroethane	1.60E-06	(µg/m3)$^{-1}$	C	CalEPA	2015 RSL Table
1-Methylnaphthalene	NA	--	No information	---	--
1,2-Dichloroethane	2.60E-05	(µg/m3)$^{-1}$	B2	IRIS	2/20/2015
1,2,4-Trimethylbenzene	NA	--	No information	---	--
2,4-Dinitrotoluene	8.90E-05	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
2,6-Dinitrotoluene	NA	--	B2	---	--
4,4'-DDD	6.90E-05	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Benzene	7.80E-06	(µg/m3)$^{-1}$	A	IRIS	2/20/2015
Benzo(a)anthracene	1.10E-04	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Benzo(a)pyrene	1.10E-03	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Benzo(b)fluoranthene	1.10E-04	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Benzo(k)fluoranthene	1.10E-04	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
bis(2-Ethylhexyl)phthalate	2.40E-06	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Bromodichloromethane	3.70E-05	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Bromomethane	NA	--	D	---	--
Chloroform	2.30E-05	(µg/m3)$^{-1}$	B2	IRIS	2/20/2015
Chloromethane	NA	--	D	---	--
Chrysene	1.10E-05	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Dibenzofuran	NA	--	D	---	--
Dieldrin	4.60E-03	(µg/m3)$^{-1}$	D	IRIS	2/20/2015
Ethylbenzene	2.50E-06	(µg/m3)$^{-1}$	D	CalEPA	2015 RSL Table
Heptachlor epoxide	2.60E-03	(µg/m3)$^{-1}$	B2	IRIS	2/20/2015
Indeno(1,2,3-cd)pyrene	1.10E-04	(µg/m3)$^{-1}$	B2	CalEPA	2015 RSL Table
Naphthalene	3.40E-05	(µg/m3)$^{-1}$	C	CalEPA	2015 RSL Table
Pentachlorophenol	5.10E-06	(µg/m3)$^{-1}$	B1	CalEPA	2015 RSL Table
Phenol	NA	--	D	---	--
Tetrachloroethene	2.60E-07	(µg/m3)$^{-1}$	B1	IRIS	2/20/2015
Trichloroethene	4.10E-06	(µg/m3)$^{-1}$	A	IRIS	2/20/2015
(m-,and/or p-)Xylene	NA	--	Inadequate information	---	--
PCB-1232	5.70E-04	(µg/m3)$^{-1}$	B2	IRIS	2/20/2015
PCB-1260	5.70E-04	(µg/m3)$^{-1}$	B2	IRIS	2/20/2015
PCB Dioxin-like Congener TEQ	3.80E+01	(µg/m3)$^{-1}$	Assessment underway	CalEPA	2015 RSL Table
2,3,7,8-TCDD TEQ	3.80E+01	(µg/m3)$^{-1}$	Assessment underway	CalEPA	2015 RSL Table
Aluminum	NA	--	No information	---	--
Antimony	NA	--	Not assessed	---	--
Arsenic	4.30E-03	(µg/m3)$^{-1}$	A	IRIS	2/20/2015
Beryllium	2.40E-03	(µg/m3)$^{-1}$	No information	IRIS	2/20/2015
Cadmium	1.80E-03	(µg/m3)$^{-1}$	B1	IRIS	2/20/2015
Chromium (2)	8.40E-02	(µg/m3)$^{-1}$	D	IRIS	2/20/2015
Cobalt	9.00E-03	(µg/m3)$^{-1}$	No information	PPRT	2015 RSL Table
Copper	NA	--	D	---	--
Cyanide	NA	--	Inadequate information	---	--

Table 12
Cancer Toxicity Data -- Inhalation
Smokey Mountain Smelters
Knoxville, Tennessee

Contaminant of Potential Concern	Unit Risk		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units		Source(s)	Dates (1)
Iron	NA	--	No information	---	--
Lead	NA	--	B2	---	--
Manganese	NA	--	D	---	--
Mercury	NA	--	D	---	--
Molybdenum	NA	--	Not detected	---	--
Nickel	2.60E-04	(µg/m3)$^{-1}$	B1	CalEPA	2015 RSL Table
Selenium	NA	--	D	---	--
Strontium	NA	--	Not detected	---	--
Thallium	NA	--	No information	---	--
Vanadium	NA	--	No information	---	--
Zinc	NA	--	D	---	--

(1) Represents date source was accessed

(2) Chromium VI used due to the absence of chromium speciation data

Definitions: CalEPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
PPRTV = Provisional Peer-Reviewed Toxicity Value
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen

Table 13R
Exposure Point Concentration Summary - Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface soil

Exposure Point	Contaminant of Potential Concern	Units	Average Conc[a]	95% UCL	Maximum Conc	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
On-Site	2,3,7,8-TCDD TEQ	mg/kg	1.42E-05	NC	2.90E-05	2.90E-05	mg/kg	Maximum	[b]
	Aluminum	mg/kg	2.90E+04	4.33E+04	1.20E+05	4.33E+04	mg/kg	95% Chebyshev (Mean, Sd) UCL	[b]
	Arsenic	mg/kg	1.60E+01	1.75E+01	3.60E+01	1.75E+01	mg/kg	95% Approximate Gamma UCL	[b]
	Chromium	mg/kg	3.24E+01	3.66E+01	8.40E+01	3.66E+01	mg/kg	95% Student's-t UCL	[b]
	Cobalt	mg/kg	1.53E+01	1.73E+01	4.10E+01	1.73E+01	mg/kg	95% Approximate Gamma UCL	[b]
	Copper	mg/kg	1.50E+02	3.72E+02	1.90E+03	3.72E+02	mg/kg	95% Chebyshev (Mean, Sd) UCL	[b]
	Iron	mg/kg	3.54E+04	3.83E+04	9.20E+04	3.83E+04	mg/kg	95% Approximate Gamma UCL	[b]
	Manganese	mg/kg	1.16E+03	1.39E+03	4.40E+03	1.39E+03	mg/kg	95% Approximate Gamma UCL	[b]
	Thallium	mg/kg	2.57E+00	NC	6.30E-01	6.30E-01	mg/kg	Maximum	[b]
	Vanadium	mg/kg	3.66E+01	3.92E+01	6.40E+01	3.92E+01	mg/kg	95% Approximate Gamma UCL	[b]
	Zinc	mg/kg	2.77E+02	6.73E+02	4.20E+03	6.73E+02	mg/kg	95% Chebyshev (Mean, Sd) UCL	[b]
Flenniken Branch	Benzo(a)anthracene	mg/kg	1.31E-01	NC	5.10E-02	5.10E-02	mg/kg	Maximum	[b]
	Benzo(a)pyrene	mg/kg	1.38E-01	NC	1.00E-01	1.00E-01	mg/kg	Maximum	[b]
	Benzo(b)fluoranthene	mg/kg	1.40E-01	NC	1.10E-01	1.10E-01	mg/kg	Maximum	[b]
	Benzo(k)fluoranthene	mg/kg	1.39E-01	NC	1.00E-01	1.00E-01	mg/kg	Maximum	[b]
	Chrysene	mg/kg	1.37E-01	NC	9.60E-02	9.60E-02	mg/kg	Maximum	[b]
	2,3,7,8-TCDD TEQ	mg/kg	5.84E-06	NC	9.90E-06	9.90E-06	mg/kg	Maximum	[b]
	Aluminum	mg/kg	1.16E+04	1.39E+04	1.80E+04	1.39E+04	mg/kg	95% Student's-t UCL	[b]
	Arsenic	mg/kg	8.58E+00	1.02E+01	1.50E+01	1.02E+01	mg/kg	95% Student's-t UCL	[b]
	Chromium	mg/kg	2.31E+01	2.81E+01	4.80E+01	2.81E+01	mg/kg	95% Student's-t UCL	[b]
	Cobalt	mg/kg	1.09E+01	1.22E+01	1.50E+01	1.22E+01	mg/kg	95% Student's-t UCL	[b]
	Cyanide	mg/kg	1.07E+00	NC	2.40E+00	2.40E+00	mg/kg	Maximum	[b]
	Iron	mg/kg	2.75E+04	3.03E+04	3.70E+04	3.03E+04	mg/kg	95% Student's-t UCL	[b]
	Manganese	mg/kg	9.77E+02	1.14E+03	1.60E+03	1.14E+03	mg/kg	95% Student's-t UCL	[b]
	Thallium	mg/kg	2.02E+00	NC	1.10E+00	1.10E+00	mg/kg	Maximum	[b]

NC = Not calculated.

[a] If nondetects are present for a COPC, the average concentration is derived using ProUCL estimation methods (i.e., regression on order [ROS] and Kaplan-Meier [KM]). These estimations are then used in order to calculate an appropriate UCL.

[b] Maximum detected concentration used as the EPC in instances where total samples were less than or equal to 8 and/or there were less than 4 detects. If the sample size was sufficient, the ProUCL recommendation was used.

Table 14R
Exposure Point Concentration Summary - Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Total soil

Exposure Point	Contaminant of Potential Concern	Units	Average Conc[a]	95% UCL	Maximum Conc	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
On-Site	Benzo(a)anthracene	mg/kg	1.24E-01	NC	8.10E-02	8.10E-02	mg/kg	Maximum	[b]
	Benzo(a)pyrene	mg/kg	1.25E-01	NC	9.10E-02	9.10E-02	mg/kg	Maximum	[b]
	Benzo(b)fluoranthene	mg/kg	1.34E-01	NC	1.00E-01	1.00E-01	mg/kg	Maximum	[b]
	Benzo(k)fluoranthene	mg/kg	1.26E-01	NC	9.10E-02	9.10E-02	mg/kg	Maximum	[b]
	Chrysene	mg/kg	1.31E-01	NC	1.00E-01	1.00E-01	mg/kg	Maximum	[b]
	Indeno (1,2,3-cd) pyrene	mg/kg	1.18E-01	NC	6.90E-02	6.90E-02	mg/kg	Maximum	[b]
	2,3,7,8-TCDD TEQ	mg/kg	1.42E-05	NC	2.90E-05	2.90E-05	mg/kg	Maximum	[b]
	PCB-1232	mg/kg	8.01E-02	NC	5.40E-01	5.40E-01	mg/kg	Maximum	[b]
	Aluminum	mg/kg	2.90E+04	3.26E+04	1.20E+05	3.26E+04	mg/kg	95% H-UCL	[b]
	Arsenic	mg/kg	1.57E+01	1.72E+01	3.60E+01	1.72E+01	mg/kg	95% Student's-t UCL	[b]
	Chromium	mg/kg	3.32E+01	3.70E+01	8.40E+01	3.70E+01	mg/kg	95% Approximate Gamma UCL	[b]
	Cobalt	mg/kg	1.55E+01	1.75E+01	4.10E+01	1.75E+01	mg/kg	95% Student's-t UCL	[b]
	Copper	mg/kg	1.42E+02	3.48E+02	1.90E+03	3.48E+02	mg/kg	95% Chebyshev (Mean, Sd) UCL	[b]
	Iron	mg/kg	3.63E+04	3.92E+04	9.20E+04	3.92E+04	mg/kg	95% Student's-t UCL	[b]
	Manganese	mg/kg	1.16E+03	1.39E+03	4.40E+03	1.39E+03	mg/kg	95% Approximate Gamma UCL	[b]
	Thallium	mg/kg	2.55E+00	NC	6.30E-01	6.30E-01	mg/kg	Maximum	[b]
	Vanadium	mg/kg	3.66E+01	3.92E+01	6.40E+01	3.92E+01	mg/kg	95% Approximate Gamma UCL	[b]
	Zinc	mg/kg	2.65E+02	6.32E+02	4.20E+03	6.32E+02	mg/kg	95% Chebyshev (Mean, Sd) UCL	[b]
Flenniken Branch	Benzo(a)anthracene	mg/kg	1.31E-01	NC	5.10E-02	5.10E-02	mg/kg	Maximum	[b]
	Benzo(a)pyrene	mg/kg	1.38E-01	NC	1.00E-01	1.00E-01	mg/kg	Maximum	[b]
	Benzo(b)fluoranthene	mg/kg	1.40E-01	NC	1.10E-01	1.10E-01	mg/kg	Maximum	[b]
	Benzo(k)fluoranthene	mg/kg	1.39E-01	NC	1.00E-01	1.00E-01	mg/kg	Maximum	[b]
	Chrysene	mg/kg	1.37E-01	NC	9.60E-02	9.60E-02	mg/kg	Maximum	[b]
	2,3,7,8-TCDD TEQ	mg/kg	5.84E-06	NC	9.90E-06	9.90E-06	mg/kg	Maximum	[b]
	Aluminum	mg/kg	1.16E+04	1.39E+04	1.80E+04	1.39E+04	mg/kg	95% Student's-t UCL	[b]
	Arsenic	mg/kg	8.58E+00	1.02E+01	1.50E+01	1.02E+01	mg/kg	95% Student's-t UCL	[b]
	Chromium	mg/kg	2.31E+01	2.81E+01	4.80E+01	2.81E+01	mg/kg	95% Student's-t UCL	[b]
	Cobalt	mg/kg	1.09E+01	1.22E+01	1.50E+01	1.22E+01	mg/kg	95% Student's-t UCL	[b]
	Cyanide	mg/kg	1.07E+00	NC	2.40E+00	2.40E+00	mg/kg	Maximum	[b]
	Iron	mg/kg	2.75E+04	3.03E+04	3.70E+04	3.03E+04	mg/kg	95% Student's-t UCL	[b]
	Manganese	mg/kg	9.77E+02	1.14E+03	1.60E+03	1.14E+03	mg/kg	95% Student's-t UCL	[b]
	Thallium	mg/kg	2.02E+00	NC	1.10E+00	1.10E+00	mg/kg	Maximum	[b]

NC = Not calculated.

[a] If nondetects are present for a COPC, the average concentration is derived using ProUCL estimation methods (i.e., regression on order [ROS] and Kaplan-Meier [KM]). These estimations are then used in order to calculate an appropriate UCL.

[b] Maximum detected concentration used as the EPC in instances where total samples were less than or equal to 8 and/or there were less than 4 detects. If the sample size was sufficient, the ProUCL recommendation was used.

Table 15
Exposure Point Concentration Summary - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Contaminant of Potential Concern	Units	Average Concentration[3]	95% UCL	Maximum Concentration	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Shallow	1,2,4-Trimethylbenzene	µg/L	2.77E+00	1.70E+00	3.40E+00	1.70E+00	µg/L	95% KM (t) UCL	[1]
	2,4-Dinitrotoluene	µg/L	8.51E+00	5.06E+00	9.30E+00	5.06E+00	µg/L	95% KM (t) UCL	[1]
	4,4'-DDD	µg/L	8.71E-02	3.20E-02	3.20E-02	3.20E-02	µg/L	Maximum	[1]
	Benzene	µg/L	2.59E+00	1.12E+00	2.60E+00	1.12E+00	µg/L	95% KM (t) UCL	[1]
	bis(2-Ethylhexyl)phthalate	µg/L	1.25E+01	2.30E+01	2.30E+01	2.30E+01	µg/L	Maximum	[1]
	Bromodichloromethane	µg/L	3.31E+00	3.20E-01	3.20E-01	3.20E-01	µg/L	Maximum	[1]
	Bromomethane	µg/L	3.37E+00	1.45E+00	3.20E+00	1.45E+00	µg/L	95% KM (t) UCL	[1]
	Chloroform	µg/L	3.86E+00	4.90E+02	9.10E+00	9.10E+00	µg/L	Maximum	[1]
	Dibenzofuran	µg/L	7.00E+00	1.60E+00	1.60E+00	1.60E+00	µg/L	Maximum	[1]
	Dieldrin	µg/L	7.66E-02	3.40E-02	3.40E-02	3.40E-02	µg/L	Maximum	[1]
	Ethylbenzene	µg/L	3.71E+00	1.93E+00	6.80E+00	1.93E+00	µg/L	95% KM (t) UCL	[1]
	Naphthalene	µg/L	6.58E+00	3.14E+00	6.30E+00	3.14E+00	µg/L	95% KM (t) UCL	[1]
	Pentachlorophenol	µg/L	1.40E+01	3.01E+00	4.00E+00	3.01E+00	µg/L	95% KM (t) UCL	[1]
	Phenol	µg/L	9.56E+01	1.57E+02	1.00E+03	1.57E+02	µg/L	95% KM (Percentile Boot) trap UCL	[1]
	Tetrachloroethene	µg/L	4.42E+00	5.69E+00	1.80E+01	5.69E+00	µg/L	95% KM (Chebyshev) UCL	[1]
	Trichloroethene	µg/L	3.48E+00	1.99E+00	4.30E+00	1.99E+00	µg/L	95% KM (Percentile Boot) trap UCL	[1]
	Vinyl chloride	µg/L	5.61E+00	8.94E+00	2.60E+01	8.94E+00	µg/L	95% KM (Chebyshev) UCL	[1]
	Aluminum	µg/L	1.39E+04	5.62E+04	2.20E+05	5.62E+04	µg/L	97.5% KM (Chebyshev) UCL	[1]
	Antimony	µg/L	9.21E+01	7.94E+00	1.30E+01	7.94E+00	µg/L	95% KM (t) UCL	[1]
	Arsenic	µg/L	2.02E+01	1.40E+01	8.20E+01	1.40E+01	µg/L	95% KM (t) UCL	[1]
	Beryllium	µg/L	2.04E+01	1.03E+01	5.40E+01	1.03E+01	µg/L	95% KM (t) UCL	[1]
	Cadmium	µg/L	9.38E+01	2.34E+00	1.40E+03	2.34E+00	µg/L	95% KM (t) UCL	[1]
	Chromium	µg/L	4.17E+01	3.14E+01	2.70E+02	3.14E+01	µg/L	95% KM (t) UCL	[1]
	Cobalt	µg/L	2.79E+02	1.14E+03	2.60E+03	1.14E+03	µg/L	99% KM (Chebyshev) UCL	[1]
	Copper	µg/L	1.33E+02	2.80E+02	1.70E+03	2.80E+02	µg/L	95% KM (Chebyshev) UCL	[1]
	Cyanide	µg/L	1.37E+01	1.07E+01	3.30E+01	1.07E+01	µg/L	95% KM (t) UCL	[1]
	Iron	µg/L	2.00E+03	2.54E+03	1.70E+04	2.54E+03	µg/L	95% KM (BCA) UCL	[1]
	Lead	µg/L	2.06E+01	1.49E+01	7.70E+01	1.49E+01	µg/L	95% KM (t) UCL	[1]
	Manganese	µg/L	1.70E+04	6.91E+04	2.00E+05	6.91E+04	µg/L	99% KM (Chebyshev) UCL	[1]
	Mercury	µg/L	1.07E+00	6.99E+00	9.60E+00	6.99E+00	µg/L	97.5% KM (Chebyshev) UCL	[1]
	Molybdenum	µg/L	2.27E+02	1.20E+02	1.20E+02	1.20E+02	µg/L	Maximum	[1]
	Nickel	µg/L	2.09E+02	7.56E+02	2.10E+03	7.56E+02	µg/L	99% KM (Chebyshev) UCL	[1]
	Selenium	µg/L	5.67E+01	1.75E+01	7.70E+01	1.75E+01	µg/L	95% KM (t) UCL	[1]
	Strontium	µg/L	6.56E+02	1.80E+03	1.80E+03	1.80E+03	µg/L	Maximum	[1]
	Thallium	µg/L	3.31E+01	2.27E+01	9.20E+01	2.27E+01	µg/L	95% KM (t) UCL	[1]
	Vanadium	µg/L	9.46E+01	2.30E+01	2.30E+01	2.30E+01	µg/L	Maximum	[1]
	Zinc	µg/L	3.33E+03	2.33E+04	7.10E+04	2.33E+04	µg/L	99% KM (Chebyshev) UCL	[1]

Table 15
Exposure Point Concentration Summary - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Contaminant of Potential Concern	Units	Average Concentration[a]	95% UCL	Maximum Concentration	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Deep	1,2-Dichloroethane	µg/L	3.04E+00	1.20E+00	1.20E+00	1.20E+00	µg/L	Max-imum	[b]
	2,4-Dinitrotoluene	µg/L	1.06E+01	1.29E+01	3.50E+01	1.29E+01	µg/L	95% KM (Percentile Bootstrap) UCL	[b]
	2,6-Dinitrotoluene	µg/L	6.66E+00	4.66E+00	7.00E+00	4.66E+00	µg/L	95% KM (t) UCL	[b]
	Benzene	µg/L	2.01E+00	8.61E-01	1.20E+00	8.61E-01	µg/L	95% KM (t) UCL	[b]
	bis(2-Ethylhexyl)phthalate	µg/L	9.46E+00	6.70E+01	6.70E+01	6.70E+01	µg/L	Max-imum	[b]
	Bromomethane	µg/L	3.45E+00	2.90E+00	2.90E+00	2.90E+00	µg/L	Max-imum	[b]
	Chloroform	µg/L	3.41E+00	2.02E+00	5.90E+00	2.02E+00	µg/L	95% KM (t) UCL	[b]
	Dieldrin	µg/L	8.70E-02	3.50E-02	3.50E-02	3.50E-02	µg/L	Max-imum	[b]
	Heptachlor epoxide	µg/L	5.08E-02	5.40E-02	5.40E-02	5.40E-02	µg/L	Max-imum	[b]
	Naphthalene	µg/L	4.92E+00	1.60E+00	1.60E+00	1.60E+00	µg/L	Max-imum	[b]
	Pentachlorophenol	µg/L	1.07E+01	2.50E+00	2.50E+00	2.50E+00	µg/L	Max-imum	[b]
	Trichloroethene	µg/L	3.30E+00	5.80E-01	5.80E-01	5.80E-01	µg/L	Max-imum	[b]
	Aluminum	µg/L	2.60E+03	3.86E+03	2.70E+04	3.86E+03	µg/L	95% KM (BCA) UCL	[b]
	Arsenic	µg/L	3.19E+01	6.67E+00	1.50E+01	6.67E+00	µg/L	95% KM (t) UCL	[b]
	Beryllium	µg/L	3.08E+01	4.80E+00	4.80E+00	4.80E+00	µg/L	Max-imum	[b]
	Cadmium	µg/L	1.57E+01	2.75E+00	6.60E+00	2.75E+00	µg/L	95% KM (t) UCL	[b]
	Chromium	µg/L	6.20E+01	2.11E+01	9.60E+01	2.11E+01	µg/L	95% KM (t) UCL	[b]
	Cobalt	µg/L	1.69E+02	1.52E+01	3.00E+01	1.52E+01	µg/L	95% KM (t) UCL	[b]
	Copper	µg/L	8.32E+01	3.48E+01	1.60E+02	3.48E+01	µg/L	95% KM (t) UCL	[b]
	Cyanide	µg/L	1.14E+01	1.10E+01	1.40E+01	1.10E+01	µg/L	95% KM (t) UCL	[b]
	Iron	µg/L	2.26E+03	1.25E+04	2.80E+04	1.25E+04	µg/L	99% KM (Chebyshev) UCL	[b]
	Lead	µg/L	3.22E+01	4.66E+00	1.50E+01	4.66E+00	µg/L	95% KM (t) UCL	[b]
	Manganese	µg/L	2.64E+04	1.00E+05	1.20E+05	1.00E+05	µg/L	99% Chebyshev (Mean, Sd) UCL	[b]
	Mercury	µg/L	1.92E-01	1.54E-01	9.10E-01	1.54E-01	µg/L	95% KM (t) UCL	[b]
	Molybdenum	µg/L	2.86E+02	2.00E+02	2.00E+02	2.00E+02	µg/L	Max-imum	[b]
	Nickel	µg/L	1.65E+02	4.83E+01	2.40E+02	4.83E+01	µg/L	95% GROS Adjusted Gamma UCL	[b]
	Selenium	µg/L	1.09E+02	3.44E+01	6.80E+01	3.44E+01	µg/L	95% KM (Percentile Bootstrap) UCL	[b]
	Strontium	µg/L	2.08E+03	8.60E+03	8.60E+03	8.60E+03	µg/L	Max-imum	[b]
	Thallium	µg/L	2.68E+01	1.74E+01	9.80E+01	1.74E+01	µg/L	95% KM (t) UCL	[b]
	Vanadium	µg/L	1.82E+02	2.80E+01	2.80E+01	2.80E+01	µg/L	Max-imum	[b]
	Zinc	µg/L	2.55E+02	1.24E+02	6.10E+02	1.24E+02	µg/L	95% KM (t) UCL	[b]

NC = Not calculated

[a] If nondetect, are presented for a COPC, the average concentration is derived using ProUCL estimation methods, i.e. regression on order statistics (ROS) and Kaplan-Meier (KM). These estimations are then used in order to calculate an appropriate UCL.

[b] Maximum detected concentration used as the EPC in cases where total sample were less than or equal to 5 and or there were less than 4 detects. If the sample size was sufficient, the ProUCL recommendation was used.

Table 16
Exposure Point Concentration Summary - Fish Tissue
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish Tissue

Exposure Point	Contaminant of Potential Concern	Units	Average Concentration[a]	95% UCL	Maximum Concentration	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Knob Creek - Carp	2,3,7,8-TCDD TEQ	mg/kg	1.42E-06	NC	2.10E-06	2.10E-06	mg/kg	Maximum	[b]
	PCB Dioxin-like Congener TEQ	mg/kg	3.00E-05	NC	4.60E-05	4.60E-05	mg/kg	Maximum	[b]
	PCB-1260	mg/kg	1.15E+00	NC	1.80E+00	1.80E+00	mg/kg	Maximum	[b]
	Arsenic	mg/kg	5.25E-02	NC	5.50E-02	5.50E-02	mg/kg	Maximum	[b]
	Chromium	mg/kg	3.23E-01	NC	9.50E-01	9.50E-01	mg/kg	Maximum	[b]
	Lead	mg/kg	3.61E-01	NC	6.30E-02	6.30E-02	mg/kg	Maximum	[b]
Knob Creek - Largemouth Bass	2,3,7,8-TCDD TEQ	mg/kg	5.00E-07	NC	5.90E-07	5.90E-07	mg/kg	Maximum	[b]
	PCB Dioxin-like Congener TEQ	mg/kg	3.25E-06	NC	3.50E-06	3.50E-06	mg/kg	Maximum	[b]
	PCB-1260	mg/kg	8.05E-02	NC	1.20E-01	1.20E-01	mg/kg	Maximum	[b]
	Chromium	mg/kg	2.22E-01	NC	6.70E-01	6.70E-01	mg/kg	Maximum	[b]
	Mercury	mg/kg	1.56E-01	NC	2.90E-01	2.90E-01	mg/kg	Maximum	[b]
Knob Creek - All Species	2,3,7,8-TCDD TEQ	mg/kg	9.60E-07	NC	2.10E-06	2.10E-06	mg/kg	Maximum	[b]
	PCB Dioxin-like Congener TEQ	mg/kg	1.66E-05	NC	4.60E-05	4.60E-05	mg/kg	Maximum	[b]
	PCB-1260	mg/kg	6.13E-01	NC	1.80E+00	1.80E+00	mg/kg	Maximum	[b]
	Arsenic	mg/kg	5.06E-01	NC	5.50E-02	5.50E-02	mg/kg	Maximum	[b]
	Chromium	mg/kg	2.72E-01	4.86E-01	9.50E-01	4.86E-01	mg/kg	95% KM (t) UCL	[b]
	Lead	mg/kg	2.05E-01	NC	6.30E-02	6.30E-02	mg/kg	Maximum	[b]
	Mercury	mg/kg	1.61E-01	1.65E-01	2.90E-01	1.65E-01	mg/kg	95% KM (t) UCL	[b]

NC = Not Calculated

[a] If nondetects are present for a COPC, the average concentration is derived using ProUCL estimation methods (i.e., regression on order [ROS] and Kaplan-Meier [KM]). These estimations are then used in order to calculate an appropriate UCL.

[b] Maximum detected concentration used as the EPC in instances where total samples were less than or equal to 8 and/or there were less than 4 detects. If the sample size was sufficient, the ProUCL recommendation was used.

Table 17
Exposure Point Concentration Summary - Soil Gas
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Air
Exposure Medium: Soil Gas

Exposure Point	Contaminant of Potential Concern	Units	Average Concentration[a]	95% UCL	Maximum Concentration	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Site	1,1-Dichloroethane	µg/m3	154	1.80E+03	1800	1.80E+03	µg/m3	Maximum	[b]
	1,2,4-Trimethylbenzene	µg/m3	116	2.19E+01	56	2.19E+01	µg/m3	95% KM (Percentile Bootstrap) UCL	[b]
	1,2-Dichloroethane	µg/m3	313	3.80E+03	3800	3.80E+03	µg/m3	Maximum	[b]
	Benzene	µg/m3	79	2.10E+01	56	2.10E+01	µg/m3	95% KM (t) UCL	[b]
	Chloroform	µg/m3	109	1.20E+01	12	1.20E+01	µg/m3	Maximum	[b]
	Chloromethane	µg/m3	846	1.00E+04	10000	1.00E+04	µg/m3	Maximum	[b]
	Ethylbenzene	µg/m3	106	3.18E+01	130	3.18E+01	µg/m3	95% KM (t) UCL	[b]

NC = Not calculated

[a] If nondetects are present for a COPC, the average concentration is derived using ProUCL estimation methods (regression on order [ROS] and Kaplan-Meier [KM]). These estimations are then used in order to calculate an appropriate UCL.

[b] Maximum detected concentration used as the EPC in instances where total samples were less than or equal to 8 and/or there were less than 4 detects. If the sample size was sufficient, the ProUCL recommendation was used.

Table 18
Soil Contact Exposure Parameters - On-Site Worker
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	On-Site Worker	adult	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 15	COPC Specific	See Table 15	Chronic daily intake (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 2014	100	EPA, 2014	EPC x IR-S x CF x FI x EF x ED x 1/BW x 1/AT
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5	Professional judgment	
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	
				ED	Exposure Duration	years	25	EPA, 2014	12	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	9,125	ED x 365 days/year	4,380	ED x 365 days/year	
Dermal Contact	On-Site Worker	adult	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 15	COPC Specific	See Table 15	Dermally absorbed Dose (mg/kg-day) =
				SA	Exposed Skin Surface Area	cm²/day	3,470	EPA, 2014	3,470	EPA, 2014	EPC x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				AF	Soil to Skin Adherence Factor	mg/cm²	0.12	EPA, 2014	0.012	EPA, 2004	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	
				ED	Exposure Duration	years	25	EPA, 2014	12	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	9,125	ED x 365 days/year	4,380	ED x 365 days/year	
Inhalation	On-Site Worker	adult	Particulate Volatiles Released from Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 15	COPC Specific	See Table 15	Average Daily Concentration (µg/m³) =
				PEF	Particulate Emission Factor from Soil	m³/kg	2.7E+09	Based on Climate Zone 11	2.7E+09	Based on Climate Zone 11	CA x ET x EF x ED x CF2 / AT
				VF	Volatilization Factor	m³/kg	COPC Specific	EPA, 2002a	COPC Specific	EPA, 2002a	
				CA	Chemical Concentration in air	µg/m³	Calculated	EPA, 2002	Calculated	EPA, 2002	
				ET	Exposure Time	hours/day	8	EPA, 2014	4	Professional judgment	where
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	CA (µg/m³) = (EPC / PEF) x CF1
				ED	Exposure Duration	years	25	EPA, 2014	12	Professional judgment	or
				CF2	Conversion Factor 2	day/hour	0.042	Unit Conversion Factor	0.042	Unit Conversion Factor	CA (µg/m³) = (EPC / VF) x CF1
				CF1	Conversion Factor 1	µg/mg	1.00E+03	Unit Conversion Factor	1.00E+03	Unit Conversion Factor	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	9,125	ED x 365 days/year	4,380	ED x 365 days/year	

Table 19
Groundwater Exposure Parameters - On-Site Worker
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	On-Site Worker	Adult	Tap Water	EPC	Exposure Point Concentration	µg/L	COPC-specific	See Table 17	COPC-specific	See Table 17	Chronic daily intake (CDI) (mg/kg-day) =
				IRW	Ingestion Rate of Water	L/day	2.5	EPA, 2014	2.5	EPA, 2014	EPC x IRW x CF x FI x EF x ED x 1/BW x 1/AT
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5	Professional judgment	
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	
				ED	Exposure Duration	years	25	EPA, 2014	12	Professional judgment	
				CF	Conversion Factor	mg/µg	1.00E-03	Unit Conversion Factor	1.00E-03	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-c	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-nc	Averaging Time (Non-Cancer)	days	9,125	ED x 365 days/year	4,380	ED x 365 days/year	

Table 20
Indoor Air Exposure Parameters - On-Site Worker
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Soil Gas

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Inhalation	On-Site Worker	Adult	Indoor Air	CA	COPC Air Concentration	µg/m³	Calculated	See Appendix C	Calculated	See Appendix C	Average Daily Concentration (µg/m³) =
				CF	Conversion Factor	days/yr	6.94E-04	Unit Conversion Factor	6.94E-04	Unit Conversion Factor	CA x ET x EF x ED x CF / AT
				ET	Exposure Time	hours/day	8	EPA, 2014	4	Professional judgment	
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	EPA, 2014	
				ED	Exposure Duration	years	25	EPA, 2014	12	Professional judgment	
				ATc	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				ATnc	Averaging Time (Non-Cancer)	days	9,125	ED x 365 days/year	4,380	ED x 365 days/year	

Table 21
Soil Contact Exposure Parameters - Trespasser
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Trespasser	Adolescent (7 through 16 years)	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Chronic Daily Intake (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA, 2004	100	EPA, 2004	EPC x IR-S x CF x FI x ED x EF / BW x 1/AT
				FI	Fraction Ingested	unitless	1	Professional Judgment	0.5	Professional Judgment	
				EF	Exposure Frequency	days/year	104	Professional Judgment	52	Professional Judgment	
				ED	Exposure Duration	years	10	Calculated based on adolescent/adult age	10	Calculated based on adolescent/adult age	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	45	EPA, 2004	45	EPA, 2004	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	5,670	ED x 365 days/year	5,670	ED x 365 days/year	
Dermal Contact	Trespasser	Adolescent (7 through 16 years)	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Dermally Absorbed Dose (mg/kg-day) =
				SA	Exposed Skin Surface Area	cm²/day	5,000	EPA, 2004	5,000	EPA, 2004	EPC x CF x SA x AF x ABS x EF x ED / BW x 1/AT
				AF	Soil to Skin Adherence Factor	mg/cm²	0.07	EPA, 2004	0.01	EPA, 2004	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				EF	Exposure Frequency	days/year	104	Professional Judgment	52	Professional Judgment	
				ED	Exposure Duration	years	10	Calculated based on adolescent/adult age	10	Calculated based on adolescent/adult age	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	45	EPA, 2004	45	EPA, 2004	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	5,670	ED x 365 days/year	5,670	ED x 365 days/year	
Inhalation	Trespasser	Adolescent (7 through 16 years)	Particulate Volatiles Released from Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Average Daily Concentration (µg/m³) =
				PEF	Particulate Emission Factor from Soil	m³/kg	5.7E+09	Based on Climate Zone 1	5.7E+09	Based on Climate Zone 1	Ca x ET x EF x ED / CF2 x AT
				VF	Volatilization Factor	m³/kg	COPC Specific	EPA, 2002a	COPC Specific	EPA, 2002a	
				Ca	Chemical Concentration in air	µg/m³	Calculated	EPA, 2002	Calculated	EPA, 2002	where
				ET	Exposure Time	hours/day	4	Professional Judgment	2	Professional Judgment	Ca (µg/m³) = (EPC / PEF) x CF1
				EF	Exposure Frequency	days/year	104	Professional Judgment	52	Professional Judgment	or
				ED	Exposure Duration	years	10	Calculated based on adolescent/adult age	10	Calculated based on adolescent/adult age	Ca (µg/m³) = (EPC / VF) x CF2
				CF2	Conversion Factor 2	days/hour	0.042	Unit Conversion Factor	0.042	Unit Conversion Factor	
				CF1	Conversion Factor 1	µg/mg	1.00E+03	Unit Conversion Factor	1.00E+03	Unit Conversion Factor	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	5,670	ED x 365 days/year	5,670	ED x 365 days/year	

Table 22
Soil Contact Exposure Parameters - Recreational User
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational User	Child	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Chronic daily intake (mg/kg-day) =
				IR	Ingestion Rate of Soil	mg/day	200	EPA, 2014	100	Professional judgment	EPC x IR x CF x FI x BioF x EF x ED / BW x 1/AT
				FI	Fraction Ingested	unitless	1	Professional judgment	0.5	Professional judgment	
				EF	Exposure Frequency	days/year	117	Professional judgment	52	Professional judgment	
				ED	Exposure Duration	years	6	Calculated based on young adult's age	6	Calculated based on young adult's age	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	15	EPA, 2014	15	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	
		Adult	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Chronic daily intake (mg/kg-day) =
				IR	Ingestion Rate of Soil	mg/day	100	EPA, 2014	50	Professional judgment	EPC x IR x CF x FI x BioF x EF x ED / BW x 1/AT
				FI	Fraction Ingested	unitless	1	Professional judgment	0.5	Professional judgment	
				BioF	Gastrointestinal Absorption Factor	unitless	1	Professional judgment	1	Professional judgment	
				EF	Exposure Frequency	days/year	117	Professional judgment	52	Professional judgment	
				ED	Exposure Duration	years	20	EPA, 2014	9	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	7,300	ED x 365 days/year	3,285	ED x 365 days/year	
Dermal Contact	Recreational User	Child	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Dermally absorbed Dose (mg/kg-day) =
				SA	Exposed Skin Surface Area	cm²/day	2,690	EPA, 2014	2,690	EPA, 2014	EPC x CF x SA x AF x ABS x EF x ED / BW x 1/AT
				AF	Soil to Skin Adherence Factor	mg/cm²	0.12	EPA, 2014	0.04	EPA, 2004	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				EF	Exposure Frequency	days/year	117	Professional judgment	52	Professional judgment	
				ED	Exposure Duration	years	6	Calculated based on young adult's age	6	Calculated based on young adult's age	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	15	EPA, 2014	15	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	
		Adult	Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1-5	COPC Specific	See Table 1-5	Dermally absorbed Dose (mg/kg-day) =
				SA	Exposed Skin Surface Area	cm²/day	6,032	EPA, 2014	6,032	EPA, 2014	EPC x CF x SA x AF x ABS x EF x ED / BW x 1/AT
				AF	Soil to Skin Adherence Factor	mg/cm²	0.07	EPA, 2004	0.01	EPA, 2004	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				EF	Exposure Frequency	days/year	117	Professional judgment	52	Professional judgment	
				ED	Exposure Duration	years	20	EPA, 2014	9	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non Cancer	days	7,300	ED x 365 days/year	3,285	ED x 365 days/year	

Table 22
Soil Contact Exposure Parameters - Recreational User
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CTE Value	CTE Rationale/Reference	Intake Equation/Model Name
Inhalation	Recreational User	Child	Particulate Volatiles Released from Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1	COPC Specific	See Table 1	Average Daily Concentration (µg/m³) =
				PEF	Particulate Emission Factor from Soil	m³/kg	5.7E+09	Based on Climate Zone 1	5.7E+09	Based on Climate Zone 1	C x ET x EF x ED x CF2 / AT
				VF	Volatilization Factor	m³/kg	COPC Specific	EPA, 2002a	COPC Specific	EPA, 2002a	
				C	Chemical Concentration in soil	µg/m³	Calculated	EPA, 2002	Calculated	EPA, 2002	where
				ET	Exposure Time	hours/day	4	Professional judgment	2	Professional judgment	C (µg/m³) = (1/PEF) x CF1
				EF	Exposure Frequency	days/year	117	Professional judgment	58	Professional judgment	or
				ED	Exposure Duration	years	6	Calculated based on young child's age	6	Calculated based on young child's age	C (µg/m³) = (1/VF) x CF1
				CF2	Conversion Factor 2	days/hour	0.042	Unit Conversion Factor	0.042	Unit Conversion Factor	
				CF1	Conversion Factor 1	µg/mg	1.00E+03	Unit Conversion Factor	1.00E+03	Unit Conversion Factor	
				AT	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	
		Adult	Particulate Volatiles Released from Surface Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 1	COPC Specific	See Table 1	Average Daily Concentration (µg/m³) =
				PEF	Particulate Emission Factor from Soil	m³/kg	5.7E+09	Based on Climate Zone 1	5.7E+09	Based on Climate Zone 1	C x ET x EF x ED x CF2 / AT
				VF	Volatilization Factor	m³/kg	COPC Specific	EPA, 2002a	COPC Specific	EPA, 2002a	
				C	Chemical Concentration in soil	µg/m³	Calculated	EPA, 2002	Calculated	EPA, 2002	where
				ET	Exposure Time	hours/day	4	Professional judgment	2	Professional judgment	C (µg/m³) = (1/PEF) x CF1
				EF	Exposure Frequency	days/year	117	Professional judgment	58	Professional judgment	or
				ED	Exposure Duration	years	20	EPA, 2004	9	Professional judgment	C (µg/m³) = (1/VF) x CF1
				CF2	Conversion Factor 2	days/hour	0.042	Unit Conversion Factor	0.042	Unit Conversion Factor	
				CF1	Conversion Factor 1	µg/mg	1.00E+03	Unit Conversion Factor	1.00E+03	Unit Conversion Factor	
				AT	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	7,300	ED x 365 days/year	3,285	ED x 365 days/year	

Table 23
Soil Contact Exposure Parameters - Construction Utility Worker
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Soils
Exposure Medium: Total Soils

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Construction/Utility Worker	Adult	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 14	COPC Specific	See Table 14	Chronic daily intake (mg/kg-day) =
				IRS	Ingestion Rate of Soil	mg/day	330	EPA, 2002	100	EPA, 2002	EPC x IRS x CF x FI x IAF x EF x ED x 1/BW x 1/AT
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5	Professional judgment	
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	
				ED	Exposure Duration	years	1	Professional judgment	1	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	365	ED x 365 days/year	365	ED x 365 days/year	
Dermal Contact	Construction/Utility Worker	Adult	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 14	COPC Specific	See Table 14	Dermally Absorbed Dose (mg/kg-day) =
				SA	Exposed Skin Surface Area	cm²/day	3,470	EPA, 2014	3,470	EPA, 2014	EPC x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				AF	Soil to Skin Adherence Factor	mg/cm²	0.3	EPA, 2004	0.1	EPA, 2004	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	
				ED	Exposure Duration	years	1	Professional judgment	1	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	365	ED x 365 days/year	365	ED x 365 days/year	
Inhalation	Construction/Utility Worker	Adult	Particulate/Volatiles Released from Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 14	COPC Specific	See Table 14	Average Daily Concentration (µg/m³) =
				PEF	Particulate Emission Factor from Soil	m³/kg	5.7E+09	Based on Climate Zone VI	5.7E+09	Based on Climate Zone VI	(CA x ET x EF x ED x CF2) / AT
				VF	Volatilization Factor	m³/kg	COPC Specific	EPA, 2013a	COPC Specific	EPA, 2013a	
				CA	Chemical Concentration in Air	µg/m³	Calculated	EPA, 2002	Calculated	EPA, 2002	where
				ET	Exposure Time	hours/day	8	EPA, 2014	4	Professional judgment	CA (µg/m³) = (EPC/PEF) x CF3
				EF	Exposure Frequency	days/year	250	EPA, 2014	125	Professional judgment	or
				ED	Exposure Duration	years	1	Professional judgment	1	Professional judgment	CA (µg/m³) = (EPC/VF) x CF3
				CF2	Conversion Factor 2	days/hour	0.042	Unit Conversion Factor	0.042	Unit Conversion Factor	
				CF3	Conversion Factor 3	µg/mg	1.00E+03	Unit Conversion Factor	1.00E+03	Unit Conversion Factor	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time (Non-Cancer)	days	365	ED x 365 days/year	365	ED x 365 days/year	

Table 24
Soil Contact Exposure Parameters - Hypothetical Future Resident
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Child/adult (Carcino)	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC specific	See Table 14	COPC specific	See Table 14	Chronic daily intake (CDI) (mg/kg-day) =
				IFS_{adj}	age adjusted soil ingestion factor	mg-year/kg-day	10^6	Calculated	91.25^6	Calculated	EPC x IFS_{adj} x CF x FI x EF x ED / BW x AT
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5^7	Professional judgment	Where
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2002	IFS_{adj} = (IFS_c x ED_c / BW_c) + (IFS_a x ED_a / BW_a)
				ED_c	Exposure Duration - child	years	6	EPA, 2014	6	EPA, 2002	
				ED_a	Exposure Duration - adult	years	20	EPA, 2014	9	Professional judgment	
				IFS_c	Ingestion Rate of Soil - child	mg/day	200	EPA, 2014	200	EPA, 2014	
				IFS_a	Ingestion Rate of Soil - adult	mg/day	100	EPA, 2014	100	EPA, 2014	
				BW	Body Weight - child	kg	15	EPA, 2014	15	EPA, 2014	
				BW_a	Body Weight - adult	kg	80	EPA, 2014	80	EPA, 2014	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				AT	Averaging Time (Carcino)	days	25,550	EPA, 1989	25,550	EPA, 1989	
		Child (Hazard Index)	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC specific	See Table 14	COPC specific	See Table 14	Chronic daily intake (CDI) (mg/kg-day) =
				IFS	Ingestion Rate of Soil	mg/day	200	EPA, 2014	200	EPA, 2014	EPC x IFS x CF x FI x EF x ED / BW x AT
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5^7	Professional judgment	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	6	EPA, 2014	6	EPA, 2014	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	15	EPA, 2014	15	EPA, 2014	
				AT	Averaging Time (Haz Index)	days	2,190	ED x 365^7 days/year	2,190	ED x 365^7 days/year	
		Adult (Hazard Index)	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC specific	See Table 14	COPC specific	See Table 14	Chronic daily intake (CDI) (mg/kg-day) =
				IFS	Ingestion Rate of Soil	mg/day	100	EPA, 2014	100	EPA, 2014	EPC x IFS x CF x FI x EF x ED / BW x AT
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5^7	Professional judgment	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	20	EPA, 2014	9	Professional judgment	
				CF	Conversion Factor	kg/mg	1.00E-06	Unit Conversion Factor	1.00E-06	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT	Averaging Time (Haz Index)	days	7,300	ED x 365^7 days/year	$3,285^7$	ED x 365^7 days/year	
Dermal Contact	Resident	Child/adult (Carcino)	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC specific	See Table 14	COPC specific	See Table 14	Chronic daily intake (CDI) (mg/kg-day) =
				SFS_{adj}	age adjusted skin contact factor	mg-year/kg-day	2.5^7	Calculated	5^7	Calculated	EPC x SFS_{adj} x CF x EF x ABS_d / BW x AT
				SA_c	Skin Surface area available for Contact	cm^2/day	2,690	EPA, 2014	2,690	EPA, 2014	Where
				SA_a	Skin Surface area available for Contact	cm^2/day	6,032	EPA, 2014	6,032	EPA, 2014	SFS_{adj} = (SA_c x AF_c x ED_c / BW_c) + (SA_a x AF_a x ED_a / BW_a)
				AF_c	Soil to Skin adherence Factor - child	mg/cm^2	0.12	EPA, 2014	0.04	EPA, 2004	
				AF_a	Soil to Skin adherence Factor - adult	mg/cm^2	0.07	EPA, 2014	0.01	EPA, 2004	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED_c	Exposure Duration - child	years	6	EPA, 2014	6	EPA, 2014	
				ED_a	Exposure Duration - adult	years	20	EPA, 2014	9	Professional judgment	
				BW	Body Weight - child	kg	15	EPA, 2014	15	EPA, 2014	
				BW_a	Body Weight - adult	kg	80	EPA, 2014	80	EPA, 2014	
				AT	Averaging Time (Carcino)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				CF_1	Conversion Factor	kg/mg	1.0E-06	Unit Conversion Factor	1.0E-06	Unit Conversion Factor	
				ABS_d	Dermal Absorption Factor	unitless	COPC specific	EPA, 2004	COPC specific	EPA, 2004	

Table 24
Soil Contact Exposure Parameters - Hypothetical Future Resident
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Total Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Dermal Contact (continued)	Residents (continued)	Child (0 to 6 years)	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 14	COPC Specific	See Table 14	Chronic Daily Intake (CDI) (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	cm²/day	2,690	EPA, 2014	2,690	EPA, 2014	EPC x SA x AF x CF x EF x ED x ABS x 1/BW x 1/AT$_{nc}$
				AF	Soil to Skin Adherence Factor	mg/cm²	0.2	EPA, 2014	0.04	EPA, 2004	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	6	EPA, 2014	6	EPA, 2014	
				BW	Body Weight	kg	15	EPA, 2014	15	EPA, 2014	
				AT$_{nc}$	Averaging Time (Non-Cancer)	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				CF$_1$	Conversion Factor	mg/µg	1.0E-06	Unit Conversion Factor	1.0E-06	Unit Conversion Factor	
		Adult (16 to 30 years)	Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 14	COPC Specific	See Table 14	Chronic Daily Intake (CDI) (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	cm²/day	6,032	EPA, 2014	6,032	EPA, 2004	EPC x SA x AF x CF x EF x ED x ABS x 1/BW x 1/AT$_{nc}$
				AF	Soil to Skin Adherence Factor	mg/cm²	0.07	EPA, 2014	0.01	EPA, 2004	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	20	EPA, 2014	9	Professional Judgment	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT$_{nc}$	Averaging Time (Non-Cancer)	days	7,300	ED x 365 days/year	3,285	ED x 365 days/year	
				ABS	Dermal Absorption Factor	unitless	COPC Specific	EPA, 2004	COPC Specific	EPA, 2004	
				CF$_1$	Conversion Factor	mg/µg	1.0E-06	Unit Conversion Factor	1.0E-06	Unit Conversion Factor	
Inhalation	Residents	Child/Adult	Particulate Volatiles Released from Total Soil	EPC	Exposure Point Concentration	mg/kg	COPC Specific	See Table 14	COPC Specific	See Table 14	Average Daily Concentration (µg/m³) =
				Cair	COPC Air Concentration	µg/m³	Calculated	Calculated	Calculated	Calculated	Cair x ET x EF x ED x CF2 / AT
				ET	Exposure Time	hours/day	24	EPA, 2014	16	Professional Judgment	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	where
				ED	Exposure Duration	years	26	EPA, 2014	15	Professional Judgment	Cair (µg/m³) = (EPC / PEF) x CF$_3$
				CF$_2$	Conversion Factor 2	days/hour	0.042	Unit Conversion Factor	0.042	Unit Conversion Factor	or
				CF$_3$	Conversion Factor 3	µg/mg	1,000	Unit Conversion Factor	1,000	Unit Conversion Factor	Cair (µg/m³) = (EPC / VF) x CF$_3$
				PEF	Particulate Emission Factor from Soil	m³/kg	5.7E+09	Based on Climate Zone 3	5.7E+09	Based on Climate Zone 3	
				VF	Volatilization Factor	m³/kg	COPC Specific	EPA, 2013a	COPC Specific	EPA, 2013a	
				AT$_c$	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT$_{nc}$	Averaging Time (Non-Cancer)	days	9,490	ED x 365 days/year	4,745	ED x 365 days/year	

Table 25
Groundwater Exposure Parameters - Hypothetical Future Resident
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale Reference	CTE Value	CTE Rationale Reference	Intake Equation Model Name
Ingestion	Residents	Child/Adult (Cancer)	Tap Water	EPC	Exposure Point Concentration	µg/L	COPC specific	See Table 15	COPC specific	See Table 15	Chronic daily intake (CDI) (mg/kg-day) =
				IFW_{adj}	Age-adjusted water ingestion factor	L-year/kg-day	0.9	Calculated	0.59	Calculated	EPC x IFW_{adj} x CF x FI x EF x 1/AT_C
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5	Professional judgment	Where
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	IFW_{adj} = (IFW_c x ED_c x 1/BW_c) + (IFW_a x ED_a x 1/BW_a)
				ED_c	Exposure Duration - child	years	6	EPA, 2014	6	EPA, 2014	
				ED_a	Exposure Duration - adult	years	20	EPA, 2014	9	Professional judgment	
				IFW_c	Ingestion Rate of Water - child	L/day	0.74	EPA, 2014	0.74	EPA, 2014	
				IFW_a	Ingestion Rate of Water - adult	L/day	2.5	EPA, 2014	2.5	EPA, 2014	
				BW_c	Body Weight - child	kg	15	EPA, 2014	15	EPA, 2014	
				BW_a	Body Weight - adult	kg	80	EPA, 2014	80	EPA, 2014	
				CF	Conversion Factor	mg/µg	1.00E-03	Unit Conversion Factor	1.00E-03	Unit Conversion Factor	
				AT_C	Averaging Time (Cancer)	days	25,550	EPA, 1989	25,550	EPA, 1989	
		Child (Noncancer)	Tap Water	EPC	Exposure Point Concentration	µg/L	COPC specific	See Table 15	COPC specific	See Table 15	Chronic daily intake (CDI) (mg/kg-day) =
				IFW	Ingestion Rate of Water	L/day	0.74	EPA, 2014	0.74	EPA, 2014	EPC x IFW x CF x FI x EF x ED x 1/BW x 1/AT_{NC}
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5	Professional judgment	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	6	EPA, 2014	6	EPA, 2014	
				CF	Conversion Factor	mg/µg	1.00E-03	Unit Conversion Factor	1.00E-03	Unit Conversion Factor	
				BW	Body Weight	kg	15	EPA, 2014	15	EPA, 2014	
				AT_{NC}	Averaging Time (Non-Cancer)	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	
		Adult (Noncancer)	Tap Water	EPC	Exposure Point Concentration	µg/L	COPC specific	See Table 15	COPC specific	See Table 15	Chronic daily intake (CDI) (mg/kg-day) =
				IFW	Ingestion Rate of Water	L/day	2.5	EPA, 2014	2.5	EPA, 2014	EPC x IFW x CF x FI x EF x ED x 1/BW x 1/AT_{NC}
				FI	Fraction Ingested	unitless	1	EPA, 1989	0.5	Professional judgment	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	20	EPA, 2014	9	Professional judgment	
				CF	Conversion Factor	mg/µg	1.00E-03	Unit Conversion Factor	1.00E-03	Unit Conversion Factor	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				AT_{NC}	Averaging Time (Non-Cancer)	days	7,300	ED x 365 days/year	3,285	ED x 365 days/year	

Table 25
Groundwater Exposure Parameters - Hypothetical Future Resident
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CTE Value	CTE Rationale/Reference	Intake Equation/Model Name
Dermal Contact	Resident	Child/adult (Carcinogenic)	Tap Water Whole Bathing/Showering	$DA_{event\ sh}$	Absorbed Dose Per Event	mg/cm²/event	COPC-specific	See Table 27	COPC-specific	See Table 27	Dermally absorbed Dose: DA_{event} (mg/kg-day) =
				SFA_{sh}	Age adjusted Skin contact factor	event-year/cm²/kg-day	7.7E+05	Calculated	4.90E+05	Calculated	$DA_{event\ sh} \times SFA_{sh} \times EF \times 1/AT_c$
				SA	Skin Surface area available for Contact	cm²	6,378	EPA, 2004	6,378	EPA, 2004	
				SA_a	Skin Surface area available for Contact	cm²	20,900	EPA, 2004	20,900	EPA, 2004	$SFA_{sh} = (SA_c \times ET_c \times ED_c \times 1/BW_c) + (SA_a \times ET_a \times ED_a \times 1/BW_a)$
				ET_c	Event Frequency - child	event/day	1	EPA, 2004	1	EPA, 2004	Dermal Calculations:
				ET_a	Event Frequency - adult	event/day	1	EPA, 2004	1	EPA, 2004	$t_{event\ sh} = (ED_c \times t_{event_c}) + (ED_a \times t_{event_a}) / (ED_c + ED_a)$
				EF	Exposure Frequency	days/year	350	EPA, 2004	350	EPA, 2004	
				ED_c	Exposure Duration - child	years	6	EPA, 2004	6	EPA, 2004	if $t_{event\ sh} \le t^*$, then $DA_{event\ sh}$ (Organics) =
				ED_a	Exposure Duration - adult	years	20	EPA, 2004	9	Professional judgment	$2 \times FA \times K_p \times C_w \times CF_1 \times CF_2 \times \sqrt{6\tau_{event} \times t_{event\ sh}/\pi}$
				BW	Body Weight - child	kg	15	EPA, 2004	15	EPA, 2004	
				BW_a	Body Weight - adult	kg	80	EPA, 2004	80	EPA, 2004	otherwise if $t_{event\ sh} > t^*$, then $DA_{event\ sh}$ (Organics) =
				AT_c	Averaging Time (Carcinogenic)	days	25,550	EPA, 1989	25,550	EPA, 1989	$FA \times K_p \times C_w \times CF_1 \times CF_2 \times$
				$t_{event\ sh}$	Age adjusted event duration	hr/event	0.67	Calculated	0.55	Calculated	$[\tau_{event\ sh}/(1+B)] + 2\tau_{event}(1 + 3B + 3B^2)/(1+B)^2$
				t_{event_c}	Event Duration - child	hr/event	0.54	EPA, 2004	0.27	Professional judgment	
				t_{event_a}	Event Duration - adult	hr/event	0.71	EPA, 2004	0.56	Professional judgment	
				FA	Fraction absorbed Water	unitless	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	$DA_{event\ sh}$ (Inorganics) =
				K_p	Dermal Permeability Coefficient	cm/hour	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	$K_p \times C_w \times CF_1 \times CF_2 \times t_{event\ sh}$
				C_w	Chemical Concentration in Water	µg/L	COPC-specific	See Table 17	COPC-specific	See Table 17	
				CF_1	Conversion Factor	mg/µg	1.0E-03	Unit Conversion Factor	1.0E-03	Unit Conversion Factor	
				CF_2	Conversion Factor	L/cm³	1.0E-03	Unit Conversion Factor	1.0E-03	Unit Conversion Factor	
				B	Ratio of Permeability Coefficient	unitless	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				t^*	Time to Reach Steady State	hour	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				t_{event}	Lag Time Per Event	hr/event	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
		Child (Noncarcinogenic)	Tap Water Whole Bathing	DA_{event}	Absorbed Dose Per Event	mg/cm²/event	COPC-specific	See Table 27	COPC-specific	See Table 27	Dermally absorbed Dose: DA_{event} (mg/kg-day) =
				SA	Skin Surface area available for Contact	cm²	6,378	EPA, 2004	6,378	EPA, 2004	
				ET	Event Frequency	event/day	1	EPA, 2004	1	EPA, 2004	$DA_{event} \times ET \times SA \times EF \times ED \times 1/BW \times 1/AT_{nc}$
				EF	Exposure Frequency	days/year	350	EPA, 2004	350	EPA, 2004	
				ED	Exposure Duration	years	6	EPA, 2004	6	EPA, 2004	DA_{event} Calculations:
				BW	Body Weight	kg	15	EPA, 2004	15	EPA, 2004	if $t_{event} \le t^*$, then DA_{event} (Organics) =
				AT_{nc}	Averaging Time (Non Carcinogenic)	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	$2 \times FA \times K_p \times C_w \times CF_1 \times CF_2 \times \sqrt{6\tau_{event} \times t_{event}/\pi}$
				FA	Fraction absorbed Water	unitless	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				K_p	Dermal Permeability Coefficient	cm/hour	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	otherwise if $t_{event} > t^*$, then DA_{event} (Organics) =
				C_w	Chemical Concentration in Water	µg/L	COPC-specific	See Table 17	COPC-specific	See Table 17	$FA \times K_p \times C_w \times CF_1 \times CF_2 \times$
				CF_1	Conversion Factor	mg/µg	1.0E-03	Unit Conversion Factor	1.0E-03	Unit Conversion Factor	$[\tau_{event}/(1+B)] + 2\tau_{event}(1 + 3B + 3B^2)/(1+B)^2$
				CF_2	Conversion Factor	L/cm³	1.0E-03	Unit Conversion Factor	1.0E-03	Unit Conversion Factor	
				B	Ratio of Permeability Coefficient	unitless	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	DA_{event} (Inorganics) =
				t^*	Time to Reach Steady State	hour	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	$K_p \times C_w \times CF_1 \times CF_2 \times t_{event}$
				t_{event}	Lag Time Per Event	hr/event	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				t_{event}	Event Duration	hr/event	0.54	EPA, 2004	0.27	Professional judgment	

Table 25
Groundwater Exposure Parameters - Hypothetical Future Resident
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Dermal Contact (continued)	Resident (continued)	Adult (Homeowner)	Tap Water (While Showering)	$DermDOSE$	Absorbed Dose Per Event	mg/cm²/event	COPC-specific	See Table 27	COPC-specific	See Table 27	Dermally Absorbed Dose: $DermDose$ (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	cm²	20,000	EPA, 2014	20,000	EPA, 2014	$DermDOSE \times ET \times SA \times EF \times ED \times 1/BW \times 1/AvTime$
				ET	Event Frequency	event/day	1	EPA, 2004	1	EPA, 2004	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	20	EPA, 2014	9	Professional judgment	
				BW	Body Weight	kg	80	EPA, 2014	80	EPA, 2014	
				$AvTime$	Averaging Time (Non-Cancer)	days	7,300	ED x 365 days/year	3,285	ED x 365 days/year	
				Fa	Fraction Absorbed Water	unitless	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				K_p	Dermal Permeability Coefficient	cm/hour	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				C_w	Chemical Concentration in Water	µg/L	COPC-specific	See Table 17	COPC-specific	See Table 17	
				CF_1	Conversion Factor	mg/µg	1.0E-03	Unit Conversion Factor	1.0E-03	Unit Conversion Factor	
				CF_2	Conversion Factor	L/cm³	1.0E-03	Unit Conversion Factor	1.0E-03	Unit Conversion Factor	
				B	Ratio of Permeability Coefficient	unitless	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	Dermal Flux: $Flux$ (mg/cm²/hour) =
				t^*	Time to Reach Steady State	hour	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	$K_p \times C_w \times CF_1 \times CF_2 \times t_{event}$
				t_{lag}	Lag Time Per Event	hr/event	COPC-specific	EPA, 2004	COPC-specific	EPA, 2004	
				t_{event}	Event Duration	hr/event	0.71	EPA, 2004	0.26	Professional judgment	

Table 26
Indoor Air Exposure Parameters - Hypothetical Future Resident
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Soil Gas

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Child/adult	Indoor air	Ca	COPC air Concentration	µg/m³	Calculated	See appendix C	Calculated	See appendix C	average Daily Concentration (µg/m³) =
				CF	Conversion Factor	dimm	6.94E-04	Unit Conversion Factor	6.94E-04	Unit Conversion Factor	Ca x ET x EF x ED x CF / aT
				ET	Exposure Time	hour/day	24	EPA, 2014	16	Professional judgment	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	26	EPA, 2014	12	Professional judgment	
				aTc	Averaging Time Carcinogen	days	25,550	EPA, 1989	25,550	EPA, 1989	
				aTnc	Averaging Time Non Carcinogen	days	9,490	ED x 365 days/year	4,475	ED x 365 days/year	

Table 27

Dermally Absorbed Dose Per Event (DA_{event}) Calculations[a] - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

COPC	EPC[b]		FA	K_p	T_{event}	B	t*	DA_{event} [a,b]	DA_{event} (mg/cm²-event)[3]	
	(µg/L)	(mg/cm)	(unitless)	(cm/hr)	(hr/event)	(unitless)	(hr)	(mg/cm²-event)	Child	Adult
Shallow										
1,2,4-Trimethylbenzene	1.70E+00	1.70E-06	1.0	5.0E-02	4.0E-01 *	4.2E+00 *	1.0E+00	2.4E-07	2.4E-07	2.1E-07
2,4-Dinitrotoluene	5.0E+00	5.0E-06	1.0	4.0E-04	1.1E+00	1.0E-02	2.0E+00	4.7E-10	4.5E-10	4.4E-10
4,4'-DDD	4.0E-02	4.0E-09	0	2.5E-01	6.6E+00	1.2E+00	2.0E+01	4.7E-12	4.5E-12	4.4E-12
Benzene	1.1E+00	1.1E-06	1.0	1.4E-02	2.0E-01	5.0E-02	7.0E-01	2.0E-10	2.7E-10	1.9E-10
bis(2-Ethylhexyl)phthalate	2.0E+01	2.0E-05	0	1.1E+00	1.0E+01	1.0E-01	4.0E+01	1.0E-04	2.4E-04	1.7E-04
Bromodichloromethane	4.0E-01	4.0E-07	1.0	4.0E-04	4E-01	2.2E-02	2.0E+00	2.7E-10	4.4E-10	2.5E-10
Bromoform	1.4E+00	1.4E-06	1.0	2.4E-04	4.0E-01	1.0E-02	7.1E-01	5.5E-10	7.1E-10	5.2E-10
Chloroform	9.0E-01	9.0E-07	1.0	9.4E-04	4.0E-01	2.7E-02	1.0E+00	9.5E-10	1.2E-09	9.2E-10
Chromium VI	1.0E+00	1.0E-06	1.0	9.7E-02	9.0E-01 *	4.0E+00 *	2.0E+01	4.9E-07	4.1E-07	4.1E-07
Cobalt	4.0E-02	4.0E-09	0	4.2E-02	1.4E+01	9.1E-02	4.5E+01	7.6E-12	9.4E-12	7.1E-12
Ethylbenzene	1.9E+00	1.9E-06	1.0	4.9E-02	4.2E-01	1.9E-01	1.0E+00	1.4E-07	1.7E-07	1.2E-07
Naphthalene	4.1E+00	4.1E-06	1.0	4.6E-02	5.5E-01	2.0E-01	1.4E+00	2.4E-07	4.0E-07	2.0E-07
Pentachlorophenol	4.0E-01	4.0E-07	0.9	1.2E-01	4.4E+00	2.4E+00	1.4E+01	1.4E-06	1.7E-06	1.2E-06
Phenol	1.5E+02	1.5E-04	1.0	4.4E-04	4.5E-01	1.0E-02	6.1E-01	9.0E-07	1.1E-06	9E-07
Tetrachloroethene	5.0E+00	5.0E-06	1.0	4.4E-02	9.0E-01	1.0E-01	2.1E+00	4.2E-07	5.1E-07	4.0E-07
Trichloroethene	1.9E+00	1.9E-06	1.0	1.0E-02	5.0E-01	5.1E-02	1.4E+00	4.0E-08	4.7E-08	4.7E-08
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	9.4E+00	9.4E-06	1.0	5.2E-02	4.0E-01	2.1E-01	1.0E+00	6.0E-07	5.2E-07	6.4E-07
Aluminum	5.0E+04	5.0E-02	...	1.0E-04	...	...	...	4.7E-05	4.0E-05	4.0E-05
Arsenic	7.9E+00	7.9E-06	...	1.0E-04	...	...	...	5.4E-09	4.2E-09	5.6E-09
Barium	1.4E+01	1.4E-05	...	1.0E-04	...	...	...	9.4E-09	7.5E-09	9.0E-09
Beryllium	1.0E+01	1.0E-05	...	1.0E-04	...	...	...	6.9E-09	5.5E-09	7.4E-09
Cadmium	2.4E+00	2.4E-06	...	1.0E-04	...	...	...	1.6E-09	1.2E-09	1.6E-09
Chromium	4.1E+01	4.1E-05	...	1.0E-04	...	...	...	2.7E-08	1.7E-08	2.2E-08
Cobalt	1.1E+01	1.1E-05	...	4.0E-04	...	...	...	4.0E-07	2.4E-07	4.2E-07
Copper	2.0E+02	2.0E-04	...	1.0E-04	...	...	...	1.3E-07	1.5E-07	1.0E-07
Cyanide	1.0E+01	1.0E-05	...	1.0E-04	...	...	...	7.1E-09	5.7E-09	7.5E-09
Iron	2.5E+04	2.5E-02	...	1.0E-04	...	...	...	1.7E-06	1.4E-06	1.0E-06
Lead	1.4E+01	1.4E-05	...	1.0E-04	...	...	...	1.0E-10	1.0E-10	1.0E-10
Magnesium	9.9E+04	9.9E-02	...	1.0E-04	...	...	...	4.0E-05	4.7E-05	4.0E-05
Manganese	9.9E+00	9.9E-06	...	1.0E-04	...	...	...	4.0E-09	4.7E-09	4.0E-09
Molybdenum	1.2E+02	1.2E-04	...	1.0E-04	...	...	...	8.4E-10	9.4E-10	5.2E-10
Nickel	7.5E+02	7.5E-04	...	2.0E-04	...	...	...	1.0E-07	1.0E-09	1.0E-07
Selenium	1.7E+01	1.7E-05	...	1.0E-04	...	...	...	1.1E-09	9.4E-09	1.2E-09
Silver	1.0E+01	1.0E-05	...	1.0E-04	...	...	...	1.2E-09	9.7E-09	1.2E-09
Thallium	2.2E+01	2.2E-05	...	1.0E-04	...	...	...	1.5E-09	1.2E-09	1.6E-09
Vanadium	2.0E+01	2.0E-05	...	1.0E-04	...	...	...	1.5E-09	1.2E-09	1.6E-09
Zinc	2.4E+04	2.4E-02	...	6.0E-04	...	...	...	9.4E-06	7.5E-06	9.0E-06
Deep										
1,2-Dichlorobenzene	1.2E+00	1.2E-06	1.0	4.2E-04	4.2E-01	1.0E-01	9.1E-01	7.0E-09	9.0E-09	6.5E-09
2,4-Dinitrotoluene	1.2E+01	1.2E-05	1.0	4.0E-04	1.1E+00	1.0E-02	2.0E+00	9.4E-10	1.1E-07	4E-10
2,6-Dinitrotoluene	4.0E+00	4.0E-06	1.0	4.0E-04	1.1E+00	1.0E-02	2.0E+00	4.1E-10	5.0E-10	4.4E-10
Benzene	6.1E-01	6.1E-07	1.0	1.4E-02	2.0E-01	5.0E-02	7.0E-01	1.5E-10	2.1E-10	1.4E-10
bis(2-Ethylhexyl)phthalate	6.7E+01	6.7E-05	0	1.1E+00	1.0E+01	1.0E-01	4.0E+01	5.5E-04	6.4E-04	5.2E-04
Bromodichloromethane	2.0E+00	2.0E-06	1.0	2.4E-04	4.0E-01	1.0E-02	7.1E-01	1.1E-10	1.4E-10	1.0E-10
Chloroform	2.0E+00	2.0E-06	1.0	9.4E-04	4.0E-01	2.7E-02	1.0E+00	2.1E-09	2.6E-09	2.0E-09
Dioxin	4.5E-02	4.5E-08	0	4.2E-02	1.4E+01	9.1E-02	4.5E+01	7.4E-12	9.5E-12	7.4E-12
Hexachlorobenzene	5.4E-02	5.4E-08	0	2.0E-02	1.5E+01 *	6.0E-02 *	4.2E+01	9.0E-12	9.5E-12	7.5E-12
Naphthalene	1.0E+00	1.0E-06	1.0	4.0E-02	5.5E-01	2.0E-01	1.4E+00	1.2E-07	1.5E-07	1.1E-07
Pentachlorophenol	2.5E+00	2.5E-06	0.9	1.2E-01	4.4E+00	2.4E+00	1.4E+01	1.1E-06	1.4E-06	1.0E-06
Trichloroethene	5.0E-01	5.0E-07	1.0	1.0E-02	5.0E-01	5.1E-02	1.4E+00	1.1E-08	1.4E-08	1.0E-08
Aluminum	4.0E+04	4.0E-02	...	1.0E-04	...	...	...	2.5E-05	2.0E-05	2.4E-05

Table 27

Dermally Absorbed Dose Per Event (DA_{event}) Calculations[a] - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

COPC	EPC[b]		FA	K_p	τ_{event}	B	t[c]	$DA_{event\ adj}$	DA_{event} (mg/cm²-event)[d]	
	(µg/L)	(mg/cm²)	(unitless)	(cm/hr)	(hr/event)	(unitless)	(hr)	(mg/cm²-event)	Child	Adult
Arsenic	6.67E+00	6.67E-06	...	1.00E-03	...	...	...	4.47E-09	3.60E-09	4.74E-09
Beryllium	4.00E+00	4.00E-06	...	1.00E-03	...	...	...	3.22E-09	2.59E-09	3.41E-09
Cadmium	2.75E+00	2.75E-06	...	1.00E-03	...	...	...	1.94E-09	1.49E-09	1.95E-09
Chromium	2.11E+01	2.11E-05	...	1.00E-03	...	...	...	1.41E-09	1.14E-09	1.50E-09
Cobalt	1.52E+01	1.52E-05	...	4.00E-04	...	...	...	4.07E-09	3.20E-09	4.31E-09
Copper	3.40E+01	3.40E-05	...	1.00E-03	...	...	...	2.33E-09	1.[illegible]E-09	2.47E-09
Cyanide	1.10E+01	1.10E-05	...	1.00E-03	...	...	...	7.37E-09	5.94E-09	7.[illegible]1E-09
Iron	1.25E+04	1.25E-02	...	1.00E-03	...	...	...	[illegible]41E-06	6.7[illegible]E-06	[illegible]91E-06
Lead	4.66E+00	4.66E-06	...	1.00E-04	...	...	...	3.12E-10	2.52E-10	3.31E-10
Manganese	1.00E+05	1.00E-01	...	1.00E-03	...	...	...	6.73E-05	5.42E-05	7.13E-05
Mercury	1.54E-01	1.54E-07	...	1.00E-03	...	...	...	1.03E-10	[illegible]32E-11	1.09E-10
Molybdenum	2.00E+02	2.00E-04	...	1.00E-03	...	...	...	1.34E-07	1.0[illegible]E-07	1.42E-07
Nickel	4.[illegible]3E+01	4.[illegible]3E-05	...	2.00E-04	...	...	...	6.47E-09	5.22E-09	6.[illegible]6E-09
Selenium	3.44E+01	3.44E-05	...	1.00E-03	...	...	...	2.31E-09	1.[illegible]6E-09	2.44E-09
Strontium	[illegible]60E+03	[illegible]60E-03	...	1.00E-03	...	...	...	5.76E-06	4.64E-06	6.11E-06
Thallium	1.74E+01	1.74E-05	...	1.00E-03	...	...	...	1.17E-09	9.41E-09	1.24E-09
Vanadium	2.[illegible]0E+01	2.[illegible]0E-05	...	1.00E-03	...	...	...	1.[illegible]E-09	1.51E-09	1.99E-09
Zinc	1.24E+02	1.24E-04	...	6.00E-04	...	...	...	4.9[illegible]E-09	4.01E-09	5.2[illegible]E-09

[a] EPA 2004
[b] See Table 15
[c] Event was age-adjusted assuming event of 0.54 for 6 years and event 0.71 for 20 years. Adjusted value equals 0.67
[d] Calculated based on Equation 3.2 or 3.3 for organics and Equation 3.4 for inorganics in EPA 2004 where τ_{event} equals 0.54 for children and 0.71 for adults
[e] Calculated based on Equation A.4 in EPA 2004
[f] Calculated based on Equation A.1 in EPA 2004

E = Ratio of the permeability coefficient of a COPC through the stratum corneum relative to its permeability coefficient across the viable epidermis
FA = Fraction absorbed
K_p = Dermal permeability coefficient
NA = Not applicable
τ_{event} = Lag time per event
t[c] = Time to reach steady state

Table 28

Inhalation Exposure Per Shower (E)
Smokey Mountain Smelters, Knoxville, Tennessee

$$E = \frac{VR \times S}{BW \times R \times 10^6} \times \frac{D_S + \exp(-R \times D_T)}{R - \frac{\exp[R \times (D_S - D_T)]}{R}}$$

Parameter	Definition	Value	Reference
E	Inhalation exposure per shower (mg/m^3).		
VR	Ventilation rate (L/minute).	15	Foster and Chrostowski, 1987
S	Indoor VOC generation rate (µg/m^3-minute).	Calculated	See Table 29
BW	Body weight (kg).	80	EPA, 2014
R	Air exchange rate (minute^{-1}).	90	Foster and Chrostowski, 1987; upper-bound value
CF	Conversion factor.	10^6	Foster and Chrostowski, 1987
Ds	Shower duration (minute).	34.8	EPA, 1997; RME value
Dt	Total duration in shower room (minute).	60	Professional judgment

Table 29

Indoor VOC Generation Rate (S)
Smokey Mountain Smelters, Knoxville, Tennessee

$$S = \frac{C_{WD} \times FR}{SV}$$

Parameter	Definition	Value	Reference
S	Indoor VOC generation rate (µg/m^3-minute).		
C_{WD}	Concentration leaving shower droplet after time t_s (µg/L).	Calculated	See Table 30
FR	Indoor shower water flow rate (L/minute).	10	Foster and Chrostowski, 1987
SV	Shower room air volume (m^3).	12	Professional Judgement

Table 30

Concentration Leaving Shower Droplet After Time T_S (C_{WD})
Smokey Mountain Smelters, Knoxville, Tennessee

$$C_{WD} = C_{WO} \times \left(1 - \exp\left(-\frac{K_{aL} \times t_s}{60 \times d}\right)\right)$$

Parameter	Definition	Value	Reference
C_{WD}	Concentration leaving shower droplet after time t_s (µg/L).		
C_{WO}	Shower water concentration (µg/L).	COPC-Specific	See Table 15
K_{aL}	Adjusted overall mass transfer coefficient (cm/hr).	Calculated	See Table 31
t_s	Shower droplet drop time (seconds).	0.5	Foster and Chrostowski, 2003
d	Shower droplet diameter (mm).	1	Foster and Chrostowski, 1987

Table 31

Adjusted Overall Mass Transfer Coefficient (Ka_L)
Smokey Mountain Smelters, Knoxville, Tennessee

$$K_{aL} = K_L \times \left(\frac{T_1 \times \mu_s}{T_s \times \mu_1} \right)^{-0.5}$$

Parameter	Definition	Value	Reference
Ka_L	Adjusted overall mass transfer coefficient (cm/hr).		
K_L	Overall mass transfer coeeficient (cm/hr).	Calculated	See Table 32
T_1	Calibration water temperature of K_L (K).	293	Foster and Chrostowski, 1987
μ_s	Water viscosity at T_s (cp).	0.59	Foster and Chrostowski, 1987
T_s	Shower water temperature (K).	318	Foster and Chrostowski, 1987; upper-bound value
μ_1	Water viscosity at T_1 (cp).	1.002	Foster and Chrostowski, 2003

Table 32

Overall Mass Transfer Coefficient (K_L)
Smokey Mountain Smelters, Knoxville, Tennessee

$$K_L = \left(\frac{1}{k_{l(VOC)}} + \frac{R \times T}{H \times k_{g(VOC)}} \right)^{-1}$$

Parameter	Definition	Value	Reference
K_L	Overall mass transfer coefficient (cm/hr).		
$k_{l\ (VOC)}$	Liquid-film mass transfer coefficient for VOC (cm/hr).	Calculated; COPC-Specific	See Table 33
R	Gas constant (atm-m^3/mol-K).	0.000082	Foster and Chrostowski, 1987
T	Absolute temperature (K).	293	Foster and Chrostowski, 1987
H	Henry's law constant (atm-m^3/mol).	COPC-Specific	EPA, 2015
$k_{g\ (VOC)}$	Gas-film mass transfer coefficient for VOC (cm/hr).	Calculated; COPC-Specific	See Table 31

Table 33

Liquid-Film Mass Transfer Coefficient ($k_{l\,(VOC)}$)
Smokey Mountain Smelters, Knoxville, Tennessee

$$k_{1(VOC)} = k_{1(CO_2)} \times \left(\frac{44}{MW_{VOC}} \right)^{0.5}$$

Parameter	Definition	Value	Reference
$k_{l\,(VOC)}$	Liquid-film mass transfer coefficient for VOC (cm/hr).		
$k_{l\,(CO2)}$	Liquid-film mass transfer coefficient for CO_2(cm/hr).	20	Foster and Chrostowski, 1987
MW_{VOC}	Molecular weight of VOC (g/mol).	COPC-Specific	EPA, 2015

Table 34

Gas-Film Mass Transfer Coefficient ($kg_{(VOC)}$)
Smokey Mountain Smelters, Knoxville, Tennessee

$$k_{g\,(VOC)} = k_{g(H_2O)} \times \left(\frac{18}{MW_{VOC}} \right)^{0.5}$$

Parameter	Definition	Value	Reference
$K_{g\,(VOC)}$	Gas-film mass transfer coefficient for VOC (cm/hr).		
$kg_{(H2O)}$	Gas-film mass transfer coefficient for H_2O (cm/hr).	3,000	Foster and Chrostowski, 1987
MW_{VOC}	Molecular weight of VOC (g/mol).	COPC-Specific	EPA, 2015

Table 35

Dermally Absorbed Dose Per Event (DA_{event}) Calculations[a] - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

COPC	EPC[c]		FA	K_p	T_{event}	B	t*	$DA_{event\ abs}$	DA_{event} (mg/cm²-event)[b]	
	(µg/L)	(mg/cm³)	(unitless)	(cm/hr)	(hr/event)	(unitless)	(hr)	(mg/cm²-event)	Child	Adult
Shallow										
1,2,4-Trichlorobenzene	1.70E+00	1.70E-03	1.0	5.7E-02	4.0E-01	4.2E+00	1.1E+00	1.0E-02	2.0E-02	1.4E-02
2,4-Dinitrotoluene	5.0E+00	5.0E-03	1.0	4.0E-04	1.1E+00	1.0E-02	2.0E+00	2.0E-03	4.2E-03	2.2E-03
4,4'-DDE	4.2E-02	4.2E-05	0.1	2.5E-01	6.6E+00	1.2E+00	2.0E+01	2.7E-03	4.2E-03	2.2E-03
Fluoranthene	1.1E+00	1.1E-03	1.0	1.4E-02	2.0E-01	5.0E-02	7.0E-01	1.4E-03	1.7E-03	1.2E-03
bis(2-Ethylhexyl)phthalate	2.0E+01	2.0E-02	0.1	1.1E+00	1.0E+01	1.0E-01	4.0E+01	1.4E-04	1.0E-04	1.1E-04
Ethylbenzene	4.2E-01	4.2E-04	1.0	4.0E-04	4E-01	2.2E-02	2.1E+00	1.0E-03	2.4E-03	1.0E-03
Toluene	1.45E+00	1.45E-03	1.0	2.4E-04	4.0E-01	1.0E-02	7.1E-01	4.0E-03	4.5E-03	4.4E-03
Chloroform	9.10E+00	9.10E-03	1.0	6.4E-04	4.0E-01	2.7E-02	1.1E+00	7.1E-03	5.7E-03	6.0E-03
Di-n-butylphthalate	1.0E+00	1.0E-03	1.0	9.7E-02	9.1E-01	4.0E+00	2.0E+00	2.4E-02	2.0E-02	2.0E-02
Dieldrin	4.0E-02	4.0E-05	0.1	4.2E-02	1.4E+01	9.1E-02	4.5E+01	5.5E-03	6.6E-03	4.0E-03
Ethylene	1.9E+00	1.9E-03	1.0	4.9E-02	4.2E-01	1.5E-01	1.0E+00	1.0E-02	1.2E-02	5.2E-03
Naphthalene	4.4E+00	4.4E-03	1.0	4.0E-02	5.5E-01	2.0E-01	1.4E+00	1.7E-02	2.4E-02	1.5E-02
Fluoranthene	4.0E+00	4.0E-03	0.1	1.2E-01	4.4E+00	2.4E+00	1.4E+01	1.0E-03	1.2E-03	6.7E-02
Phenol	1.5E+02	1.5E-04	1.0	4.4E-04	4.5E-01	1.2E-02	6.1E-01	6.6E-02	7.9E-02	5.0E-02
Tetrachloroethene	5.0E+00	5.0E-03	1.0	4.4E-02	9.0E-01	1.0E-01	2.1E+00	4.0E-02	4.0E-02	2.5E-02
Trichloroethene	1.0E+00	1.0E-03	1.0	1.1E-02	5.1E-01	5.1E-02	1.4E+00	2.0E-03	4.4E-03	2.4E-03
1,1,2-Trichloroethane	9.4E+00	9.4E-03	1.0	5.4E-02	4.2E-01	2.1E-01	1.0E+00	5.0E-02	6.0E-02	4.2E-02
Aluminum	5.0E+04	5.0E-02	...	1.0E-04	...	...	...	1.5E-05	1.5E-05	2.0E-05
Antimony	7.4E+00	7.4E-03	...	1.0E-04	...	...	...	2.2E-03	2.4E-03	2.0E-03
Arsenic	1.4E+01	1.4E-02	...	1.0E-04	...	...	...	4.2E-03	4.7E-03	5.0E-03
Barium	1.0E+01	1.0E-02	...	1.0E-04	...	...	...	4.4E-03	2.7E-03	4.7E-03
Beryllium	2.4E+00	2.4E-03	...	1.0E-04	...	...	...	7.7E-10	6.6E-10	4.1E-10
Chromium	4.4E+01	4.4E-02	...	1.0E-04	...	...	...	1.0E-03	4.1E-03	1.1E-03
Cobalt	1.1E+04	1.1E-01	...	4.0E-04	...	...	...	1.5E-02	1.2E-02	1.5E-02
Copper	2.0E+01	2.0E-02	...	1.0E-04	...	...	...	9.2E-03	7.5E-03	1.0E-02
Cyanide	1.0E+01	1.0E-02	...	1.0E-04	...	...	...	4.5E-03	2.0E-03	4.4E-03
Iron	2.5E+04	2.5E-01	...	1.0E-04	...	...	...	4.0E-02	6.6E-02	9.1E-02
Lead	1.4E+01	1.4E-02	...	1.0E-04	...	...	...	4.0E-10	4.0E-10	5.4E-10
Magnesium	6.9E+04	6.9E-01	...	1.0E-04	...	...	...	2.2E-05	1.6E-05	2.4E-05
Manganese	6.9E+00	6.9E-03	...	1.0E-04	...	...	...	2.4E-03	1.9E-03	2.5E-03
Molybdenum	1.2E+02	1.2E-01	...	1.0E-04	...	...	...	4.6E-03	4.2E-03	4.4E-03
Nickel	7.5E+02	7.5E-01	...	2.0E-04	...	...	...	4.9E-03	4.0E-03	5.4E-03
Selenium	1.7E+01	1.7E-02	...	1.0E-04	...	...	...	5.7E-03	4.7E-03	6.2E-03
Silver	1.0E+01	1.0E-02	...	1.0E-04	...	...	...	5.4E-03	4.6E-03	6.4E-03
Thallium	2.2E+01	2.2E-02	...	1.0E-04	...	...	...	7.4E-03	6.1E-03	1.7E-03
Vanadium	2.4E+01	2.4E-02	...	1.0E-04	...	...	...	7.5E-03	6.2E-03	2.0E-03
Zinc	2.4E+04	2.4E-01	...	6.0E-04	...	...	...	4.0E-03	4.7E-03	5.0E-03
Deep										
1,2-Dichlorobenzene	1.2E+00	1.2E-03	1.0	4.2E-02	4.2E-01	1.0E-02	9.1E-01	5.0E-03	9.0E-03	6.5E-03
2,4-Dinitrotoluene	1.2E+01	1.2E-02	1.0	4.0E-04	1.1E+00	1.0E-02	2.0E+00	6.0E-03	1.0E-02	4E-03
2,6-Dinitrotoluene	4.0E+00	4.0E-03	1.0	4.7E-04	1.1E+00	1.0E-02	2.0E+00	2.0E-03	5.0E-03	4.4E-03
Fluoranthene	6.1E-01	6.1E-02	1.0	1.4E-02	2.0E-01	5.0E-02	7.0E-01	1.1E-03	2.1E-03	1.4E-03
bis(2-Ethylhexyl)phthalate	6.7E+01	6.7E-02	0.1	1.1E+00	1.0E+01	1.0E-01	4.0E+01	4.0E-04	6.4E-04	5.2E-04
Ethylbenzene	2.0E+00	2.0E-03	1.0	2.4E-04	4.0E-01	1.0E-02	7.1E-01	1.2E-03	1.4E-03	1.0E-03
Chloroform	2.0E+00	2.0E-03	1.0	6.4E-04	4.0E-01	2.7E-02	1.1E+00	1.5E-03	2.0E-03	2.0E-03
Dieldrin	4.5E-02	4.5E-05	0.1	4.2E-02	1.4E+01	9.1E-02	4.5E+01	5.7E-03	9.6E-03	7.4E-03
Heptachlor epoxide	5.4E-02	5.4E-05	0.1	2.0E-02	1.5E+01	6.0E-02	4.2E+01	5.9E-03	9.5E-03	7.5E-03
Naphthalene	1.0E+00	1.0E-03	1.0	4.0E-02	5.5E-01	2.0E-01	1.4E+00	9.1E-03	1.5E-02	1.1E-02
Fluoranthene	2.5E+00	2.5E-03	0.1	1.2E-01	4.4E+00	2.4E+00	1.4E+01	5.2E-03	1.4E-03	1.1E-03
Trichloroethene	5.1E-01	5.1E-02	1.0	1.1E-02	5.1E-01	5.1E-02	1.4E+00	4.0E-03	1.4E-03	1.0E-03
Aluminum	4.0E+04	4.0E-01	...	1.0E-04	...	...	...	1.2E-03	1.0E-03	1.4E-03

Table 35

Dermally Absorbed Dose Per Event (DA_{event}) Calculations[a] - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

COPC	EPC[b]		FA	K_p	τ_{event}	B	t[c]	$DA_{event\ adj}$	DA_{event} (mg/cm²-event)[d]	
	(µg/L)	(mg/cm²)	(unitless)	(cm/hr)	(hr/event)	(unitless)	(hr)	(mg/cm²-event)	Child	Adult
Arsenic	6.67E+00	6.67E-06	...	1.00E-03	...	...	...	2.20E-09	1.00E-09	2.40E-09
Beryllium	4.00E+00	4.00E-06	...	1.00E-03	...	...	...	1.50E-09	1.30E-09	1.73E-09
Cadmium	2.75E+00	2.75E-06	...	1.00E-03	...	...	...	9.00E-10	7.43E-10	9.90E-10
Chromium	2.11E+01	2.11E-05	...	1.00E-03	...	...	...	6.96E-09	5.70E-09	7.60E-09
Cobalt	1.52E+01	1.52E-05	...	4.00E-04	...	...	...	2.00E-09	1.64E-09	2.19E-09
Copper	3.41E+01	3.41E-05	...	1.00E-03	...	...	...	1.15E-09	9.39E-09	1.25E-09
Cyanide	1.10E+01	1.10E-05	...	1.00E-03	...	...	...	3.63E-09	2.97E-09	3.96E-09
Iron	1.25E+04	1.25E-02	...	1.00E-03	...	...	...	4.14E-06	3.39E-06	4.52E-06
Lead	4.66E+00	4.66E-06	...	1.00E-04	...	...	...	1.54E-10	1.26E-10	1.68E-10
Manganese	1.00E+05	1.00E-01	...	1.00E-03	...	...	...	3.31E-05	2.71E-05	3.61E-05
Mercury	1.54E-01	1.54E-07	...	1.00E-03	...	...	...	5.00E-11	4.16E-11	5.54E-11
Molybdenum	2.00E+02	2.00E-04	...	1.00E-03	...	...	...	6.60E-08	5.40E-08	7.20E-08
Nickel	4.03E+01	4.03E-05	...	2.00E-04	...	...	...	3.19E-09	2.61E-09	3.48E-09
Selenium	3.44E+01	3.44E-05	...	1.00E-03	...	...	...	1.14E-09	9.30E-09	1.24E-09
Strontium	6.60E+03	6.60E-03	...	1.00E-03	...	...	...	2.04E-06	2.32E-06	3.10E-06
Thallium	1.74E+01	1.74E-05	...	1.00E-03	...	...	...	5.75E-09	4.71E-09	6.27E-09
Vanadium	2.00E+01	2.00E-05	...	1.00E-03	...	...	...	9.24E-09	7.56E-09	1.01E-09
Zinc	1.24E+02	1.24E-04	...	6.00E-04	...	...	...	2.45E-08	2.01E-08	2.68E-08

[a] EPA, 2004
[b] See Table 15
[c] Event was age-adjusted assuming tevent of 0.27 for 6 years and tevent 0.36 for 9 years. Adjusted value equals 0.33
[d] Calculated based on Equation 3.2 or 3.3 for organics and Equation 3.4 for inorganics in EPA, 2004 where t_{event} equals 0.27 for children and 0.36 for adults
[e] Calculated based on Equation A.4 in EPA, 2004
[f] Calculated based on Equation A.1 in EPA, 2004

E = Ratio of the permeability coefficient of a COPC through the stratum corneum relative to its permeability coefficient across the viable epidermis
FA = Fraction absorbed
K_p = Dermal permeability coefficient
NA = Not applicable
τ_{event} = Lag time per event
t* = Time to reach steady state

Table 36
Fish Ingestion Exposure Parameters - Angler
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Fish
Exposure Medium: Fish Tissue

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/Reference	CTE Value	CTE Rationale/Reference	Intake Equation/Model Name
Ingestion	Angler	Child	Fish Tissue	C_f	Concentration in Fish	mg/kg	COPC-specific	See Table 1c	COPC-specific	See Table 1c	Chronic daily intake (mg/kg-day) =
				IRF	Fish Ingestion Rate	g/day	27	Professional judgment	13.5	Professional judgment	C_f x IRF x FI x CF x EF x ED x 1/BW x 1/AT
				FI	Fraction of Ingested Fish from Knob Creek	unitless	1	Professional judgment	0.5	Professional judgment	
				CF	Conversion Factor	kg/g	1.00E+03	Unit conversion factor	1.00E+03	Unit conversion factor	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	6	EPA, 2014	6	EPA, 2014	
				BW	Body Weight	kg	15	EPA, 2014	15	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non-Cancer	days	2,190	ED x 365 days/year	2,190	ED x 365 days/year	
		Adult	Fish Tissue	C_f	Concentration in Fish	mg/kg	To be determined	See Table 1c	To be determined	See Table 1c	Chronic daily intake (mg/kg-day) =
				IRF	Fish Ingestion Rate	g/day	54	EPA, 2000	27	Professional judgment	C_f x IRF x FI x CF x EF x ED x 1/BW x 1/AT
				FI	Fraction of Ingested Fish from Knob Creek	unitless	1	Professional judgment	0.5	Professional judgment	
				CF	Conversion Factor	kg/g	1.00E+03	Unit conversion factor	1.00E+03	Unit conversion factor	
				EF	Exposure Frequency	days/year	350	EPA, 2014	350	EPA, 2014	
				ED	Exposure Duration	years	26	EPA, 2014	26	EPA, 2014	
				BW	Body Weight	kg	70	EPA, 2014	70	EPA, 2014	
				AT-C	Averaging Time-Cancer	days	25,550	EPA, 1989	25,550	EPA, 1989	
				AT-NC	Averaging Time-Non-Cancer	days	9,490	ED x 365 days/year	9,490	ED x 365 days/year	

Table 37R

Calculation of Cancer Risks - Mutagenic Mode of Action - Current/Future Trespasser Exposure to Surface Soil
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Incidental Soil Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{IRS} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)		
Parameter	Units	6-<16
EPC	mg/kg	See Below
IRS	mg/day	100
FI	unitless	1
CF	kg/mg	1E-06
EF	days/year	104
ED	years	10
BW	kg	45
AT	days	25550
CSFo	(mg/kg-day) [1]	
ADAF	unitless	3

Dermal Contact Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} \times \text{CSFd} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)		
Parameter	Units	6-<16
EPC	mg/kg	
SA	cm^2/day	6032
AF	mg/cm^2	0.07
ABS	unitless	
EF	days/year	104
ED	years	10
CF	kg/mg	1E-06
BW	kg	45
AT	days	25550
CSFd	(mg/kg-day) [1]	
ADAF	unitless	3

Inhalation of Particulate Risk

Where:

$$\text{Risk} = \text{EPC} \times 1/\text{PEF} \sum_i \frac{\text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{AT}} \times \text{URF} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)		
Parameter	Units	6-<16
EPC	mg/kg	See Below
PEF	m^3/kg	5.7E+09
ET	hours/day	4
EF	days/year	104
ED	years	10
CF	µg/mg	1000
AT	hours	613200
URF	(µg/m^3) [1]	See Below
ADAF	unitless	3

COPC	Incidential Soil Ingestion Risks			
	EPC	CSFo	6-<16	
On-Site				
Chromium	3.66E+01	5.0E-01	5.0E-06	
Flenniken Branch				
Benzo(a)anthracene	5.10E-02	7.3E-01	1.0E-08	
Benzo(a)pyrene	1.00E-01	7.3E+00	2.0E-07	
Benzo(b)fluoranthene	1.10E-01	7.3E-01	2.2E-08	
Benzo(k)fluoranthene	1.00E-01	7.3E-02	2.0E-09	
Chrysene	9.60E-02	7.3E-03	1.9E-10	
Chromium	2.81E+01	5.0E-01	3.8E-06	

COPC	Dermal Contact Risks				
	EPC	CSFd	ABS	6-<16	
On-Site					
Chromium	3.66E+01	2.0E+01	NA	NA	
Flenniken Branch					
Benzo(a)anthracene	5.10E-02	7.3E-01	0.13	5.5E-09	
Benzo(a)pyrene	1.00E-01	7.3E+00	0.13	1.1E-07	
Benzo(b)fluoranthene	1.10E-01	7.3E-01	0.13	1.2E-08	
Benzo(k)fluoranthene	1.00E-01	7.3E-02	0.13	1.1E-09	
Chrysene	9.60E-02	7.3E-03	0.13	1.0E-10	
Chromium	2.81E+01	2.0E+01	NA	NA	

COPC	Inhalation of Particulate Risks		
	EPC	URFi	6-<16
On-Site			
Chromium	3.66E+01	8.4E-02	1.1E-08
Flenniken Branch			
Benzo(a)anthracene	5.10E-02	1.1E-04	2.0E-14
Benzo(a)pyrene	1.00E-01	1.1E-03	4.0E-13
Benzo(b)fluoranthene	1.10E-01	1.1E-04	4.4E-14
Benzo(k)fluoranthene	1.00E-01	1.1E-04	4.0E-14
Chrysene	9.60E-02	1.1E-05	3.8E-15
Chromium	2.81E+01	8.4E-02	8.5E-09

COPC	Total Cancer Risks			
	Soil Ingestion	Dermal Contact	Inhalation	Total
On-Site				
Chromium	5.0E-06	NA	1.1E-08	**5.0E-06**
Flenniken Branch				
Benzo(a)anthracene	1.0E-08	5.5E-09	2.0E-14	**1.6E-08**
Benzo(a)pyrene	2.0E-07	1.1E-07	4.0E-13	**3.1E-07**
Benzo(b)fluoranthene	2.2E-08	1.2E-08	4.4E-14	**3.4E-08**
Benzo(k)fluoranthene	2.0E-09	1.1E-09	4.0E-14	**3.1E-09**
Chrysene	1.9E-10	1.0E-10	3.8E-15	**2.9E-10**
Chromium	3.8E-06	NA	8.5E-09	**3.8E-06**

Table 38R

Calculation of Cancer Risks - Mutagenic Mode of Action - Current/Future Trespasser Exposure to Surface Soil
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Incidental Soil Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{IRS} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)		
Parameter	Units	6-<16
EPC	mg/kg	See Below
IRS	mg/day	100
FI	unitless	0.5
CF	kg/mg	1E-06
EF	days/year	52
ED	years	10
BW	kg	45
AT	days	25550
CSFo	(mg/kg-day)$^{-1}$	
ADAF	unitless	3

Dermal Contact Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} \times \text{CSFd} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)		
Parameter	Units	6-<16
EPC	mg/kg	
SA	cm^2/day	6032
AF	mg/cm^2	0.01
ABS	unitless	
EF	days/year	52
ED	years	10
CF	kg/mg	1E-06
BW	kg	45
AT	days	25550
CSFd	(mg/kg-day)$^{-1}$	
ADAF	unitless	3

Inhalation of Particulate Risk

Where:

$$\text{Risk} = \text{EPC} \times 1/\text{PEF} \sum_i \frac{\text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{AT}} \times \text{URF} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)		
Parameter	Units	6-<16
EPC	mg/kg	See Below
PEF	m^3/kg	5.7E+09
ET	hours/day	2
EF	days/year	52
ED	years	10
CF	µg/mg	1000
AT	hours	613200
URF	(µg/m^3)$^{-1}$	See Below
ADAF	unitless	3

COPC	Incidential Soil Ingestion Risks			
	EPC	CSFo	6-<16	
On-Site				
Chromium	3.66E+01	5.0E-01	1.2E-06	
Flenniken Branch				
Benzo(a)anthracene	5.10E-02	7.3E-01	2.5E-09	
Benzo(a)pyrene	1.00E-01	7.3E+00	5.0E-08	
Benzo(b)fluoranthene	1.10E-01	7.3E-01	5.4E-09	
Benzo(k)fluoranthene	1.00E-01	7.3E-02	5.0E-10	
Chrysene	9.60E-02	7.3E-03	4.8E-11	
Chromium	2.81E+01	5.0E-01	9.5E-07	

COPC	Dermal Contact Risks				
	EPC	CSFd	ABS	6-<16	
On-Site					
Chromium	3.66E+01	2.0E+01	NA	NA	
Flenniken Branch					
Benzo(a)anthracene	5.10E-02	7.3E-01	0.13	4.0E-10	
Benzo(a)pyrene	1.00E-01	7.3E+00	0.13	7.8E-09	
Benzo(b)fluoranthene	1.10E-01	7.3E-01	0.13	8.5E-10	
Benzo(k)fluoranthene	1.00E-01	7.3E-02	0.13	7.8E-11	
Chrysene	9.60E-02	7.3E-03	0.13	7.5E-12	
Chromium	2.81E+01	2.0E+01	NA	NA	

COPC	Inhalation of Particulate Risks		
	EPC	URFi	6-<16
On-Site			
Chromium	3.66E+01	8.4E-02	2.8E-09
Flenniken Branch			
Benzo(a)anthracene	5.10E-02	1.1E-04	5.0E-15
Benzo(a)pyrene	1.00E-01	1.1E-03	9.9E-14
Benzo(b)fluoranthene	1.10E-01	1.1E-04	1.1E-14
Benzo(k)fluoranthene	1.00E-01	1.1E-04	9.9E-15
Chrysene	9.60E-02	1.1E-05	9.5E-16
Chromium	2.81E+01	8.4E-02	2.1E-09

COPC	Total Cancer Risks			
	Soil Ingestion	Dermal Contact	Inhalation	Total
On-Site				
Chromium	1.2E-06	NA	2.8E-09	**1.2E-06**
Flenniken Branch				
Benzo(a)anthracene	2.5E-09	4.0E-10	5.0E-15	**2.9E-09**
Benzo(a)pyrene	5.0E-08	7.8E-09	9.9E-14	**5.7E-08**
Benzo(b)fluoranthene	5.4E-09	8.5E-10	1.1E-14	**6.3E-09**
Benzo(k)fluoranthene	5.0E-10	7.8E-11	9.9E-15	**5.7E-10**
Chrysene	4.8E-11	7.5E-12	9.5E-16	**5.5E-11**
Chromium	9.5E-07	NA	2.1E-09	**9.5E-07**

Table 39R

Calculation of Cancer Risks - Mutagenic Mode of Action - Current/Future Recreational User Exposure to Surface Soil
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Incidental Soil Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{IRS} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	Units	0-<2	2-<6
EPC	mg/kg	See Below	
IRS	mg/day	200	200
FI	unitless	1	1
CF	kg/mg	1E-06	1E-06
EF	days/year	117	117
ED	years	2	4
BW	kg	15	15
AT	days	25550	25550
CSFo	$(\text{mg/kg-day})^{-1}$	See Below	
ADAF	unitless	10	3

Dermal Contact Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} \times \text{CSFd} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	Units	0-<2	2-<6
EPC	mg/kg	See Below	
SA	cm^2/day	2800	2800
AF	mg/cm^2	0.2	0.2
ABS	unitless	See Below	
EF	days/year	117	117
ED	years	2	4
CF	kg/mg	1E-06	1E-06
BW	kg	15	15
AT	days	25550	25550
CSFd	$(\text{mg/kg-day})^{-1}$	See Below	
ADAF	unitless	10	3

Inhalation of Particulate Risk

Where:

$$\text{Risk} = \text{EPC} \times 1/\text{PEF} \sum_i \frac{\text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{AT}} \times \text{URF} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	Units	0-<2	2-<6
EPC	mg/kg	See Below	
PEF	m^3/kg	5.7E+09	5.7E+09
ET	hours/day	4	4
EF	days/year	117	117
ED	years	2	4
CF	µg/mg	1000	1000
AT	hours	613200	613200
URF	$(\mu g/m^3)^{-1}$	See Below	
ADAF	unitless	10	3

COPC	Incidential Soil Ingestion Risks			
	EPC	CSFo	0-<2	2-<6
On-Site				
Chromium	3.66E+01	5.0E-01	2.2E-05	1.3E-05
Flenniken Branch				
Benzo(a)anthracene	5.10E-02	7.3E-01	4.5E-08	2.7E-08
Benzo(a)pyrene	1.00E-01	7.3E+00	8.9E-07	5.3E-07
Benzo(b)fluoranthene	1.10E-01	7.3E-01	9.8E-08	5.9E-08
Benzo(k)fluoranthene	1.00E-01	7.3E-02	8.9E-09	5.3E-09
Chrysene	9.60E-02	7.3E-03	8.6E-10	5.1E-10
Chromium	2.81E+01	5.0E-01	1.7E-05	1.0E-05

COPC	Dermal Contact Risks				
	EPC	CSFd	ABS	0-<2	2-<6
On-Site					
Chromium	3.66E+01	2.0E+01	NA	NA	NA
Flenniken Branch					
Benzo(a)anthracene	5.10E-02	7.3E-01	0.13	1.7E-08	9.9E-09
Benzo(a)pyrene	1.00E-01	7.3E+00	0.13	3.2E-07	1.9E-07
Benzo(b)fluoranthene	1.10E-01	7.3E-01	0.13	3.6E-08	2.1E-08
Benzo(k)fluoranthene	1.00E-01	7.3E-02	0.13	3.2E-09	1.9E-09
Chrysene	9.60E-02	7.3E-03	0.13	3.1E-10	1.9E-10
Chromium	2.81E+01	2.0E+01	NA	NA	NA

COPC	Inhalation of Particulate Risks			
	EPC	URFi	0-<2	2-<6
On-Site				
Chromium	3.66E+01	8.4E-02	8.3E-09	5.0E-09
Flenniken Branch				
Benzo(a)anthracene	5.10E-02	1.1E-04	1.5E-14	9.1E-15
Benzo(a)pyrene	1.00E-01	1.1E-03	3.0E-13	1.8E-13
Benzo(b)fluoranthene	1.10E-01	1.1E-04	3.3E-14	2.0E-14
Benzo(k)fluoranthene	1.00E-01	1.1E-04	3.0E-14	1.8E-14
Chrysene	9.60E-02	1.1E-05	2.8E-15	1.7E-15
Chromium	2.81E+01	8.4E-02	6.4E-09	3.8E-09

COPC	Total Cancer Risks			
	Soil Ingestion	Dermal Contact	Inhalation	Total
On-Site				
Chromium	3.6E-05	NA	1.3E-08	**3.6E-05**
Flenniken Branch				
Benzo(a)anthracene	7.3E-08	2.6E-08	2.4E-14	**9.9E-08**
Benzo(a)pyrene	1.4E-06	5.2E-07	4.7E-13	**1.9E-06**
Benzo(b)fluoranthene	1.6E-07	5.7E-08	5.2E-14	**2.1E-07**
Benzo(k)fluoranthene	1.4E-08	5.2E-09	4.7E-14	**1.9E-08**
Chrysene	1.4E-09	5.0E-10	4.6E-15	**1.9E-09**
Chromium	2.7E-05	NA	1.0E-08	**2.7E-05**

Table 40R

Calculation of Cancer Risks - Mutagenic Mode of Action - Current/Future Recreational User Exposure to Surface Soil
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Incidental Soil Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{IRS} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	Units	0-<2	2-<6
EPC	mg/kg	See Below	
IRS	mg/day	100	100
FI	unitless	0.5	0.5
CF	kg/mg	1E-06	1E-06
EF	days/year	58	58
ED	years	2	4
BW	kg	15	15
AT	days	25550	25550
CSFo	(mg/kg-day)$^{-1}$	See Below	
ADAF	unitless	10	3

Dermal Contact Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_i \frac{\text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} \times \text{CSFd} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	Units	0-<2	2-<6
EPC	mg/kg	See Below	
SA	cm^2/day	2800	2800
AF	mg/cm^2	0.04	0.04
ABS	unitless	See Below	
EF	days/year	58	58
ED	years	2	4
CF	kg/mg	1E-06	1E-06
BW	kg	15	15
AT	days	25550	25550
CSFd	(mg/kg-day)$^{-1}$	See Below	
ADAF	unitless	10	3

Inhalation of Particulate Risk

Where:

$$\text{Risk} = \text{EPC} \times 1/\text{PEF} \sum_i \frac{\text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{AT}} \times \text{URF} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	Units	0-<2	2-<6
EPC	mg/kg	See Below	
PEF	m^3/kg	5.7E+09	5.7E+09
ET	hours/day	2	2
EF	days/year	58	58
ED	years	2	4
CF	µg/mg	1000	1000
AT	hours	613200	613200
URF	(µg/m^3)$^{-1}$	See Below	
ADAF	unitless	10	3

	Incidential Soil Ingestion Risks			
COPC	EPC	CSFo	0-<2	2-<6
On-Site				
Chromium	3.66E+01	5.0E-01	2.8E-06	1.7E-06
Flenniken Branch				
Benzo(a)anthracene	5.10E-02	7.3E-01	5.6E-09	3.4E-09
Benzo(a)pyrene	1.00E-01	7.3E+00	1.1E-07	6.6E-08
Benzo(b)fluoranthene	1.10E-01	7.3E-01	1.2E-08	7.3E-09
Benzo(k)fluoranthene	1.00E-01	7.3E-02	1.1E-09	6.6E-10
Chrysene	9.60E-02	7.3E-03	1.1E-10	6.4E-11
Chromium	2.81E+01	5.0E-01	2.1E-06	1.3E-06

	Dermal Contact Risks				
COPC	EPC	CSFd	ABS	0-<2	2-<6
On-Site					
Chromium	3.66E+01	2.0E+01	NA	NA	NA
Flenniken Branch					
Benzo(a)anthracene	5.10E-02	7.3E-01	0.13	1.6E-09	9.8E-10
Benzo(a)pyrene	1.00E-01	7.3E+00	0.13	3.2E-08	1.9E-08
Benzo(b)fluoranthene	1.10E-01	7.3E-01	0.13	3.5E-09	2.1E-09
Benzo(k)fluoranthene	1.00E-01	7.3E-02	0.13	3.2E-10	1.9E-10
Chrysene	9.60E-02	7.3E-03	0.13	3.1E-11	1.9E-11
Chromium	2.81E+01	2.0E+01	NA	NA	NA

	Inhalation of Particulate Risks			
COPC	EPC	URFi	0-<2	2-<6
On-Site				
Chromium	3.66E+01	8.4E-02	2.1E-09	1.2E-09
Flenniken Branch				
Benzo(a)anthracene	5.10E-02	1.1E-04	3.8E-15	2.3E-15
Benzo(a)pyrene	1.00E-01	1.1E-03	7.4E-14	4.4E-14
Benzo(b)fluoranthene	1.10E-01	1.1E-04	8.1E-15	4.9E-15
Benzo(k)fluoranthene	1.00E-01	1.1E-04	7.4E-15	4.4E-15
Chrysene	9.60E-02	1.1E-05	7.1E-16	4.2E-16
Chromium	2.81E+01	8.4E-02	1.6E-09	9.5E-10

	Total Cancer Risks			
COPC	Soil Ingestion	Dermal Contact	Inhalation	Total
On-Site				
Chromium	4.4E-06	NA	3.3E-09	**4.4E-06**
Flenniken Branch				
Benzo(a)anthracene	9.0E-09	2.6E-09	6.0E-15	**1.2E-08**
Benzo(a)pyrene	1.8E-07	5.1E-08	1.2E-13	**2.3E-07**
Benzo(b)fluoranthene	1.9E-08	5.7E-09	1.3E-14	**2.5E-08**
Benzo(k)fluoranthene	1.8E-09	5.1E-10	1.2E-14	**2.3E-09**
Chrysene	1.7E-10	4.9E-11	1.1E-15	**2.2E-10**
Chromium	3.4E-06	NA	2.5E-09	**3.4E-06**

Table 41R

Calculation of Cancer Risks - Mutagenic Mode of Action - Future Residential Exposure to Surface Soil
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Incidental Soil Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_{i} \frac{\text{IRS} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)					
Parameter	Units	0-<2	2-<6	6-<16	16-<26
EPC	mg/kg	See Below			
IRS	mg/kg-day	200	200	100	100
FI	unitless	1	1	1	1
CF	kg/mg	1E-06	1E-06	1E-06	1E-06
EF	days/year	350	350	350	350
ED	years	2	4	10	10
BW	kg	15	15	70	70
AT	days	25550	25550	25550	25550
CSFo	(mg/kg-day)$^{-1}$	See Below			
ADAF	unitless	10	3	3	1

Dermal Contact Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_{i} \frac{\text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} \times \text{CSFd} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)					
Parameter	Units	0-<2	2-<6	6-<16	16-<26
EPC	mg/kg	See Below			
SA	cm^2/day	2800	2800	5700	5700
AF	mg/cm^2	0.2	0.2	0.07	0.07
ABS	unitless	See Below			
EF	days/year	350	350	350	350
ED	years	2	4	10	10
CF	kg/mg	1E-06	1E-06	1E-06	1E-06
BW	kg	15	15	70	70
AT	days	25550	25550	25550	25550
CSFd	(mg/kg-day)$^{-1}$	See Below			
ADAF	unitless	10	3	3	1

Inhalation of Particulate Risk

Where:

$$\text{Risk} = \text{EPC} \times 1/\text{PEF} \sum_{i} \frac{\text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{AT}} \times \text{URF} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)					
Parameter	Units	0-<2	2-<6	6-<16	16-<26
EPC	mg/kg	See Below			
PEF	m^3/kg	5.7E+09	5.7E+09	5.7E+09	5.7E+09
ET	hours/day	24	24	24	24
EF	days/year	350	350	350	350
ED	years	2	4	10	10
CF	ug/mg	1000	1000	1000	1000
AT	hours	613200	613200	613200	613200
URF	ug/m^3^{-1}	See Below			
ADAF	unitless	10	3	3	1

COPC	Incidental Soil Ingestion Risks					
	EPC	CSFo	0-<2	2-<6	6-<16	16-<26
On-Site						
Chromium	4.00E+01	5.0E-01	6.7E-05	4.0E-05	9.4E-06	4.1E-06
Flenniken Branch						
Benzo(a)anthracene	5.10E-02	7.3E-01	1.4E-07	2.E-08	1.0E-08	6.4E-09
Benzo(a)pyrene	1.00E-01	7.3E+00	2.7E-06	1.6E-06	4.E-07	1.4E-07
Benzo(b)fluoranthene	1.10E-01	7.3E-01	2.0E-07	1.E-07	4.1E-08	1.4E-08
Benzo(k)fluoranthene	1.00E-01	7.3E-02	2.7E-08	1.6E-08	4.E-09	1.4E-09
Chrysene	9.00E-02	7.3E-03	2.0E-09	1.5E-09	4.0E-10	1.2E-10
Chromium	2.1E+01	5.0E-01	5.1E-05	4.1E-05	7.2E-06	2.4E-06

COPC	Dermal Contact Risks						
	EPC	CSFd	ABS	0-<2	2-<6	6-<16	16-<26
On-Site							
Chromium	4.00E+01	2.0E+01	NA	NA	NA	NA	NA
Flenniken Branch							
Benzo(a)anthracene	5.10E-02	7.3E-01	0.13	2.0E-10	1.7E-10	1.0E-10	4.5E-11
Benzo(a)pyrene	1.00E-01	7.3E+00	0.13	5.6E-07	4.4E-07	2.1E-07	6.0E-08
Benzo(b)fluoranthene	1.10E-01	7.3E-01	0.13	6.2E-10	4.7E-10	2.4E-10	7.5E-11
Benzo(k)fluoranthene	1.00E-01	7.3E-02	0.13	5.6E-09	4.4E-09	2.1E-09	6.6E-10
Chrysene	9.00E-02	7.3E-03	0.13	5.4E-10	4.2E-10	2.0E-10	6.6E-11
Chromium	2.1E+01	2.0E+01	NA	NA	NA	NA	NA

COPC	Inhalation of Particulate Risks					
	EPC	URFi	0-<2	2-<6	6-<16	16-<26
On-Site						
Chromium	4.00E+01	4E-02	1.5E-07	9E-08	2.2E-08	7.4E-09
Flenniken Branch						
Benzo(a)anthracene	5.10E-02	1.1E-04	2.7E-14	1.6E-14	4.1E-14	1.4E-14
Benzo(a)pyrene	1.00E-01	1.1E-04	5.4E-12	4.2E-12	9E-12	2.7E-12
Benzo(b)fluoranthene	1.10E-01	1.1E-04	5.9E-14	4.5E-14	E-14	2.9E-14
Benzo(k)fluoranthene	1.00E-01	1.1E-04	5.4E-13	4.2E-13	9E-13	2.7E-13
Chrysene	9.00E-02	1.1E-05	5.1E-14	4.1E-14	7.7E-14	2.6E-14
Chromium	2.1E+01	4E-02	1.1E-07	8.E-08	1.7E-07	5.7E-08

COPC	Total Cancer Risks			
	Soil Ingestion	Dermal Contact	Inhalation	Total
On-Site				
Chromium	1.2E-04	NA	5.4E-07	**1.2E-04**
Flenniken Branch				
Benzo(a)anthracene	2.4E-07	6.0E-09	9.E-14	**3.0E-07**
Benzo(a)pyrene	4.E-06	1.2E-06	1.9E-11	**5.9E-06**
Benzo(b)fluoranthene	5.2E-07	1.4E-07	2.1E-12	**6.5E-07**
Benzo(k)fluoranthene	4.E-08	1.2E-08	1.9E-12	**5.9E-08**
Chrysene	4.6E-09	1.1E-09	1.E-14	**5.7E-09**
Chromium	9.2E-05	NA	4.1E-07	**9.2E-05**

Table 42

Calculation of Cancer Risks - Mutagenic Mode of Action - Future Residential Exposure to Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Tapwater Ingestion Risk

Where:

$$Risk = EPC \times \sum_{i} \frac{IRW \times FI \times EF \times ED \times CF}{BW \times AT} \times CSFo \times ADAF$$

Exposure Parameters (by age interval, i)					
Parameter	**Units**	**0-<2**	**2-<6**	**6-<16**	**16-<26**
EPC	µg/L	See Below			
IRW	L/day	0.78	0.78	2.5	2.5
FI	unitless	1	1	1	1
CF	mg/µg	1E-03	1E-03	1E-03	1E-03
EF	days/year	350	350	350	350
ED	years	2	4	10	10
BW	kg	15	15	80	80
AT	days	25550	25550	25550	25550
CSFo	(mg/kg-day)$^{-1}$	See Below			
ADAF	unitless	10	3	3	1

	Tapwater Ingestion Risks					
COPC	**EPC**	**CSFo**	**0-<2**	**2-<6**	**6-<16**	**16-<26**
Shallow						
Chromium	3.14E+01	5.0E-01	2.2E-04	1.3E-04	2.0E-04	6.7E-05
Deep						
Chromium	2.11E+01	5.0E-01	1.5E-04	9.0E-05	1.4E-04	4.5E-05

Dermal Contact Risk

Where:

$$Risk = \sum_{i} \frac{DAevent \times EV \times SA \times EF \times ED}{BW \times AT} \times CSFd \times ADAF$$

Exposure Parameters (by age interval, i)					
Parameter	**Units**	**0-<2**	**2-<6**	**6-<16**	**16-<26**
DAevent	mg/cm^2-event	See Below			
EV	event/day	1	1	1	1
SA	cm^2	6378	6378	20900	20900
EF	days/year	350	350	350	350
ED	years	2	4	10	10
BW	kg	15	15	80	80
AT	days	25550	25550	25550	25550
CSFd	(mg/kg-day)$^{-1}$	See Below			
ADAF	unitless	10	3	3	1

	Dermal Contact Risks					
COPC	**DAevent**	**CSFd**	**0-<2**	**2-<6**	**6-<16**	**16-<26**
Shallow						
Chromium	2.10E-08	2.0E+01	4.9E-05	2.9E-05	4.5E-05	1.5E-05
Deep						
Chromium	1.41E-08	2.0E+01	3.3E-05	2.0E-05	3.0E-05	1.0E-05

	Total Cancer Risks		
COPC	**Tapwater Ingestion**	**Dermal Contact**	**Total**
Shallow			
Chromium	6.3E-04	1.4E-04	**7.7E-04**
Deep			
Chromium	4.2E-04	9.3E-05	**5.1E-04**

Table 43R

Calculation of Cancer Risks - Mutagenic Mode of Action - Future Residential Exposure to Surface Soil
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Incidental Soil Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_{i} \frac{\text{IRS} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)				
Parameter	Units	0-<2	2-<6	20-<26
EPC	mg/kg	See Below		
IRS	mg/day	200	200	100
FI	unitless	0.5	0.5	0.5
CF	kg/mg	1E-06	1E-06	1E-06
EF	days/yr	350	350	350
ED	yrs	2	4	6
BW	kg	15	15	70
AT	days	25550	25550	25550
CSFo	(mg/kg-day)$^{-1}$	See Below		
ADAF	unitless	10	3	1

COPC	Incidential Soil Ingestion Risks				
	EPC	CSFo	0-<2	2-<6	20-<26
On-Site					
Chromium	3.0E+01	5.0E-01	3.3E-05	2.0E-05	9.4E-07
Flenniken Branch					
Benzo(a)anthracene	5.10E-02	7.3E-01	6.2E-07	4.1E-07	1.9E-09
Benzo(a)pyrene	1.00E-01	7.3E+00	1.3E-06	8.0E-07	3.7E-08
Benzo(b)fluoranthene	1.10E-01	7.3E-01	1.5E-07	9.8E-08	4.1E-09
Benzo(k)fluoranthene	1.00E-01	7.3E-02	1.3E-08	8.0E-09	3.7E-10
Chrysene	9.00E-02	7.3E-03	1.1E-09	7.2E-10	3.3E-11
Chromium	2.1E+01	5.0E-01	2.3E-05	1.5E-05	7.2E-07

Dermal Contact Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_{i} \frac{\text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}} \times \text{CSFd} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)				
Parameter	Units	0-<2	2-<6	20-<26
EPC	mg/kg	See Below		
SA	cm^2/day	2000	2000	5000
AF	mg/cm^2	0.004	0.004	0.001
ABS	unitless	See Below		
EF	days/yr	350	350	350
ED	yrs	2	4	6
CF	kg/mg	1E-06	1E-06	1E-06
BW	kg	15	15	70
AT	days	25550	25550	25550
CSFd	(mg/kg-day)$^{-1}$	See Below		
ADAF	unitless	10	3	1

COPC	Dermal Contact Risks					
	EPC	CSFd	ABS	0-<2	2-<6	20-<26
Chromium	3.0E+01	2.0E+01	0.0	0.0	0.0	0.0
Benzo(a)anthracene	5.10E-02	7.3E-01	0.13	9.5E-09	5.7E-09	3.0E-10
Benzo(a)pyrene	1.00E-01	7.3E+00	0.13	1.9E-07	1.1E-07	5.9E-09
Benzo(b)fluoranthene	1.10E-01	7.3E-01	0.13	2.1E-08	1.2E-08	6.5E-10
Benzo(k)fluoranthene	1.00E-01	7.3E-02	0.13	1.9E-09	1.1E-09	5.9E-11
Chrysene	9.00E-02	7.3E-03	0.13	1.5E-10	1.1E-10	5.3E-12
Chromium	2.1E+01	2.0E+01	0.0	0.0	0.0	0.0

Inhalation of Particulate Risk

Where:

$$\text{Risk} = \text{EPC} \times 1/\text{PEF} \sum_{i} \frac{\text{ET} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{AT}} \times \text{URF} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)				
Parameter	Units	0-<2	2-<6	20-<26
EPC	mg/kg	See Below		
PEF	m^3/kg	5.7E+09	5.7E+09	5.7E+09
ET	hours/day	1.0	1.0	1.0
EF	days/yr	350	350	350
ED	yrs	2	4	6
CF	kg/mg	1000	1000	1000
AT	hours	613.200	613.200	613.200
URF	(µg/m^3)$^{-1}$	See Below		
ADAF	unitless	10	3	1

COPC	Inhalation of Particulate Risks				
	EPC	URFi	0-<2	2-<6	20-<26
Chromium	3.0E+01	4E-02	9.9E-09	5.9E-09	3.0E-09
Benzo(a)anthracene	5.10E-02	1.1E-04	1.8E-13	1.1E-13	5.4E-14
Benzo(a)pyrene	1.00E-01	1.1E-03	3.5E-12	2.1E-12	1.1E-12
Benzo(b)fluoranthene	1.10E-01	1.1E-04	3.9E-13	2.3E-13	1.2E-13
Benzo(k)fluoranthene	1.00E-01	1.1E-04	3.5E-13	2.1E-13	1.1E-13
Chrysene	9.00E-02	1.1E-05	3.4E-14	2.0E-14	1.0E-14
Chromium	2.1E+01	4E-02	7.0E-09	4.1E-09	2.1E-09

COPC	Total Cancer Risks			
	Soil Ingestion	Dermal Contact	Inhalation	Total
On-Site				
Chromium	5.4E-05	0.0	1.3E-07	**5.5E-05**
Flenniken Branch				
Benzo(a)anthracene	1.1E-07	1.8E-09	3.4E-13	**1.3E-07**
Benzo(a)pyrene	2.2E-06	3.0E-07	6.7E-12	**2.5E-06**
Benzo(b)fluoranthene	2.4E-07	3.3E-08	7.4E-13	**2.7E-07**
Benzo(k)fluoranthene	2.2E-08	3.0E-09	6.7E-13	**2.5E-08**
Chrysene	2.1E-09	2.9E-10	6.5E-14	**2.4E-09**
Chromium	4.2E-05	0.0	1.4E-07	**4.2E-05**

Table 44

Calculation of Cancer Risks - Mutagenic Mode of Action - Future Residential Exposure to Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Tapwater Ingestion Risk

Where:

$$Risk = EPC \times \sum_{i} \frac{IRW \times FI \times EF \times ED \times CF}{BW \times AT} \times CSFo \times ADAF$$

Exposure Parameters (by age interval, i)				
Parameter	**Units**	**0-<2**	**2-<6**	**20-<26**
EPC	µg/L	See Below		
IRW	L/day	0.78	0.78	2.5
FI	unitless	0.5	0.5	0.5
CF	mg/µg	1E-03	1E-03	1E-03
EF	days/year	350	350	350
ED	years	2	4	6
BW	kg	15	15	80
AT	days	25550	25550	25550
CSFo	(mg/kg-day)$^{-1}$	See Below		
ADAF	unitless	10	3	1

	Tapwater Ingestion Risks				
COPC	**EPC**	**CSFo**	**0-<2**	**2-<6**	**20-<26**
Shallow					
Chromium	3.14E+01	5.0E-01	1.1E-04	6.7E-05	2.0E-05
Deep					
Chromium	2.11E+01	5.0E-01	7.5E-05	4.5E-05	1.4E-05

Dermal Contact Risk

Where:

$$Risk = \sum_{i} \frac{DAevent \times EV \times SA \times EF \times ED}{BW \times AT} \times CSFd \times ADAF$$

Exposure Parameters (by age interval, i)				
Parameter	**Units**	**0-<2**	**2-<6**	**20-<26**
DAevent	mg/cm^2-event	See Below		
EV	event/day	1	1	1
SA	cm^2	6378	6378	20900
EF	days/year	350	350	350
ED	years	2	4	6
BW	kg	15	15	80
AT	days	25550	25550	25550
CSFd	(mg/kg-day)$^{-1}$	See Below		
ADAF	unitless	10	3	1

	Dermal Contact Risks				
COPC	**DAevent**	**CSFd**	**0-<2**	**2-<6**	**20-<26**
Shallow					
Chromium	1.04E-08	2.0E+01	2.4E-05	1.4E-05	4.5E-06
Deep					
Chromium	6.96E-09	2.0E+01	1.6E-05	9.7E-06	3.0E-06

	Total Cancer Risks		
COPC	**Tapwater Ingestion**	**Dermal Contact**	**Total**
Shallow			
Chromium	2.0E-04	NA	**2.0E-04**
Deep			
Chromium	1.3E-04	NA	**1.3E-04**

Table 45

Calculation of Cancer Risks - Mutagenic Mode of Action - Current/Future Angler Exposure to Fish Tissue
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Fish Ingestion Risk

$$\text{Risk} = \text{EPC} \times \sum_{i} \frac{\text{IRF} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	**Units**	**0-<2**	**2-<6**
EPC	mg/kg	See Below	
IRF	g/day	27	27
FI	unitless	1	1
CF	kg/g	1E-03	1E-03
EF	days/year	350	350
ED	years	2	4
BW	kg	15	15
AT	days	25550	25550
CSFo	(mg/kg-day) [1]	See Below	
ADAF	unitless	10	3

COPC	Fish Ingestion Risks			
	EPC	**CSFo**	**0-<2**	**2-<6**
Carp				
Chromium	9.50E-01	5.0E-01	2.3E-04	1.4E-04
Largemouth Bass				
Chromium	6.70E-01	5.0E-01	1.7E-04	9.9E-05
All Species				
Chromium	4.86E-01	5.0E-01	1.2E-04	7.2E-05

COPC	Total Cancer Risks
	Fish Ingestion
Carp	
Chromium	3.7E-04
Largemouth Bass	
Chromium	2.6E-04
All Species	
Chromium	1.9E-04

Table 46

Calculation of Cancer Risks - Mutagenic Mode of Action - Current/Future Angler Exposure to Fish Tissue
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Fish Ingestion Risk

Where:

$$\text{Risk} = \text{EPC} \times \sum_{i} \frac{\text{IRF} \times \text{FI} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}} \times \text{CSFo} \times \text{ADAF}$$

Exposure Parameters (by age interval, i)			
Parameter	**Units**	**0-<2**	**2-<6**
EPC	mg/kg	See Below	
IRF	g/day	13.5	13.5
FI	unitless	0.5	0.5
CF	kg/g	1E-03	1E-03
EF	days/year	350	350
ED	years	2	4
BW	kg	15	15
AT	days	25550	25550
CSFo	(mg/kg-day) [1]	See Below	
ADAF	unitless	10	3

COPC	Fish Ingestion Risks			
	EPC	**CSFo**	**0-<2**	**2-<6**
Carp				
Chromium	9.50E-01	5.0E-01	5.9E-05	3.5E-05
Largemouth Bass				
Chromium	6.70E-01	5.0E-01	4.1E-05	2.5E-05
All Species				
Chromium	4.86E-01	5.0E-01	3.0E-05	1.8E-05

COPC	Total Cancer Risks
	Fish Ingestion
Carp	
Chromium	9.4E-05
Largemouth Bass	
Chromium	6.6E-05
All Species	
Chromium	4.8E-05

Table 47

Calculation of Cancer Risks from Trichloroethylene - Mutagenic Mode of Action - Future Residential Exposure to Groundwater

Reasonable Maximum Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Tapwater Ingestion Risk

Where:

$$Risk = EPC \times \sum_i \left(\left(\frac{IRW \times FI \times EF \times ED \times CF}{BW \times AT} \right) \times CSF_{kidney} \times ADAF \right) + \left(\left(\frac{IRW \times FI \times EF \times ED \times CF}{BW \times AT} \right) \times CSF_{Liver + NHL} \right)$$

Exposure Parameters (by age interval, i)					
Parameter	**Units**	**0-<2**	**2-<6**	**6-<16**	**16-<26**
EPC	µg/L	See Below			
IRW	L/day	0.78	0.78	2.5	2.5
FI	unitless	1	1	1	1
CF	mg/µg	1E-03	1E-03	1E-03	1E-03
EF	days/year	350	350	350	350
ED	years	2	4	10	10
BW	kg	15	15	80	80
AT	days	25550	25550	25550	25550
CSF_{kidney}	(mg/kg-day)$^{-1}$	9.3E-03			
ADAF	unitless	10	3	3	1
$CSF_{liver+NHL}$	(mg/kg-day)$^{-1}$	3.7E-02			

COPC	EPC (µg/L)	Tapwater Ingestion Risks 0-<2	2-<6	6-<16	16-<26
Shallow					
Trichloroethylene	1.99E+00	3.7E-07	3.7E-07	5.5E-07	3.9E-07
Deep					
Trichloroethylene	5.80E-01	1.1E-07	1.1E-07	1.6E-07	1.1E-07

Dermal Contact Risk

Where:

$$Risk = \sum_i \left(\left(\frac{DAevent \times EV \times SA \times EF \times ED}{BW \times AT} \right) \times CSF_{kidney} \times ADAF \right) + \left(\left(\frac{DAevent \times EV \times SA \times EF \times ED}{BW \times AT} \right) \times CSF_{Liver + NHL} \right)$$

Exposure Parameters (by age interval, i)					
Parameter	**Units**	**0-<2**	**2-<6**	**6-<16**	**16-<26**
DAevent	mg/cm^2-event	See Below			
EV	event/day	1	1	1	1
SA	cm^2	6378	6378	20900	20900
EF	days/year	350	350	350	350
ED	years	2	4	10	10
BW	kg	15	15	80	80
AT	days	25550	25550	25550	25550
CSF_{kidney}	(mg/kg-day)$^{-1}$	9.3E-03			
ADAF	unitless	10	3	3	1
$CSF_{liver+NHL}$	(mg/kg-day)$^{-1}$	3.7E-02			

COPC	DAevent (mg/cm^2-event)	Dermal Contact Risks 0-<2	2-<6	6-<16	16-<26
Shallow					
Trichloroethylene	3.96E-08	6.0E-08	6.0E-08	9.2E-08	6.6E-08
Deep					
Trichloroethylene	1.15E-08	1.7E-08	1.7E-08	2.7E-08	1.9E-08

COPC	Total Cancer Risks: Tapwater Ingestion	Dermal Contact	Total
Shallow			
Trichloroethylene	1.7E-06	2.8E-07	**2.0E-06**
Deep			
Trichloroethylene	4.9E-07	8.1E-08	**5.7E-07**

Table 48

Calculation of Cancer Risks from Trichloroethylene - Mutagenic Mode of Action - Future Residential Exposure to Groundwater

Reasonable Maximum Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Tapwater Ingestion Risk

Where:

$$Risk = EPC \times \sum_i \left[\left(\frac{IRW \times FI \times EF \times ED \times CF}{BW \times AT} \right) \times CSF_{Kidney} \times ADAF \right] + \left[\left(\frac{IRW \times FI \times EF \times ED \times CF}{BW \times AT} \right) \times CSF_{Liver+NHL} \right]$$

Exposure Parameters (by age interval, i)				
Parameter	**Units**	**0-<2**	**2-<6**	**16-<26**
EPC	µg/L	See Below		
IRW	L/day	0.78	0.78	2.5
FI	unitless	0.5	0.5	0.5
CF	mg/µg	1E-03	1E-03	1E-03
EF	days/year	350	350	350
ED	years	2	4	9
BW	kg	15	15	80
AT	days	25550	25550	25550
CSF_{Kidney}	(mg/kg-day)$^{-1}$	9.3E-03		
ADAF	unitless	10	3	1
$CSF_{Liver+NHL}$	(mg/kg-day)$^{-1}$	3.7E-02		

COPC	EPC (µg/L)	Tapwater Ingestion Risks 0-<2	2-<6	16-<26
Shallow				
Trichloroethylene	1.99E+00	1.8E-07	1.8E-07	1.8E-07
Deep				
Trichloroethylene	5.80E-01	5.4E-08	5.4E-08	5.2E-08

Dermal Contact Risk

Where:

$$Risk = \sum_i \left[\left(\frac{DAevent \times EV \times SA \times EF \times ED}{BW \times AT} \right) \times CSF_{Kidney} \times ADAF \right] + \left[\left(\frac{DAevent \times EV \times SA \times EF \times ED}{BW \times AT} \right) \times CSF_{Liver+NHL} \right]$$

Exposure Parameters (by age interval, i)				
Parameter	**Units**	**0-<2**	**2-<6**	**16-<26**
DAevent	mg/cm^2-event	See Below		
EV	event/day	1	1	1
SA	cm^2	6378	6378	20900
EF	days/year	350	350	350
ED	years	2	4	9
BW	kg	15	15	80
AT	days	25550	25550	25550
CSF_{Kidney}	(mg/kg-day)$^{-1}$	9.3E-03		
ADAF	unitless	10	3	1
$CSF_{Liver+NHL}$	(mg/kg-day)$^{-1}$	3.7E-02		

COPC	DAevent (mg/cm^2-event)	Dermal Contact Risks 0-<2	2-<6	16-<26
Shallow				
Trichloroethylene	2.88E-08	4.4E-08	4.4E-08	4.3E-08
Deep				
Trichloroethylene	8.39E-09	1.3E-08	1.3E-08	1.3E-08

COPC	Total Cancer Risks: Tapwater Ingestion	Dermal Contact	Total
Shallow			
Trichloroethylene	5.5E-07	1.3E-07	**6.8E-07**
Deep			
Trichloroethylene	1.6E-07	3.8E-08	**2.0E-07**

Table 49R

Summary of Soil Cancer Risks and Hazard Indices
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Cancer Risk				Hazard Index			
	Soil Ingestion	Dermal Contact with Soil	Inhalation of Particulate/VOCs	Total	Soil Ingestion	Dermal Contact with Soil	Inhalation of Particulate/VOCs	Total
RME								
On-Site								
On-Site Worker	1.2E-05	1.1E-06	4.8E-08	1.3E-05	0.3	0.01	0.002	0.3
Trespasser	6.7E-06	3.4E-07	1.1E-08	7.1E-06	0.2	0.008	0.0003	0.3
Recreational Child	4.3E-05	5.3E-07	1.3E-08	4.3E-05	2	0.02	0.0004	2
Recreational Adult	4.3E-06	4.3E-07	9.0E-09	4.8E-06	0.2	0.005	0.0004	0.2
Construction Worker	1.6E-06	1.5E-07	1.4E-08	1.8E-06	0.9	0.02	0.002	1
Age-Adjusted Resident	1.6E-04	4.7E-06	1.9E-06	1.6E-04	NA	NA	NA	NA
Adult Resident	NA	NA	NA	NA	0.4	0.02	0.007	0.5
Child Resident	NA	NA	NA	NA	5	0.09	0.007	5
Flenniken Branch								
On-Site Worker	9.6E-06	7.7E-07	3.6E-08	1.0E-05	0.2	0.005	0.001	0.2
Trespasser	5.5E-06	3.1E-07	8.7E-09	5.9E-06	0.2	0.004	0.0002	0.2
Recreational Child	3.3E-05	9.0E-07	1.0E-08	3.4E-05	1	0.01	0.004	1
Recreational Adult	2.9E-06	2.9E-07	6.8E-09	3.2E-06	0.1	0.002	0.004	0.1
Construction Worker	1.0E-06	7.7E-08	1.4E-09	1.1E-06	0.7	0.01	0.02	0.8
Age-Adjusted Resident	1.4E-04	3.0E-06	5.5E-07	1.4E-04	NA	NA	NA	NA
Adult Resident	NA	NA	NA	NA	0.3	0.007	0.07	0.4
Child Resident	NA	NA	NA	NA	4	0.04	0.07	4
CTE								
On-Site								
On-Site Worker	1.4E-06	4.6E-08	5.8E-09	1.4E-06	0.08	0.0009	0.0004	0.08
Trespasser	1.7E-06	2.4E-08	2.8E-09	1.7E-06	0.06	0.0006	0.00009	0.06
Recreational Child	5.3E-06	8.8E-08	3.3E-09	5.4E-06	0.2	0.003	0.0001	0.2
Recreational Adult	2.4E-07	1.4E-08	1.0E-09	2.6E-07	0.02	0.0004	0.0001	0.02
Construction Worker	1.2E-07	2.4E-08	3.5E-09	1.5E-07	0.08	0.004	0.0004	0.08
Age-Adjusted Resident	6.6E-05	6.0E-07	1.9E-07	6.7E-05	NA	NA	NA	NA
Adult Resident	NA	NA	NA	NA	0.2	0.002	0.005	0.2
Child Resident	NA	NA	NA	NA	2	0.02	0.005	2
Flenniken Branch								
On-Site Worker	1.2E-06	3.1E-08	4.3E-09	1.2E-06	0.06	0.0003	0.0003	0.06
Trespasser	1.4E-06	2.2E-08	2.2E-09	1.4E-06	0.04	0.0003	0.00006	0.04
Recreational Child	4.1E-06	1.1E-07	2.6E-09	4.2E-06	0.1	0.002	0.0009	0.1
Recreational Adult	1.6E-07	9.4E-09	7.6E-10	1.7E-07	0.01	0.0002	0.0009	0.01
Construction Worker	7.7E-08	1.3E-08	3.6E-10	9.1E-08	0.2	0.002	0.004	0.2
Age-Adjusted Resident	5.1E-05	3.7E-07	1.5E-07	5.1E-05	NA	NA	NA	NA
Adult Resident	NA	NA	NA	NA	0.2	0.001	0.04	0.2
Child Resident	NA	NA	NA	NA	2	0.01	0.04	2

Table 50

Summary of Groundwater Cancer Risks and Hazard Indices
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Cancer Risk				Hazard Index			
	Tapwater Ingestion	Dermal Contact with Groundwater	Inhalation of VOCs	Total	Tapwater Ingestion	Dermal Contact with Groundwater	Inhalation of VOCs	Total
RME								
Shallow Groundwater								
On-Site Worker	3.1E-04	---	---	3.1E-04	199	---	---	199
Age-Adjusted Resident	8.6E-04	5.0E-04	2.8E-09	1.4E-03	---	---	---	---
Adult Resident	---	---	---	---	279	16	0.000068	296
Child Resident	---	---	---	---	465	22	---	487
Deep Groundwater								
On-Site Worker	2.7E-04	---	---	2.7E-04	132	---	---	132
Age-Adjusted Resident	6.9E-04	1.0E-03	1.1E-09	1.7E-03	---	---	---	---
Adult Resident	---	---	---	---	185	26	0.000040	211
Child Resident	---	---	---	---	307	38	---	345
CTE								
Shallow Groundwater								
On-Site Worker	3.7E-05	---	---	3.7E-05	50	---	---	50
Age-Adjusted Resident	3.0E-04	1.6E-04	1.0E-09	4.6E-04	---	---	---	---
Adult Resident	---	---	---	---	140	8.7	0.000068	148
Child Resident	---	---	---	---	232	12	---	245
Deep Groundwater								
On-Site Worker	3.2E-05	---	---	3.2E-05	33	---	---	33
Age-Adjusted Resident	2.3E-04	4.2E-04	4.1E-10	6.5E-04	---	---	---	---
Adult Resident	---	---	---	---	92	16	0.000040	109
Child Resident	---	---	---	---	154	26	---	180

Table 51

Summary of Fish Ingestion Cancer Risks and Hazard Indices
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Cancer Risk Fish Ingestion	Hazard Index Fish Ingestion
RME		
Knob Creek - Carp		
Adult Angler	2.5E-03	45
Child Angler	1.8E-03	119
Knob Creek - Largemouth Bass		
Adult Angler	2.7E-04	5.8
Child Angler	3.8E-04	15
Knob Creek - All Species		
Adult Angler	2.4E-03	46
Child Angler	1.7E-03	122
CTE		
Knob Creek - Carp		
Adult Angler	6.3E-04	11
Child Angler	4.6E-04	30
Knob Creek - Largemouth Bass		
Adult Angler	6.7E-05	1.5
Child Angler	9.5E-05	3.9
Knob Creek - All Species		
Adult Angler	6.1E-04	11
Child Angler	4.2E-04	31

Table 52

Summary of Inhalation Cancer Risks and Hazard Indices
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Cancer Risk	Hazard Index
	Inhalation	Inhalation
RME		
On-Site Worker	8.3E-04	15
Resident	3.6E-03	63
CTE		
On-Site Worker	1.0E-04	1.8
Resident	1.4E-03	24

Table 53R

Summary of Cumulative Cancer Risks and Hazard Indices
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Cancer Risk			Total Cancer Risk	Hazard Index			Total Hazard Index
	Soil	Groundwater	Soil Gas		Soil	Groundwater	Soil Gas	
RME								
On-Site - Shallow								
On-Site Worker	1.3E-05	3.1E-04	8.3E-04	1.2E-03	0.3	199	15	215
Age-Adjusted Resident	1.6E-04	1.4E-03	3.6E-03	5.2E-03	NA	NA	63	63
Adult Resident	NA	NA	NA	NA	0.5	296	NA	296
Child Resident	NA	NA	NA	NA	5	487	NA	492
On-Site - Deep								
On-Site Worker	1.3E-05	2.7E-04	8.3E-04	1.1E-03	0.3	132	15	147
Age-Adjusted Resident	1.6E-04	1.7E-03	3.6E-03	5.5E-03	NA	NA	63	NA
Adult Resident	NA	NA	NA	NA	0.5	211	NA	211
Child Resident	NA	NA	NA	NA	5	345	NA	350
Flenniken Branch - Shallow								
On-Site Worker	1.0E-05	3.1E-04	8.3E-04	1.2E-03	0.3	199	15	215
Age-Adjusted Resident	1.4E-04	1.4E-03	3.6E-03	5.1E-03	NA	NA	63	NA
Adult Resident	NA	NA	NA	NA	0.5	296	NA	296
Child Resident	NA	NA	NA	NA	5	487	NA	492
Flenniken - Deep								
On-Site Worker	1.0E-05	2.7E-04	8.3E-04	1.1E-03	0.3	132	15	147
Age-Adjusted Resident	1.4E-04	1.7E-03	3.6E-03	5.5E-03	NA	NA	63	NA
Adult Resident	NA	NA	NA	NA	0.5	211	NA	211
Child Resident	NA	NA	NA	NA	5	345	NA	350
CTE								
On-Site - Shallow								
On-Site Worker	1.4E-06	3.7E-05	1.0E-04	1.4E-04	0.08	50	2	52
Age-Adjusted Resident	6.7E-05	4.6E-04	1.4E-03	1.9E-03	NA	NA	24	24
Adult Resident	NA	NA	NA	NA	0.2	148	NA	148
Child Resident	NA	NA	NA	NA	2	245	NA	247
On-Site - Deep								
On-Site Worker	1.4E-06	3.2E-05	1.0E-04	1.3E-04	0.08	33	2	35
Age-Adjusted Resident	6.7E-05	6.5E-04	1.4E-03	2.1E-03	NA	NA	24	NA
Adult Resident	NA	NA	NA	NA	0.2	109	NA	109
Child Resident	NA	NA	NA	NA	2	180	NA	182
Flenniken Branch - Shallow								
On-Site Worker	1.2E-06	3.7E-05	1.0E-04	1.4E-04	0.06	50	2	52
Age-Adjusted Resident	5.1E-05	4.6E-04	1.4E-03	1.9E-03	NA	NA	24	NA
Adult Resident	NA	NA	NA	NA	0.2	148	NA	148
Child Resident	NA	NA	NA	NA	2	245	NA	246
Flenniken - Deep								
On-Site Worker	1.2E-06	3.2E-05	1.0E-04	1.3E-04	0.06	33	2	35
Age-Adjusted Resident	5.1E-05	6.5E-04	1.4E-03	2.1E-03	NA	NA	24	NA
Adult Resident	NA	NA	NA	NA	0.2	109	NA	109
Child Resident	NA	NA	NA	NA	2	180	NA	182

*Note that only the on-site worker and resident receptors were evaluated for more than one exposure medium. The cancer risks and hazard indices for the remaining receptors are presented in Tables 49 through 52.

Table 54R

Summary of COC Exceedances - Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Receptor Scenario							
			Recreational User		Construction Worker	Resident		
	On-Site Worker	Trespasser	Child	Adult		Age-Adjusted	Child	Adult
RME								
On-Site								
2,3,7,8-TCDD TEQ	C		C			C		
PCB-1232								
Arsenic	C	C	C	C		C		
Chromium	C	C	C	C		C		
Flenniken Branch								
Benzo(a)pyrene			C			C		
2,3,7,8-TCDD TEQ						C		
Arsenic	C	C	C	C		C		
Chromium	C	C	C	C		C		
Thallium							NC	
CTE								
On-Site								
2,3,7,8-TCDD TEQ						C		
Arsenic				C		C		
Chromium		C	C	C		C		
Flenniken Branch								
Benzo(a)pyrene						C		
Arsenic						C		
Chromium			C			C		

Note that shaded cells indicate a carcinogenic risk exceeding 1E-04 or a total HI exceeding 1.0.
C = Carcinogenic risk exceeding 1E-06.
NC = Noncancer HQ exceeding 1.0

Table 55

Summary of COC Exceedances - Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Receptor Scenario			
		Resident		
	On-Site Worker	Age-Adjusted	Child	Adult
RME				
Shallow				
2,4-Dinitrotoluene	C	C		
4,4-DDT		C		
Benzene				
bis(2-Ethylhexyl) phthalate	C	C	NC	NC
Chloroform	C	C		
Dieldrin	C	C		
Pentachlorophenol	C	C		
Trichloroethene		C		
Aluminum	NC		NC	NC
Antimony				
Arsenic	C and NC	C	NC	NC
Beryllium				
Cadmium				
Chromium	C	C		
Cobalt	NC		NC	NC
Cyanide				
Manganese	NC		NC	NC
Mercury			NC	
Molybdenum			NC	
Nickel			NC	NC
Thallium	NC		NC	NC
Zinc	NC		NC	NC
Deep				
1,2-Dichloroethane		C		
2,4-Dinitrotoluene	C	C		
2,6-Dinitrotoluene	C	C		
bis(2-Ethylhexyl) phthalate	C	C	NC	NC
Dieldrin	C	C		
Heptachlor Epoxide	C	C		
Pentachlorophenol	C	C		
Arsenic	C	C	NC	
Chromium	C	C		
Cobalt	NC		NC	NC
Cyanide			NC	
Manganese	NC		NC	NC
Molybdenum			NC	NC
Thallium	NC		NC	NC
CTE				
Shallow				
2,4-Dinitrotoluene	C	C		
bis(2-Ethylhexyl) phthalate		C	NC	NC
Chloroform		C		
Dieldrin		C		
Pentachlorophenol	C	C		
Aluminum			NC	
Arsenic	C	C	NC	
Cadmium				
Chromium	C	C		
Cobalt	NC		NC	NC
Cyanide				
Manganese	NC		NC	NC
Nickel				
Thallium	NC		NC	NC
Zinc			NC	NC
Deep				
2,4-Dinitrotoluene	C	C		
2,6-Dinitrotoluene	C	C		
bis(2-Ethylhexyl) phthalate		C	NC	NC
Dieldrin		C		
Heptachlor Epoxide		C		
Pentachlorophenol		C		
Arsenic	C	C		
Chromium	C	C		
Cobalt			NC	
Manganese	NC		NC	NC
Thallium	NC		NC	NC

Note that shaded cells indicate a carcinogenic risk exceeding 1E-04 or a total HI exceeding 1.0.
C = Carcinogenic risk exceeding 1E-06.
NC = Noncancer HQ exceeding 1.0

Table 56

Summary of COC Exceedances - Fish
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Receptor Scenario	
	Angler	
	Child	Adult
RME		
Knob Creek Carp		
2,3,7,8-TCDD TEQ	C and NC	C and NC
PCB Dioxin-like Congener TEQ	C and NC	C and NC
PCB-1260	C	C
Arsenic	C	C
Chromium	C	C
Largemouth Bass		
2,3,7,8-TCDD TEQ	C and NC	C
PCB Dioxin-like Congener TEQ	C and NC	C and NC
PCB-1260	C	C
Chromium	C	C
Mercury	NC	NC
All Species		
2,3,7,8-TCDD TEQ	C and NC	C and NC
PCB Dioxin-like Congener TEQ	C and NC	C and NC
PCB-1260	C	C
Arsenic	C	C
Chromium	C	C
Mercury	NC	NC
CTE		
Knob Creek Carp		
2,3,7,8-TCDD TEQ	C and NC	C
PCB Dioxin-like Congener TEQ	C and NC	C and NC
PCB-1260	C	C
Arsenic	C	C
Chromium	C	C
Largemouth Bass		
2,3,7,8-TCDD TEQ	C	C
PCB Dioxin-like Congener TEQ	C and NC	C
PCB-1260	C	C
Chromium	C	C
All Species		
2,3,7,8-TCDD TEQ	C and NC	C
PCB Dioxin-like Congener TEQ	C and NC	C and NC
PCB-1260	C	C
Arsenic	C	C
Chromium	C	C

Note that shaded cells indicate a carcinogenic risk exceeding 1E-04 or a total HI exceeding 1.0.
C = Carcinogenic risk exceeding 1E-06.
NC = Noncancer HQ exceeding 1.0

Table 57

Summary of COC Exceedances - Soil Gas
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Unit/ Receptor	Receptor Scenario	
	On-Site Worker	Resident
RME		
1,1-Dichloroethane	C	C
1,2-Dichloroethane	C and NC	C and NC
Benzene	C	C
Chloroform	C	C
Chloromethane	NC	NC
Ethylbenzene	---	C
CTE		
1,1-Dichloroethane	C	C
1,2-Dichloroethane	NC	C and NC
Benzene	---	C
Chloroform	---	C
Chloromethane	---	NC
Ethylbenzene	---	C

Note that shaded cells indicate a carcinogenic risk exceeding 1E-04 or a total HI exceeding 1.0.
C = Carcinogenic risk exceeding 1E-06.
NC = Noncancer HQ exceeding 1.0

Table 58

Summary of Soil Remedial Goal Options - Residential Soil Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Chemical of Concern[2]	Exposure Unit	Soil RGOs[1] (units in mg/kg)					
		Cancer-Based			Noncancer-Based		
		1E-06	1E-05	1E-04	0.1	1	3
Chromium	On-Site	0.3	3	30	---	---	---
Thallium	Flenniken Branch	---	---	---	0.08	0.8	2

[1]RGOs based on RME residential exposure assumptions

[2]Per EPA Region 4 guidance, carcinogenic COCs selected based on risks in exceedance of 1E-04. Noncancer COCs selected based on HQs in exceedance of 1 and/or contributing to target organ-specific HIs greater than 1.0 (EPA, 2000).

Table 59

Summary of Soil Remedial Goal Options - On-Site Worker Soil Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Chemical of Concern[2]	Exposure Unit	Soil RGOs[1] (units in mg/kg)					
		Cancer-Based			Noncancer-Based		
		1E-06	1E-05	1E-04	0.1	1	3
Chromium	On-Site	7	65	654	350	37	0.1

[1]RGOs based on RME on-site worker exposure assumptions.

[2]Per EPA Region 4 guidance, carcinogenic COCs selected based on risks in exceedance of 1E-04. Noncancer COCs selected based on HQs in exceedance of 1 and/or contributing to target organ-specific HIs greater than 1.0 (EPA, 2000).

Table 7-2
Summary of Groundwater Remedial Goal Options - Residential Use of Groundwater
Smokey Mountain Smelters
Knoxville, Knox County, Tennessee

Chemical of Concern[2]	Groundwater Depth	Groundwater Remedial Goal Options[1] (units in µg/L)						MCL[3] (µg/L)
		Cancer-Based			Noncancer-Based			
		1E-06	1E-05	1E-04	0.1	1	3	
Aluminum	Shallow	NA	NA	NA	1,997	19,967	59,900	NA
Ammonia	Shallow	NA	NA	NA	NA	30,000 [4]	NA	NA
Arsenic	Shallow, Deep	0.05	0.5	5	0.6	6	18	10
Chromium	Shallow, Deep	0.04	0.4	4	NA	NA	NA	100
Cobalt	Shallow, Deep	NA	NA	NA	0.6	6	18	NA
Fluoride	Shallow	NA	NA	NA	NA	NA	NA	4,000
Manganese	Shallow, Deep	NA	NA	NA	43	433	1,300	NA
Mercury	Shallow	NA	NA	NA	0.6	6	17	2
Molybdenum	Shallow, Deep	NA	NA	NA	10	100	300	NA
Nickel	Shallow	NA	NA	NA	39	392	1,177	NA
Nitrate/Nitrite	Shallow	NA	NA	NA	NA	NA	NA	10,000
Pentachlorophenol	Shallow, Deep	0.2	2	21	10	100	301	1
Thallium	Shallow, Deep	NA	NA	NA	0.02	0.2	0.6	2
Zinc	Shallow	NA	NA	NA	600	6,001	18,002	NA

Notes

[1] RGOs based on RME residential exposure assumptions.

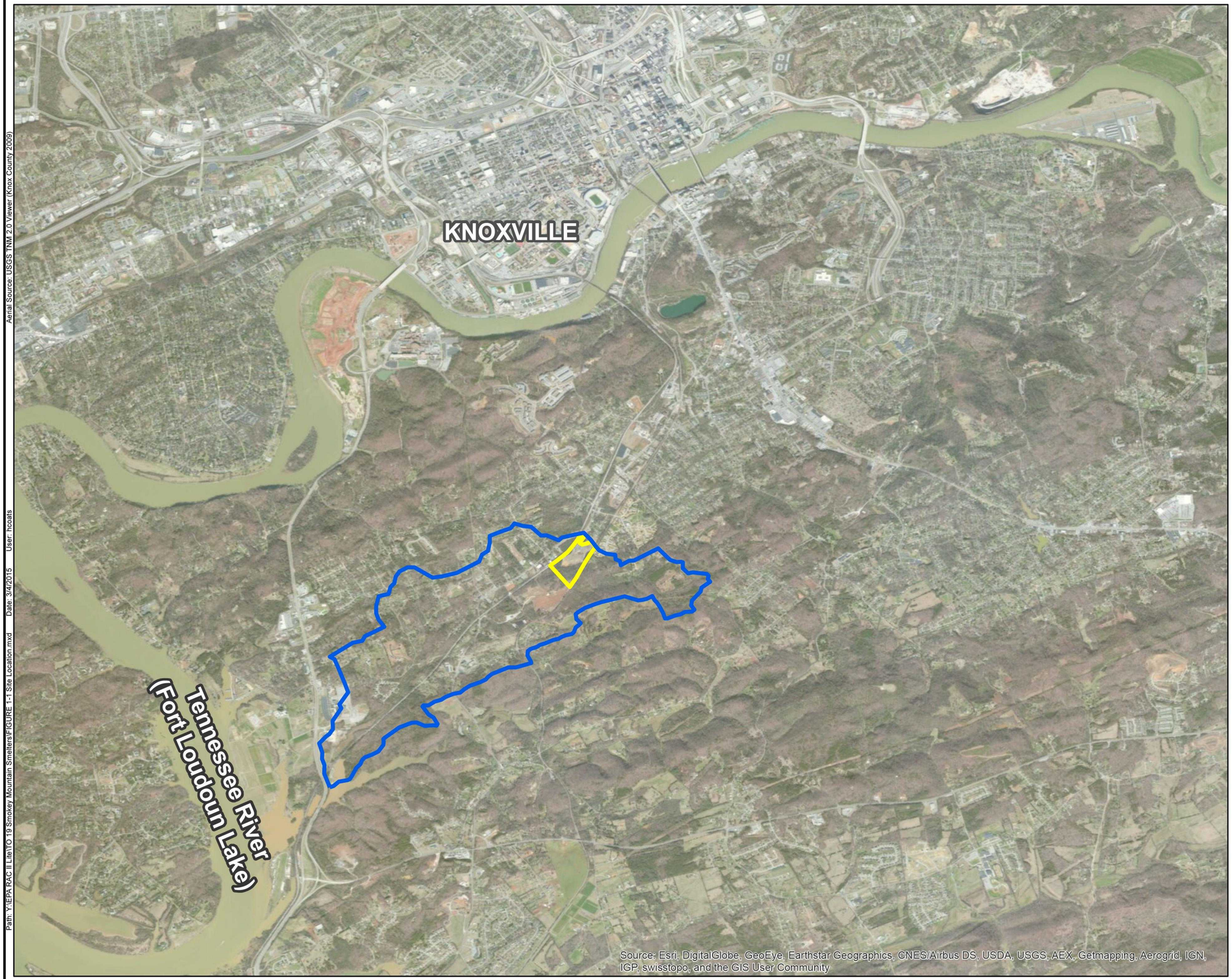
[2] Per EPA Region 4 guidance, carcinogenic chemicals of concern (COCs) selected based on risks in exceedance of 1E-04. Noncancer COCs selected based on HQs in exceedance of 1 and/or contributing to target organ-specific HIs greater than 1.0 (EPA, 2000).

[3] MCL - Maximum contaminant level

[4] EPA Lifetime Health Advisory

NA - Not applicable

FIGURES



Legend

Watershed Boundary

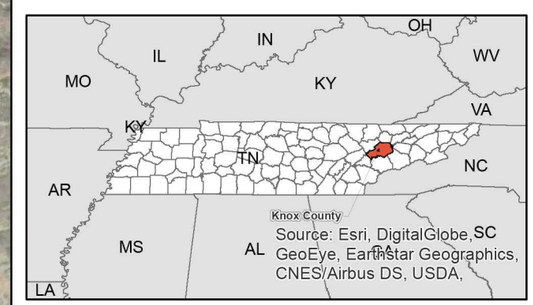
Approximate Site Boundary

N

Miles

0 1 2

WGS84



SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 1-1
Site Location

J.M.WALLER® ASSOCIATES, INC.

A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009)

Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\FIGURE 1-1 Site Location.mxd Date: 3/4/2015 User: hcoats

Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009)

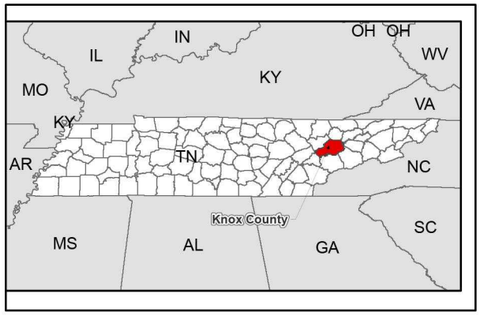
Path: Y:\EPA RAC II LiteTO 19 Smokey Mountain Smelters\GIS\Figure 2-2 Site Layout.mxd Date: 4/25/2015 User: hcoats

Legend

- SMS Site Features Points
- Railroad Tracks
- Abandoned Railroad Spur
- Montgomery Village Apts.
- Historic Surface Water Areas
- SMS CAP Area (Footprint of former process building)
- SMS CAP Area 2 (Footprint of the former waste area)
- Former Structure
- Waste Pile
- SMS Approx Site Boundary
- Temporary Gravel Road
- Former Settling Ponds
- Pond
- Surface Water Pathway

Feet
0 95 190 380
WGS84

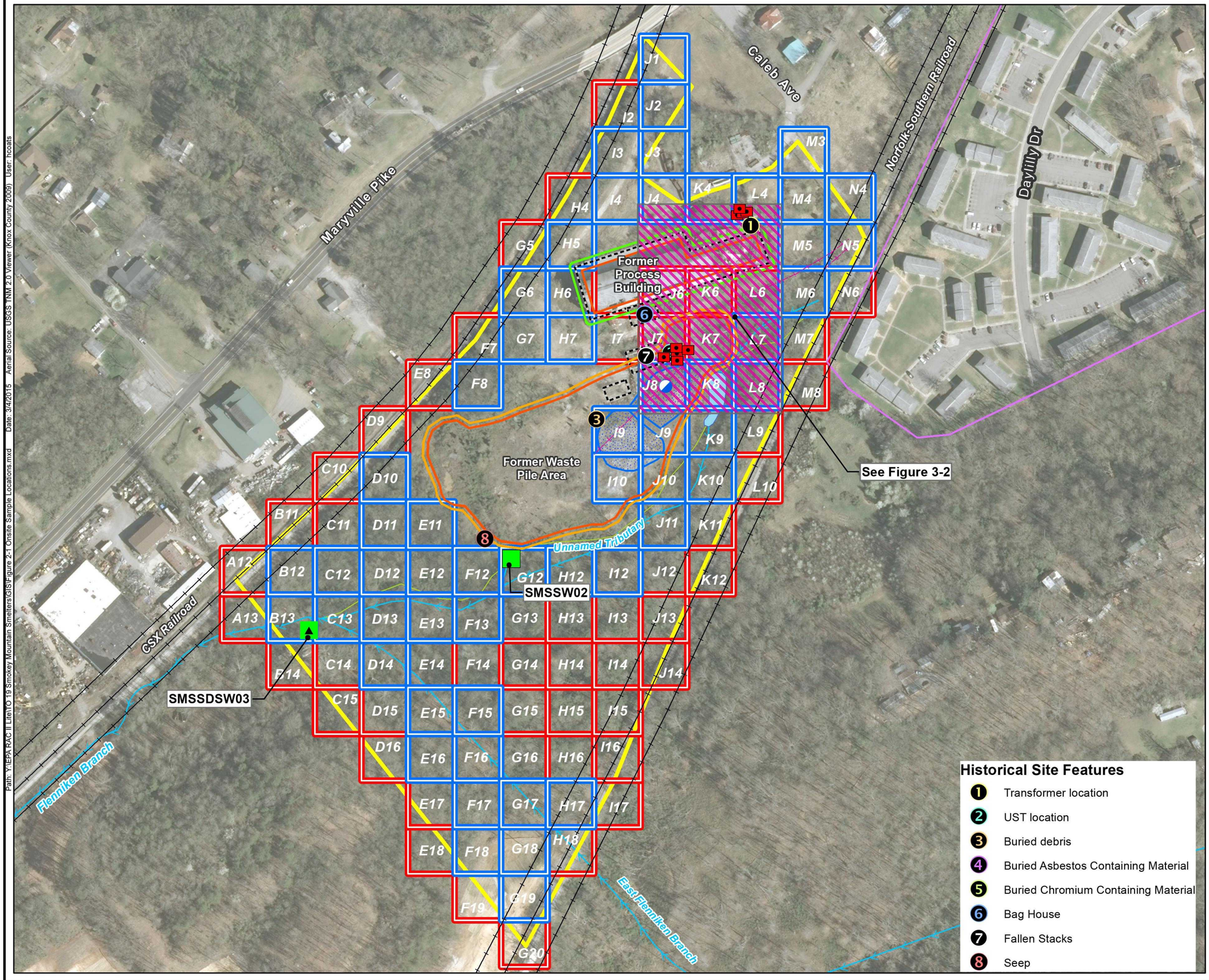
N



SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 1-2
SITE LAYOUT

J.M.WALLER® ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS



Legend

- Sediment
- Co-Located Sample
- Surface Water
- Soil & Groundwater
- Subsurface Soil
- Railroad Tracks
- Montgomery Village Apts.
- Proposed Limits of Cap (Footprint of former process building)
- Proposed Limits of Cap (Footprint of the former waste area)

SMS Site Features

- Former Structure
- Waste Pile

GRIDS

- Sampled *(Surface soil samples were collected at the centroid of each grid from 0 to 1 foot below ground surface)*
- Not Sampled
- Site Boundary
- Former Settling Ponds
- Pond
- Surface Water Pathway
- Surface Water Body

Feet: 0, 100, 200, 400

WGS84

N

Historical Site Features

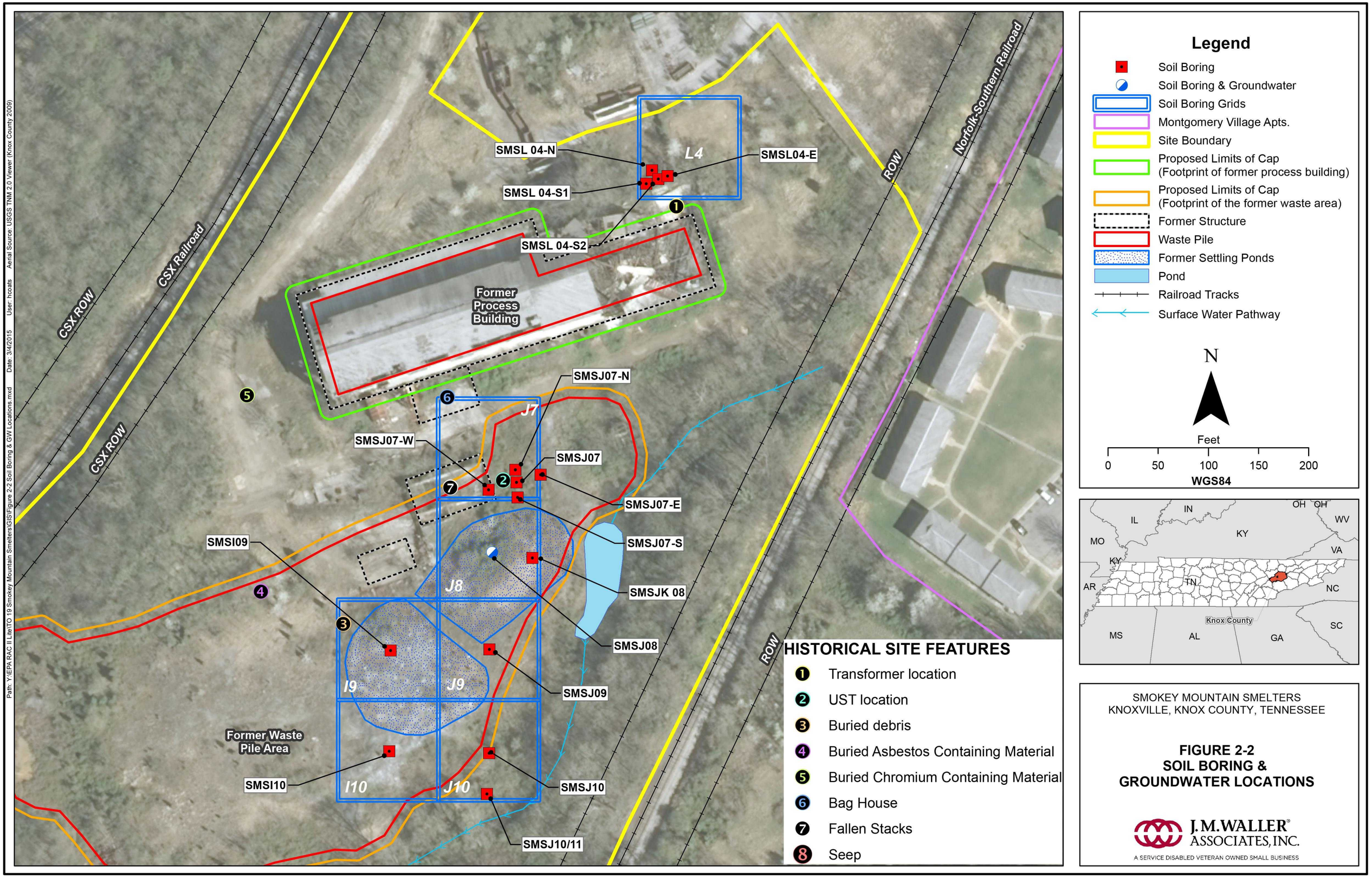
1. Transformer location
2. UST location
3. Buried debris
4. Buried Asbestos Containing Material
5. Buried Chromium Containing Material
6. Bag House
7. Fallen Stacks
8. Seep

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 2-1
ONSITE SAMPLE LOCATIONS

J.M.WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 2-1 Onsite Sample Locations.mxd Date: 3/4/2015 Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009) User: hcoats


Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 2-2 Soil Boring & GW Locations.mxd Date: 3/4/2015 User: hcoats Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009)
CSX ROW
CSX Railroad
CSX ROW
Norfolk-Southern Railroad
ROW
ROW
SMSL 04-N
SMSL04-E
SMSL 04-S1
SMSL 04-S2
L4
Former Process Building
SMSJ07-N
SMSJ07-W
SMSJ07
SMSJ07-E
SMSJ07-S
SMSJK 08
SMSJ08
SMSJ09
SMSI09
SMSI10
SMSJ10
SMSJ10/11
J7
J8
I9
J9
I10
J10
Former Waste Pile Area
Legend
Soil Boring
Soil Boring & Groundwater
Soil Boring Grids
Montgomery Village Apts.
Site Boundary
Proposed Limits of Cap (Footprint of former process building)
Proposed Limits of Cap (Footprint of the former waste area)
Former Structure
Waste Pile
Former Settling Ponds
Pond
Railroad Tracks
Surface Water Pathway
N
Feet
0 50 100 150 200
WGS84
IL IN OH OH WV MO KY VA KY AR TN NC MS AL GA SC
Knox County
HISTORICAL SITE FEATURES
1 Transformer location
2 UST location
3 Buried debris
4 Buried Asbestos Containing Material
5 Buried Chromium Containing Material
6 Bag House
7 Fallen Stacks
8 Seep
SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE
FIGURE 2-2
SOIL BORING &
GROUNDWATER LOCATIONS
J.M.WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Legend

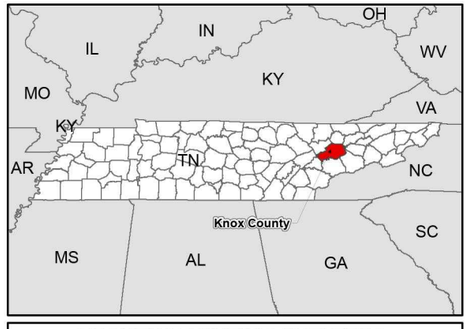
- Shallow Monitor Wells
- Deep Monitor Wells
- Railroad Tracks
- Railroad ROW
- SMS Approx Site Boundary
- Waste Area
- Montgomery Village Apts.
- Former Structure
- Temporary Gravel Road
- Drainage Ditch
- Pond
- Surface Water Pathway

N

Feet

0 87.5 175 350

WGS84

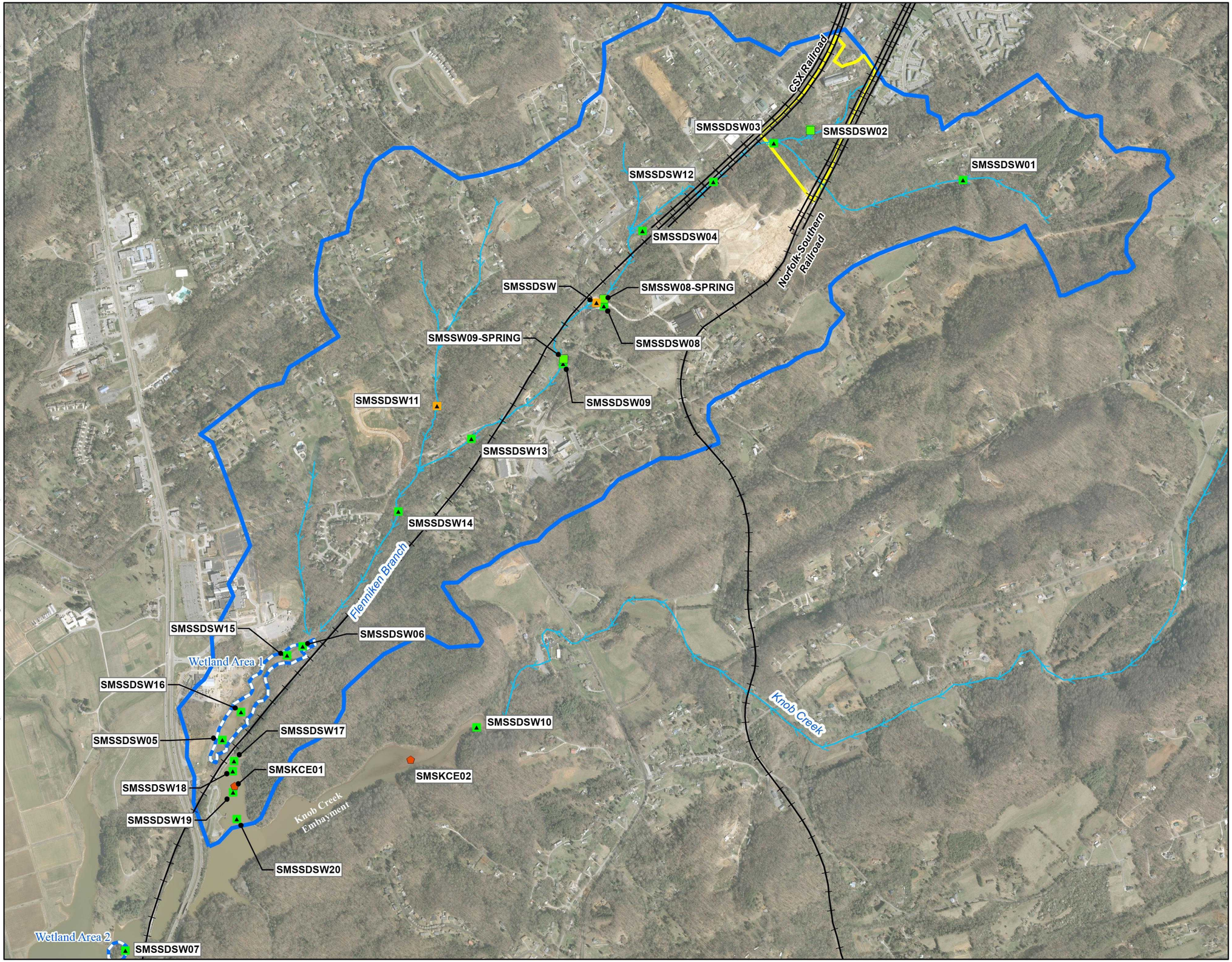


SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 2-3
Monitor Well Locations

J.M.WALLER® ASSOCIATES, INC.

A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS



Legend

Sample Locations

- Surface Water
- Co-Located
- Fish Tissue
- Surface Water/Sediment/Benthic
- Railroad Tracks
- Wetland Areas
- Surface Water Pathway
- SMS Approx Site Boundary
- Watershed Boundary

N

Feet

0 500 1,000 2,000

WGS84

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 2-4
Surface Water Sample Locations

J.M.WALLER ASSOCIATES, INC.
A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 2-4 Surface Water Sample Locations.mxd Date: 3/4/2015 User: hcoats Aerial Source: USGS TNM 2.0 Viewer (Knox County 2009)

Path: X:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 2-5 Soil Gas Locations.mxd Date: 3/4/2015 User: hcoats

Legend

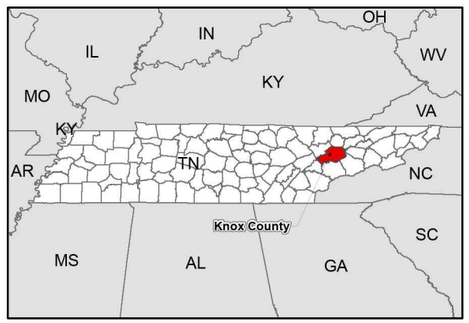
- Soil Vapor Locations
- Shallow Montior Wells
- Deep Monitor Wells
- Former Structure
- Waste Area
- SMS Site Boundary
- Drainage Ditch
- Pond
- Streams
- Railroad Tracks
- Railroad ROW

N

Feet

0 95 190 380

WGS84



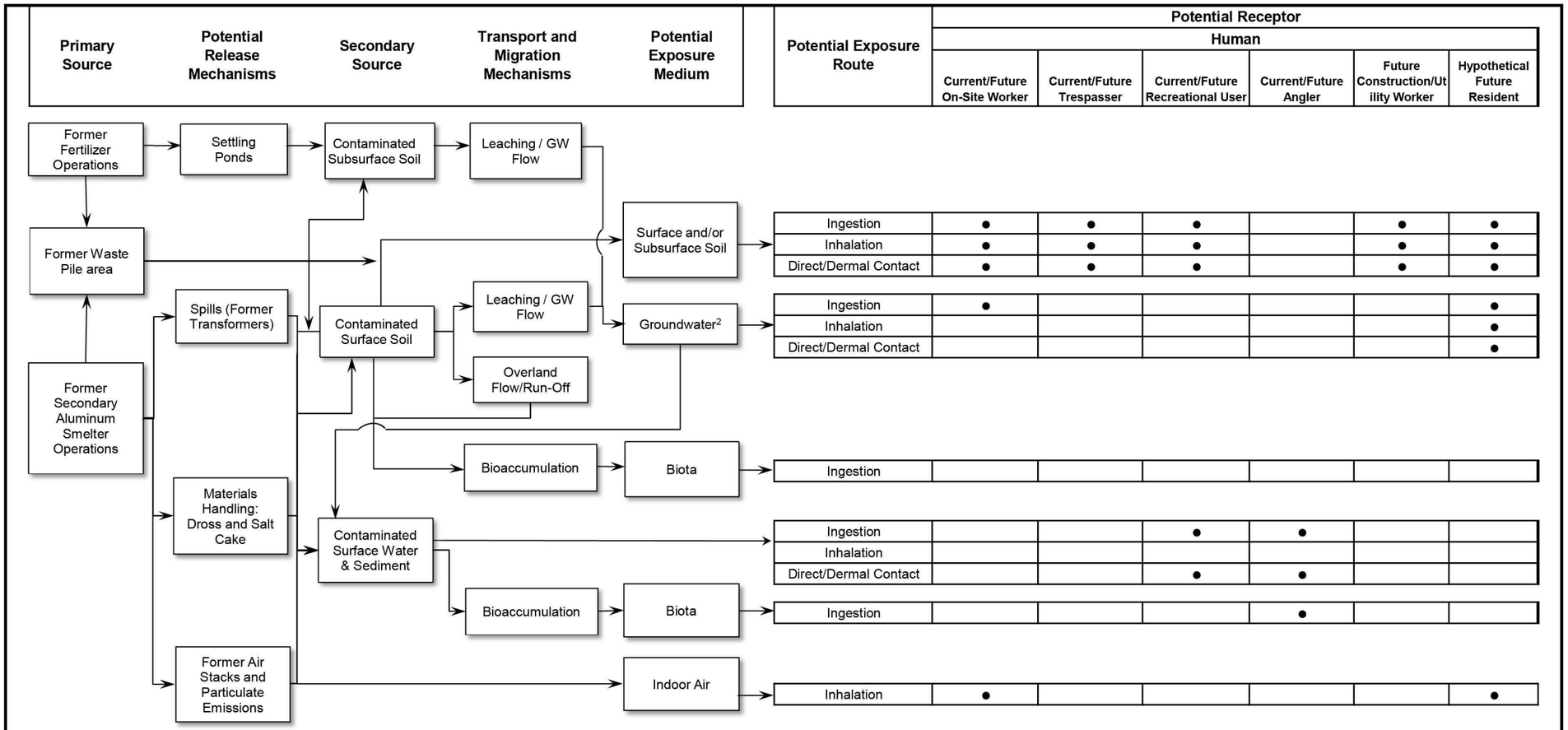
SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 2-5
Soil Gas Locations

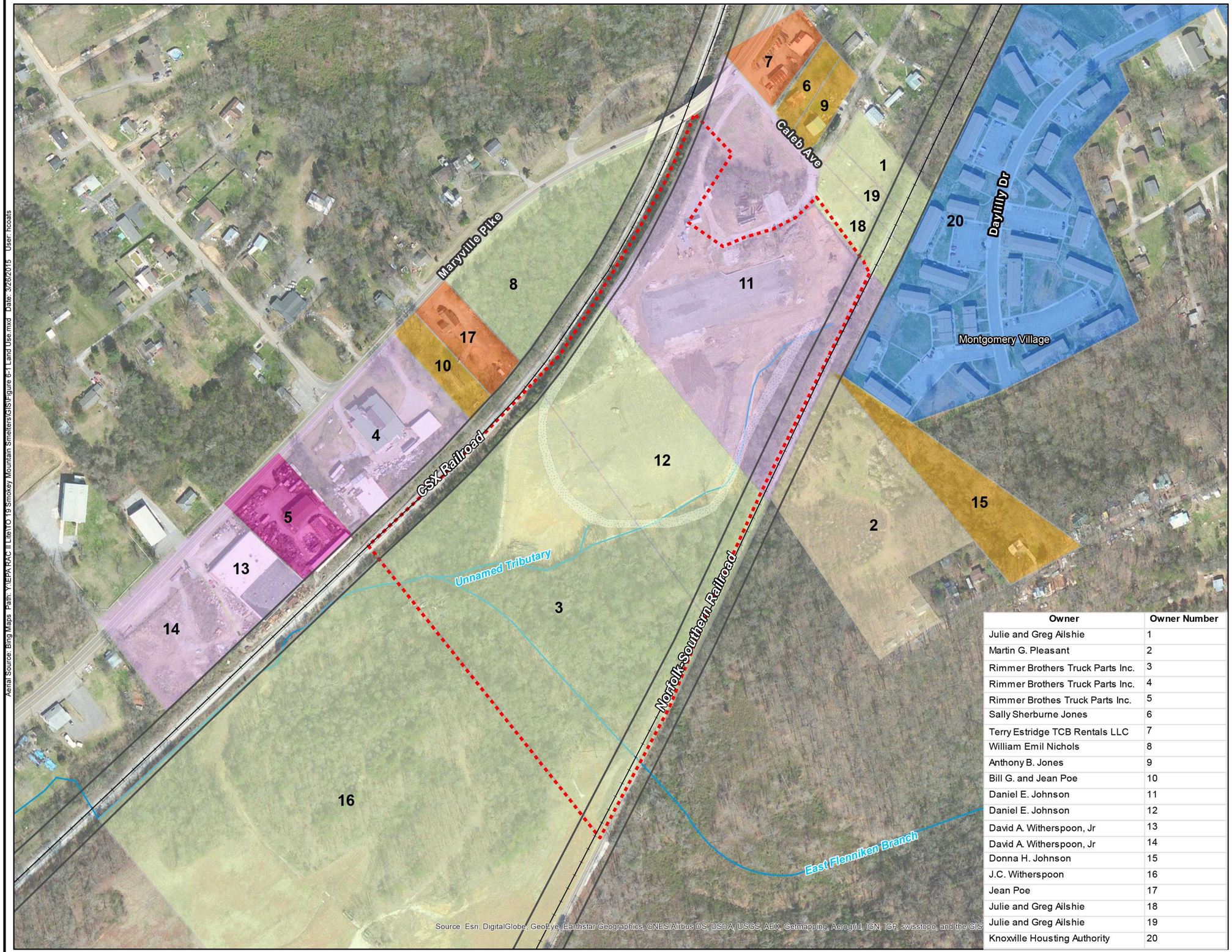
J.M.WALLER® ASSOCIATES, INC.

A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Figure 4-1
Human Health Conceptual Site Model
Smokey Mountain Smelters
Knoxville, Tennessee



Notes:
1. ● - Indicates a potentially complete exposure pathway.
2. Potential groundwater exposure would be through nearby potable wells. More information needed to determine if wells are affected.



Owner	Owner Number
Julie and Greg Ailshie	1
Martin G. Pleasant	2
Rimmer Brothers Truck Parts Inc.	3
Rimmer Brothers Truck Parts Inc.	4
Rimmer Brothes Truck Parts Inc.	5
Sally Sherburne Jones	6
Terry Estridge TCB Rentals LLC	7
William Emil Nichols	8
Anthony B. Jones	9
Bill G. and Jean Poe	10
Daniel E. Johnson	11
Daniel E. Johnson	12
David A. Witherspoon, Jr	13
David A. Witherspoon, Jr	14
Donna H. Johnson	15
J.C. Witherspoon	16
Jean Poe	17
Julie and Greg Ailshie	18
Julie and Greg Ailshie	19
Knoxville Housting Authority	20

Legend

- SMS Site Boundary
- Agriculture
- Commercial
- Industrial
- Office
- Public/Quasi Public Land
- Rural Residential
- Single Family Residential
- Drainage Ditch
- Streams
- Railroad Tracks
- Railroad ROW

N

Feet

0 125 250 500

WGS84

SMOKEY MOUNTAIN SMELTERS
KNOXVILLE, KNOX COUNTY, TENNESSEE

FIGURE 6-1
Land Use

J.M.WALLER® ASSOCIATES, INC.

A SERVICE DISABLED VETERAN OWNED SMALL BUSINESS

Aerial Source: Bing Maps Path: Y:\EPA RAC II Lite\TO 19 Smokey Mountain Smelters\GIS\Figure 6-1 Land Use.mxd Date: 3/26/2015 User: hcoats

APPENDIX A
SURFACE WATER EVALUATION

Appendix A
Surface Water Evaluation
Smokey Mountain Smelters
Knoxville, Tennessee

As noted in Section 4, based on the minimum likelihood of human health exposure to surface water and the low levels observed in the available surface water data, the surface water contact exposure scenarios were eliminated from consideration. This risk-based surface water screening evaluation was the basis of that determination.

Based on the minimum likelihood of human health exposure to surface water on-site and along Flenniken Branch, it was assumed that the surface water contact exposure scenarios for these EAs should be eliminated from consideration in the HHRA. To account for potential human health exposure to surface water in the Knob Creek Embayment, a risk-based surface water screening evaluation was performed.

There were 9 surface water samples collected within Knob Creek Embayment. Several VOCs and inorganics were detected in Knob Creek surface water. Table A-1 presents a summary of the analytes detected in surface water collected from Knob Creek, the screening toxicity value, and whether the maximum detected concentration exceeded the screening toxicity value. Updated National Recommended Water Quality Criteria (WQC) (EPA, 2014e) were used as the primary reference for the screening toxicity value. In the absence of a WQC, a site-specific surface water value for recreational exposure was calculated using the EPA on-line RSL calculator (EPA, 2015c) and input values used are as noted on Table A-2.

All of the detected chemicals were below the screening value, with the exception of arsenic and manganese. The ratios of the maximum detected concentrations to the RSLs for arsenic and manganese were 178 and 4.4. The ratios calculated from comparisons of soil, groundwater, and fish concentrations with their RSLs were either similar or much greater (groundwater). Additionally, the WQCs were used as a primary reference. If site-specific RSLs were used as screening toxicity values, manganese would not be a COPC and the arsenic ratio would be 1.6. From this, it is clear that the contribution to risks from the surface water pathway would be very small compared to the risks from

other pathways. Considering the minimal likelihood of human exposure to surface water and that the contribution to overall risk would be minimal, the surface water pathway was not quantitatively evaluated further in this risk assessment.

Table A-1
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Surface Water
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (N/C) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion
Tuckaleechee Embayment	67641	Acetone	12	12	ug/l	SMSSA20	1/4	10 - 10	12	41000 n	NO	BSL
	71432	Benzene	0.13	0.13	ug/l	SMSSA20	1/4	5 - 5	0.13	2.2	NO	BSL
	100414	Ethylbenzene	0.14	0.14	ug/l	SMSSA20	1/4	5 - 5	0.14	530	NO	BSL
	179601231	m- and p-Xylene	0.46	0.46	ug/l	SMSSA20	1/4	5 - 5	0.46	NEA	NO	NEA
	95476	o-Xylene	0.21	0.21	ug/l	SMSSA20	1/4	5 - 5	0.21	1170 n	NO	BSL
	108883	Toluene	0.54	0.54	ug/l	SMSSA20	1/4	5 - 5	0.54	1000	NO	BSL
	95636	1,2,4-Trimethylbenzene	0.18	0.18	ug/l	SMSSA20	1/2	5 - 5	0.18	NEA	NO	NEA
	7429905	Aluminum	130	490	ug/l	SMSSA17	8/9	200 - 200	490	46700 n	NO	BSL
	7440382	Arsenic	1	3.2	ug/l	SMSSA07	4/9	1 - 10	3.2	0.018	YES	ASL
	7440393	Barium	30	40	ug/l	SMSSA17	6/9	200 - 200	40	1000	NO	BSL
	7440702	Calcium	39000	62000	ug/l	SMSSA17	9/9	NA	62000	NUT	NO	NUT
	7440508	Copper	2	2	ug/l	SMSSA07	1/9	10 - 25	2	1300	NO	BSL
	57125	Cyanide	2.1	2.1	ug/l	SMSSA07	1/9	10 - 15	2.1	140.00	NO	BSL
	7439896	Iron	260	990	ug/l	SMSSA17	8/9	270 - 270	990	32700 n	NO	BSL
	7439921	Lead	1.1	1.2	ug/l	SMSSA17	2/9	1 - 10	1.2	15	NO	BSL
	7439954	Magnesium	3200	6500	ug/l	SMSSA20	9/9	NA	6500	NUT	NO	NUT
	7439965	Manganese	130	220	ug/l	SMSSA18, SMSSA19, SMSSA20	9/9	NA	220	50	YES	ASL
	7440097	Potassium	1400	2100	ug/l	SMSSA07	7/9	5000 - 5000	2100	NUT	NO	NUT
	7440235	Sodium	10000	32000	ug/l	SMSSA17	9/9	NA	32000	NUT	NO	NUT
	7440246	Strontium	120	160	ug/l	SMSSA17	5/5	NA	160	28000 n	NO	BSL
	7440315	Tin	17	17	ug/l	SMSSA20	1/5	15 - 15	17	28000 n	NO	BSL
	7440666	Zinc	2.6	7.8	ug/l	SMSSA20	2/9	10 - 60	7.8	5000	NO	BSL
	Conventional											
	7664417	Ammonia as N	67.7	160	ug/l	SMSSA20	3/3	NA	160	NEA	NO	NEA
	16887006	Chloride	15500	58600	ug/l	SMSSA20	5/5	NA	58600	NEA	NO	NEA
	16984488	Fluoride	74	240	ug/l	SMSSA20	2/5	1000 - 1000	240	1870 n	NO	BSL
	14797558	Nitrate as N	73	2300	ug/l	SMSSA20	4/4	NA	2300	10000	NO	BSL
	14797650	Nitrite as N	67	67	ug/l	SMSSA07	1/3	100 - 100	67	4670 n	NO	BSL
	14265442	Orthophosphate as P	19	19	ug/l	SMSSA20	1/4	1000 - 1000	19	NEA	NO	NEA
	14808798	Sulfate as SO4	1000	12200	ug/l	SMSSA20	5/5	NA	12200	NEA	NO	NEA
	18496258	Sulfide	200	200	ug/l	SMSSA20	1/1	NA	200	NEA	NO	NEA

Note: none

(1) Maximum detected concentration used for screening

(2) Nutrient Recommended Ambient Criteria AQC (water + organism) from EPA 2014c. In the absence of a AQC, tap water RSL were used (Regional Screening Levels, 2015).

ASL = above screening level

BSL = below screening level

n = screened against screening level at a target risk of 1E-06

NA = not applicable

NEA = No benchmark available

nc = non-screened against screening level at a target hazard quotient of 0.1

NUT = essential nutrient

Table A-2
Site-Specific Recreator Equation Inputs for Surface Water
Smokey Mountain Smelters
Knoxville, Tennessee

Variable	Value
TR (target cancer risk) unitless	0.000001
ED_{recw} (exposure duration - recreator) year	26
ED_{recwa} (exposure duration - adult) year	20
ED_{recwc} (exposure duration - child) year	6
ED_{0-2} (mutagenic exposure duration) year	2
ED_{2-6} (mutagenic exposure duration) year	4
ED_{6-16} (mutagenic exposure duration) year	10
ED_{16-30} (mutagenic exposure duration) year	10
THQ (target hazard quotient) unitless	0.1
LT (lifetime - recreator) year	70
EF (exposure frequency) day/year	104
EF_{recwa} (adult exposure frequency) day/year	104
EF_{recwc} (child exposure frequency) day/year	104
EF_{0-2} (mutagenic exposure frequency) day/year	104
EF_{2-6} (mutagenic exposure frequency) day/year	104
EF_{6-16} (mutagenic exposure frequency) day/year	104
EF_{16-30} (mutagenic exposure frequency) day/year	104
$ET_{recw-adj}$ (age-adjusted exposure time) hour/event	2
$ET_{recw-madj}$ (mutagenic age-adjusted exposure time)	2
ET_{recwa} (adult exposure time) hour/event	2
ET_{recwc} (child exposure time) hour/event	2
$ET_{recw0-2}$ (mutagenic exposure time) hour/event	2
$ET_{recw2-6}$ (mutagenic exposure time) hour/event	2
$ET_{recw6-16}$ (mutagenic exposure time) hour/event	2
$ET_{recw16-30}$ (mutagenic exposure time) hour/event	2
EV_{recwa} (adult) events/day	1
EV_{recwc} (child) events/day	1
EV_{0-2} (mutagenic) events/day	1
EV_{2-6} (mutagenic) events/day	1
EV_{6-16} (mutagenic) events/day	1
EV_{16-30} (mutagenic) events/day	1
BW_{recwc} (body weight - child) kg	15
BW_{recwa} (body weight - adult) kg	80
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-30} (mutagenic body weight) kg	80
SA_{recwc} (skin surface area - child) cm^2	6378
SA_{recwa} (skin surface area - adult) cm^2	20900
SA_{0-2} (skin surface area - mutagenic) cm^2	6378
SA_{2-6} (skin surface area - mutagenic) cm^2	6378
SA_{6-16} (skin surface area - mutagenic) cm^2	20900
SA_{16-30} (skin surface area - mutagenic) cm^2	20900
SA_{0-2} (mutagenic skin surface area) cm^2	6378
SA_{2-6} (mutagenic skin surface area) cm^2	6378
SA_{6-16} (mutagenic skin surface area) cm^2	20900
SA_{16-30} (mutagenic skin surface area) cm^2	20900
$IFW_{rec-adj}$ (age-adjusted water intake rate) L/kg	6.76
$IFWM_{rec-adj}$ (mutagenic age-adjusted water intake rate)	27.387
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm^2-event/kg	808724.8
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm^2-	2501865.6
IRW_{recwa} (water intake rate - adult) L/hr	0.05
IRW_{recwc} (water intake rate - child) L/hr	0.05
IRW_{0-2} (mutagenic water intake rate) L/hr	0.05
IRW_{2-6} (mutagenic water intake rate) L/hr	0.05
IRW_{6-16} (mutagenic water intake rate) L/hr	0.05
IRW_{16-30} (mutagenic water intake rate) L/hr	0.05
l_{sc} (apparent thickness of stratum corneum) cm	0.001

Output generated 18FEB2015:13:05:42

APPENDIX B
ProUCL OUTPUTS

APPENDIX B-1
ON-SITE SURFACE SOIL

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File [illegible]
Full Precision OFF
Confidence Coefficient [illegible]
Number of Bootstrap Operations [illegible]

Aluminum

General Statistics

Number of Valid Observations [illegible]

Number of Distinct Observations [illegible]

Raw Statistics

Minimum [illegible]
Maximum [illegible]
Mean [illegible]
Geometric Mean [illegible]
Median [illegible]
SD [illegible]
Std. Error of Mean [illegible]
Coefficient of Variation [illegible]
Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]
Maximum of Log Data [illegible]
Mean of Log Data [illegible]
SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]
Shapiro-Wilk critical value [illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]
95% Modified-t UCL (Johnson-1978) [illegible]

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]
Shapiro-Wilk critical value [illegible]

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL [illegible]
95% Chebyshev (MVUE) UCL [illegible]
97.5% Chebyshev (MVUE) UCL [illegible]
99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected) [illegible]
Theta Star [illegible]
nu star [illegible]
A-D Test Statistic [illegible]
Anderson-Darling Test Statistic [illegible]
Kolmogorov-Smirnov Test Statistic [illegible]
Kolmogorov-Smirnov critical value [illegible]

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when k star > 0.5) [illegible]
95% Adjusted Gamma UCL (use when k star ≤ 0.5) [illegible]

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL [illegible]
95% Jackknife UCL [illegible]
95% Standard Bootstrap UCL [illegible]
95% Bootstrap-t UCL [illegible]
95% Hall's Bootstrap UCL [illegible]
95% Percentile Bootstrap UCL [illegible]
95% BCA Bootstrap UCL [illegible]
95% Chebyshev(Mean, Sd) UCL [illegible]
97.5% Chebyshev(Mean, Sd) UCL [illegible]
99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

Use 95% Chebyshev(Mean, Sd) UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 22

Raw Statistics

Minimum: 6.9
Maximum: 6
Mean: 15.99
Geometric Mean: 14.99
Median: 15
SD: 6.051
Std. Error of Mean: 0.64
Coefficient of Variation: 0.7
Skewness: 1.2

Log-transformed Statistics

Minimum of Log Data: 1.9
Maximum of Log Data: 5.4
Mean of Log Data: 2.70
SD of Log Data: 0.61

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.911
Shapiro Wilk Critical Value: 0.947
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.9
Shapiro Wilk Critical Value: 0.947
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 17.44
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL (Chen-1995): 17.5
95% Modified-UCL (Johnson-1977): 17.47

Assuming Lognormal Distribution

95% H-UCL: 17.59
95% Chebyshev (MVUE) UCL: 19.67
97.5% Chebyshev (MVUE) UCL: 21.27
99% Chebyshev (MVUE) UCL: 24.4

Gamma Distribution Test

K-Star (bias corrected): 7.442
Theta Star: 2.149
MLE of Mean: 15.99
MLE of Standard Deviation: 5.62
nu star: 72.9
Approximate Chi Square Value: 05.667
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 66.5

Anderson-Darling Test Statistic: 0.49
Anderson-Darling 5% Critical Value: 0.751
Kolmogorov-Smirnov Test Statistic: 0.052
Kolmogorov-Smirnov 5% Critical Value: 0.127
Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 17.41
95% Jackknife UCL: 17.44
95% Standard Error Trap UCL: 17
95% Error Trap UCL: 17.66
95% Half Error Trap UCL: 17.69
95% Percentile Error Trap UCL: 17.42
95% Error Error Trap UCL: 17.61
95% Chebyshev (Mean, Sd) UCL: 19.76
97.5% Chebyshev (Mean, Sd) UCL: 21.9
99% Chebyshev (Mean, Sd) UCL: 24.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 17.47
95% Adjusted Gamma UCL (Use when n >= 40): 17.52

Potential UCL to Use

Use 95% Approximate Gamma UCL: 17.47

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Chromium

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 27

Raw Statistics

Minimum: 14
Maximum: 4
Mean: 2.41
Geometric Mean: 29.0
Median: 2
SD: 17.6
Std. Error of Mean: 2.4
Coefficient of Variation: 0.5
Skewness: 1.744

Log-transformed Statistics

Minimum of Log Data: 2.6
Maximum of Log Data: 4.4
Mean of Log Data: 6
SD of Log Data: 0.45

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.794
Shapiro Wilk Critical Value: 0.947
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.9
Shapiro Wilk Critical Value: 0.947
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 6.57
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL (Chen-1995): 7.15
95% Modified-UCL (Johnson-1978): 6.67

Assuming Lognormal Distribution

95% H-UCL: 1
95% Chebyshev (MVUE) UCL: 41.51
97.5% Chebyshev (MVUE) UCL: 45.59
99% Chebyshev (MVUE) UCL: 5

Gamma Distribution Test

K-Star (bias corrected): 4.42
Theta Star: 7.19
MLE of Mean: 2.41
MLE of Standard Deviation: 15.4
nu star: 4.4
Approximate Chi Square Value (.05): 6.7
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 5

Anderson-Darling Test Statistic: 1
Anderson-Darling 5% Critical Value: 0.754
Kolmogorov-Smirnov Test Statistic: 0.14
Kolmogorov-Smirnov 5% Critical Value: 0.127
Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL: 6.49
95% Jackknife UCL: 6.57
95% Standard Error Trap UCL: 6.49
95% Error Trap UCL: 7.7
95% Half Error Trap UCL: 7.26
95% Percentile Error Trap UCL: 6
95% Error Error Trap UCL: 7.1
95% Chebyshev (Mean, Sd) UCL: 4.22
97.5% Chebyshev (Mean, Sd) UCL: 47.9
99% Chebyshev (Mean, Sd) UCL: 57.09

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n>=40): 6.7
95% Adjusted Gamma UCL (Use when n<=40): 6.5

Potential UCL to Use

Use 95% Student's UCL: 6.57
or 95% Modified-UCL: 6.67

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Cobalt

General Statistics

Number of valid observations [illegible]

Number of Distinct observations [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of Log Data [illegible]

SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic [illegible]

Shapiro Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic [illegible]

Shapiro Wilk Critical Value [illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]

95% Modified-Bootstrap-t UCL (Johnson-1978) [illegible]

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected MLE) [illegible]

Theta Star [illegible]

nu star [illegible]

MLE of Standard Deviation [illegible]

nu star [illegible]

approximate Chi Square Value (.05, df) [illegible]

adjusted Level of Significance [illegible]

adjusted Chi Square Value [illegible]

Anderson-Darling Test Statistic [illegible]

Anderson-Darling 5% critical value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov 5% critical value [illegible]

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCA Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Assuming Gamma Distribution

95% approximate Gamma UCL (use when n>=50) [illegible]

95% adjusted Gamma UCL (use when n<50) [illegible]

Potential UCL to Use

95% approximate Gamma UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Copper

General Statistics

Number of Valid Observations [illegible]

Number of Distinct Observations [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of Log Data [illegible]

SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL [illegible]

95% Modified-Johnson UCL [illegible]

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected) [illegible]

Theta Star [illegible]

nu star [illegible]

A-D Test Statistic [illegible]

Anderson-Darling Critical Value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov Critical Value [illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernible Distribution (0.05)

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when k star > 0.1) [illegible]

95% Adjusted Gamma UCL (use when k star ≤ 0.1) [illegible]

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCA Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

95% Chebyshev(Mean, Sd) UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Iron

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 0

Raw Statistics

Minimum: 16.000
Maximum: 92.000
Mean: 5.67
Geometric Mean: 5.92
Median: 40.000
SD: 12.15
Std. Error of Mean: 1.759
Coefficient of Variation: 0.4
Skewness: 1.97

Log-transformed Statistics

Minimum of Log Data: 9.6
Maximum of Log Data: 11.4
Mean of Log Data: 10.4
SD of Log Data: 0.21

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.71
Shapiro Wilk Critical Value: 0.947

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 7.92
95% Modified-UCL (Johnson-1978): 4.01

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.977
Shapiro Wilk Critical Value: 0.947

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 4.2
95% Chebyshev (MVUE) UCL: 4.52
97.5% Chebyshev (MVUE) UCL: 4.56
99% Chebyshev (MVUE) UCL: 5.757

Gamma Distribution Test

Kolmogorov Corrected: 0.2
Theta Star: 10
MLE of Mean: 5.67
MLE of Standard Deviation: 11.09
nu star: 90.96
Approximate Chi Square Value (.05): 40.6
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 6

Anderson-Darling Test Statistic: 0.9
Anderson-Darling 5% Critical Value: 0.749
Kolmogorov-Smirnov Test Statistic: 0.0
Kolmogorov-Smirnov 5% Critical Value: 0.127

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 2.70
95% Adjusted Gamma UCL (Use when n < 40): 6.2

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 2.61
95% Jackknife UCL: 1
95% Standard Bootstrap UCL: 2.0
95% Bootstrap-t UCL: 9.011
95% Hall's Bootstrap UCL: 40.1
95% Percentile Bootstrap UCL: 2.4
95% BCA Bootstrap UCL: 7
95% Chebyshev (Mean, Sd) UCL: 4.0
97.5% Chebyshev (Mean, Sd) UCL: 4.6
99% Chebyshev (Mean, Sd) UCL: 5.2

Potential UCL to Use

Use 95% Approximate Gamma UCL: 2.70

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Manganese

General Statistics

Number of Valid Observations [illegible]

Number of Distinct Observations [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of Log Data [illegible]

SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]

95% Modified-Bootstrap-t UCL (Johnson-1978) [illegible]

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected MLE) [illegible]

Theta Star [illegible]

nu star [illegible]

MLE of Mean [illegible]

MLE of Standard Deviation [illegible]

nu hat [illegible]

Approximate Chi Square Value (.05) [illegible]

Adjusted Level of Significance [illegible]

Adjusted Chi Square Value [illegible]

Anderson-Darling Test Statistic [illegible]

Anderson-Darling Critical Value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov Critical Value [illegible]

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=40) [illegible]

95% Adjusted Gamma UCL (use when n<40) [illegible]

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCA Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

Use 95% Approximate Gamma UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Zinc

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 5

Raw Statistics

Minimum: 4
Maximum: 4200
Mean: 2767
Geometric Mean: 1119
Median: 65
SD: 6.6
Std. Error of Mean: 90.9
Coefficient of Variation: 2.02
Skewness: 5.245

Log-transformed Statistics

Minimum of Log Data: 5.26
Maximum of Log Data: 4
Mean of Log Data: 4.717
SD of Log Data: 1.15

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.406
Shapiro Wilk Critical Value: 0.947
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.49
Shapiro Wilk Critical Value: 0.947
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 4.29
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL (Chen-1995): 4.92
95% Modified-UCL (Johnson-1977): 4.407

Assuming Lognormal Distribution

95% H-UCL: 0
95% Chebyshev (MVUE) UCL: 99
97.5% Chebyshev (MVUE) UCL: 47.7
99% Chebyshev (MVUE) UCL: 1

Gamma Distribution Test

K-Star (bias corrected): 0.644
Theta Star: 4.29
MLE of Mean: 2767
MLE of Standard Deviation: 44.9
Nu Star: 0
Approximate Chi Square Value (.05): 1
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 45.6

Anderson-Darling Test Statistic: 4.452
Anderson-Darling 5% Critical Value: 0.799
Kolmogorov-Smirnov Test Statistic: 0.255
Kolmogorov-Smirnov 5% Critical Value: 0.12
Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL: 4.26
95% Jackknife UCL: 4.29
95% Standard Error Trap UCL: 4.2
95% Error Trap UCL: 75
95% Half Error Trap UCL: 95.4
95% Percentile Error Trap UCL: 447
95% Error Error Trap UCL: 506
95% Chebyshev (Mean, Sd) UCL: 67
97.5% Chebyshev (Mean, Sd) UCL: 44.9
99% Chebyshev (Mean, Sd) UCL: 11.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 1
95% Adjusted Gamma UCL (Use when n < 40): 4

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL: 67

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Mercury

General Statistics

Total Number of observations	4	Number of Distinct Observations	[illegible]
Number of Detects	47	Number of Non-Detects	1
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	1
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Average Detect	[illegible]	Percent Non-Detects	[illegible]
Median Detect	[illegible]	SD Detects	[illegible]
Standard Error of Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Detected data NOT Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	[illegible]	Detected data NOT Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D critical value	[illegible]	Detected data NOT Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S critical value	[illegible]	Detected data NOT Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square value (.05,...)	[illegible]	adjusted Chi Square value (.05,...)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection levels or single DL

GROS may not be used when kstar of detected data is small such as < 1.0

For such situations, GROS method may yield incorrect values of UCLs and BTLs

For gamma distributed detected data, BTLs and UCLs may be computed using gamma distribution on the imputed data

Mean	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (beta)	[illegible]
approximate Chi Square value (.05,...)	[illegible]	adjusted Chi Square value (.05,...)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Detected data NOT Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	[illegible]	Detected data NOT Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in original scale	[illegible]	Mean in Log scale	[illegible]
SD in original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL in original scale	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (BCA) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in original scale	[illegible]	Mean in Log scale	[illegible]
SD in original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (use when n>=50)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% Hall's Bootstrap UCL [illegible]

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Vanadium

General Statistics

Total Number of observations	40	Number of Distinct observations	[illegible]
		Number of Missing observations	
Minimum	17	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	Std Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	[illegible]	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]
		95% Modified-Bootstrap-t UCL (Johnson-1978)	[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**	
5% A-D critical value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S critical value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]	95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**	
5% Lilliefors critical value	[illegible]	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of logged Data	[illegible]
Maximum of Logged Data	[illegible]	SD of logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]	99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Adjusted Gamma UCL	[illegible]

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.
These recommendations are based upon various factors such as skewness, sample size, and the number of distinct or detected data.
However, it may be noted that the Chebyshev inequality based UCLs may provide much higher coverage than the other UCLs.
For additional insight the user may want to consult a statistician.

APPENDIX B-2
ON-SITE TOTAL SOIL

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

[illegible]

Aluminum

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

[illegible]

Assuming Gamma Distribution

[illegible]

Potential UCLs to Use

[illegible]

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations: 2

Raw Statistics

Minimum: 0.14
Maximum: 0.6
Mean: 15.71
Geometric Mean: 1.77
Median: 15
SD: 6.2
Std. Error of Mean: 0.64
Coefficient of Variation: 0.4
Skewness: 0.4

Log-transformed Statistics

Minimum of Log Data: -1.966
Maximum of Log Data: -5.4
Mean of Log Data: 2.622
SD of Log Data: 0.7

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.112
Lilliefors Critical Value: 0.122

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-UCL: 17.16

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 17.24
95% Modified-UCL (Johnson-1978): 17.17

Lognormal Distribution Test

Lilliefors Test Statistic: 0.20
Lilliefors Critical Value: 0.122

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 22.2
95% Chebyshev (MVUE) UCL: 26.57
97.5% Chebyshev (MVUE) UCL: 0.2
99% Chebyshev (MVUE) UCL: 7.69

Gamma Distribution Test

Kolmogorov-Smirnov Test Statistic: 0.1
Theta Star: 4.211
MLE of Mean: 15.71
MLE of Standard Deviation: 1.4
Nu Star: 95.5
Approximate Chi Square Value (0.05): 50.4
Adjusted Level of Significance: 0.0455
Adjusted Chi Square Value: 49

Anderson-Darling Test Statistic: 1.6
Anderson-Darling 5% Critical Value: 0.754
Kolmogorov-Smirnov Test Statistic: 0.141
Kolmogorov-Smirnov 5% Critical Value: 0.12

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n = 40): 17.7
95% Adjusted Gamma UCL (Use when n = 40): 17.79

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 17.1
95% Jackknife UCL: 17.16
95% Standard Error Trap UCL: 17.19
95% Error Trap UCL: 17.2
95% Half Error Trap UCL: 17.4
95% Percentile Error Trap UCL: 17.17
95% Error Error Trap UCL: 17.2
95% Chebyshev (Mean, Sd) UCL: 19.4
97.5% Chebyshev (Mean, Sd) UCL: 21.11
99% Chebyshev (Mean, Sd) UCL: 24

Potential UCL to Use

Use 95% Student's-UCL: 17.16

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Chromium

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations: 1

Raw Statistics

Minimum: 14
Maximum: 14
Mean: 1[illegible]
Geometric Mean: 2[illegible]
Median: 2[illegible]
SD: 1[illegible]
Std. Error of Mean: 2
Coefficient of Variation: 0.51[illegible]
Skewness: 1.00

Log-transformed Statistics

Minimum of Log Data: 2.[illegible]
Maximum of Log Data: 4.[illegible]
Mean of Log Data: [illegible]
SD of Log Data: 0.44

Relevant UCL Statistics

Normal Distribution Test

Lilliefor Test Statistic: 0.1[illegible]
Lilliefor Critical Value: 0.1[illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 7.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 7.5
95% Modified-UCL (Johnson-1978): 7.1

Lognormal Distribution Test

Lilliefor Test Statistic: 0.0[illegible]
Lilliefor Critical Value: 0.1[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 7.05
95% Chebyshev (MVUE) UCL: 4.[illegible]
97.5% Chebyshev (MVUE) UCL: 4.[illegible]
99% Chebyshev (MVUE) UCL: 5.[illegible]

Gamma Distribution Test

K-Star (bias corrected): 4.[illegible]
Theta Star: 7.[illegible]
MLE of Mean: 1[illegible]
MLE of Standard Deviation: 15.[illegible]
nu star: 4[illegible]
Approximate Chi Square Value: 05.[illegible]
Adjusted Level of Significance: 0.0455
Adjusted Chi Square Value: 44.[illegible]

Anderson-Darling Test Statistic: 0.[illegible]
Anderson-Darling 5% Critical Value: 0.754
Kolmogorov-Smirnov Test Statistic: 0.11
Kolmogorov-Smirnov 5% Critical Value: 0.1[illegible]

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 6.[illegible]
95% Adjusted Gamma UCL (Use when n < 40): 7.[illegible]

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 7.0
95% Jackknife UCL: 7.1
95% Standard Error Trap UCL: 6.[illegible]
95% Error Trap UCL: [illegible]
95% Half Error Trap UCL: 7.[illegible]
95% Percentile Error Trap UCL: 7.[illegible]
95% Error Error Trap UCL: 7.[illegible]
95% Chebyshev (Mean, Sd) UCL: 4.[illegible]
97.5% Chebyshev (Mean, Sd) UCL: 4.[illegible]
99% Chebyshev (Mean, Sd) UCL: 5.[illegible]

Potential UCL to Use

Use 95% Approximate Gamma UCL: 6.[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Cobalt

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

[illegible]

Assuming Gamma Distribution

[illegible]

Potential UCLs to Use

[illegible]

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Copper

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernible Distribution (0.05)

Nonparametric Statistics

[illegible]

Assuming Gamma Distribution

[illegible]

Potential UCL to Use

[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Iron

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations:

Raw Statistics

Minimum: 16000
Maximum: 92000
Mean: 6[illegible]
Geometric Mean: 4442
Median: 5000
SD: 1[illegible]5
Std. Error of Mean: 17[illegible]
Coefficient of Variation: 0.[illegible]47
Skewness: 1.[illegible]16

Log-transformed Statistics

Minimum of Log Data: 9.[illegible]
Maximum of Log Data: 11.4
Mean of Log Data: 10.45
SD of Log Data: 0.[illegible]5

Relevant UCL Statistics

Normal Distribution Test

Lilliefor Test Statistic: 0.11
Lilliefor Critical Value: 0.1[illegible]

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 9[illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 95[illegible]1
95% Modified-UCL (Johnson-1978): 9[illegible]65

Lognormal Distribution Test

Lilliefor Test Statistic: 0.09
Lilliefor Critical Value: 0.1[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 9[illegible]4
95% Chebyshev (MVUE) UCL: 4[illegible]
97.5% Chebyshev (MVUE) UCL: 4[illegible]
99% Chebyshev (MVUE) UCL: 5[illegible]

Gamma Distribution Test

K-Star (bias corrected): 9[illegible]
Theta Star: 97
MLE of Mean: 6[illegible]
MLE of Standard Deviation: 1[illegible]
nu star: 96[illegible]5
Approximate Chi Square Value (05): 9[illegible]
Adjusted Level of Significance: 0.0455
Adjusted Chi Square Value: 95[illegible]

Anderson-Darling Test Statistic: 0.[illegible]4
Anderson-Darling 5% Critical Value: 0.75
Kolmogorov-Smirnov Test Statistic: 0.0[illegible]
Kolmogorov-Smirnov 5% Critical Value: 0.1[illegible]

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 9[illegible]4
95% Adjusted Gamma UCL (Use when n < 40): 9[illegible]7

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 9[illegible]
95% Jackknife UCL: 9[illegible]
95% Standard Error Trap UCL: 9[illegible]
95% Error Trap UCL: 9[illegible]
95% Half Error Trap UCL: 4[illegible]
95% Percentile Error Trap UCL: 9[illegible]
95% Error Error Trap UCL: 9[illegible]
95% Chebyshev (Mean, Sd) UCL: 4[illegible]
97.5% Chebyshev (Mean, Sd) UCL: 4[illegible]
99% Chebyshev (Mean, Sd) UCL: 5[illegible]

Potential UCL to Use

Use 95% Student's UCL: 9[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Manganese

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

[illegible]

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

[illegible]

Potential UCL to Use

[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Zinc

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations: 7

Raw Statistics

Minimum: 94

Maximum: 4200

Mean: 2647

Geometric Mean: 1101

Median: 65

SD: 1[illegible]

Std. Error of Mean: 4[illegible]

Coefficient of Variation: 2[illegible]

Skewness: 5.447

Log-transformed Statistics

Minimum of Log Data: 5[illegible]

Maximum of Log Data: [illegible]

Mean of Log Data: 4.701

SD of Log Data: 1.1[illegible]

Relevant UCL Statistics

Normal Distribution Test

Lilliefor Test Statistic: 0.[illegible]54

Lilliefor Critical Value: 0.1[illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 4[illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 4[illegible]

95% Modified-UCL (Johnson-1978): 4[illegible]

Gamma Distribution Test

K-Star (bias corrected): 0.[illegible]

Theta Star: [illegible]

MLE of Mean: 2647

MLE of Standard Deviation: 2[illegible]

nu star: 70[illegible]

Approximate Chi Square Value: 0.5[illegible]

Adjusted Level of Significance: 0.0455

Adjusted Chi Square Value: 51.[illegible]

Anderson-Darling Test Statistic: 4.[illegible]

Anderson-Darling 5% Critical Value: 0.[illegible]

Kolmogorov-Smirnov Test Statistic: 0.[illegible]

Kolmogorov-Smirnov 5% Critical Value: 0.1[illegible]

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n>=40): 5[illegible]

95% Adjusted Gamma UCL (Use when n>=40): [illegible]

Potential UCL to Use

Lognormal Distribution Test

Lilliefor Test Statistic: 0.[illegible]1

Lilliefor Critical Value: 0.1[illegible]

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 4[illegible]

95% Chebyshev (MVUE) UCL: 7[illegible]

97.5% Chebyshev (MVUE) UCL: 4[illegible]

99% Chebyshev (MVUE) UCL: 5[illegible]

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL: 4[illegible]

95% Jackknife UCL: 4[illegible]

95% Standard Error Trap UCL: 4[illegible]

95% Error Trap UCL: 6[illegible]

95% Half Error Trap UCL: [illegible]

95% Percentile Error Trap UCL: 4[illegible]

95% Error Error Trap UCL: 5[illegible]

95% Chebyshev (Mean, Sd) UCL: [illegible]

97.5% Chebyshev (Mean, Sd) UCL: 7[illegible]

99% Chebyshev (Mean, Sd) UCL: 11[illegible]

UCL 95% Chebyshev (Mean, Sd) UCL: [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Mercury

General Statistics

Total Number of observations	51	Number of Distinct Observations	[illegible]
Number of Detects	50	Number of Non-Detects	1
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	1
Minimum Detect	0.0117	Minimum Non-Detect	0.17
Maximum Detect	0.24	Maximum Non-Detect	0.17
Average Detect	0.0[illegible]5	Percent Non-Detects	1.96%
Median Detect	0.114	SD Detects	0.15
Log-mean Detect	0.07[illegible]	CV Detects	1.[illegible]15
Skewness Detects	4.[illegible]	Kurtosis Detects	24.7
Mean of Logged Detects	-2.[illegible]4	SD of Logged Detects	0.751

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.51	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	0.947	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.2[illegible]4	**Lilliefors GOF Test**	
5% Lilliefors critical value	0.1[illegible]5	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.11	Standard Error of Mean	0.0[illegible]2
SD	0.147	95% KM (BCA) UCL	0.15
95% KM (t) UCL	0.14	95% KM (Percentile Bootstrap) UCL	0.14[illegible]
95% KM (z) UCL	0.14	95% KM (Bootstrap t) UCL	0.1[illegible]
90% KM (Chebyshev) UCL	0.17[illegible]	95% KM (Chebyshev) UCL	0.2[illegible]4
97.5% KM (Chebyshev) UCL	0.2[illegible]4	99% KM (Chebyshev) UCL	0.[illegible]1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]7	**Anderson-Darling GOF Test**	
5% A-D critical value	0.7[illegible]7	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.2[illegible]7	**Kolmogorov-Smirnoff GOF**	
5% K-S critical value	0.1[illegible]7	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.514	k star (bias corrected MLE)	1.441
Theta hat (MLE)	0.0775	Theta star (bias corrected MLE)	0.0764
nu hat (MLE)	151.4	nu star (bias corrected)	144.1
MLE Mean (bias corrected)	0.114	MLE Sd (bias corrected)	0.0961

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.54	nu hat (KM)	54.4
approximate Chi Square value (.05, df)	41.55	adjusted Chi Square value (.05, df)	41.1
95% Gamma approximate KM-UCL (use when df>=50)	0.157	95% Gamma adjusted KM-UCL (use when df<50)	0.151

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied ND values or single DL

GROS may not be used when kstar of detected data < small such as 0.1

For such situations, GROS method may not be valid to calculate UCL and ET

For gamma distributed detected data, BTA and UCL may be computed using gamma distributed KM estimates

Mean	0.0117	Mean	0.11
SD	0.0[illegible]4	SD	0.0[illegible]1
SE of Mean	0.147		1.1
k hat (MLE)	1.5	k star (bias corrected MLE)	1.441
Theta hat (MLE)	0.0[illegible]	Theta star (bias corrected MLE)	0.0775
nu hat (MLE)	151.4	nu star (bias corrected)	144
MLE Mean (bias corrected)	0.11	MLE Sd (bias corrected)	0.0[illegible]7
		adjusted Level of Significance (beta)	0.0[illegible]5
approximate Chi Square value (144.000, .05)	1.21	adjusted Chi Square value (144.000, beta)	1.11
95% Gamma approximate UCL (use when df>=50)	0.1[illegible]	95% Gamma adjusted UCL (use when df<50)	0.1[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9[illegible]7	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	0.947	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.15[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	0.1[illegible]5	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in original scale	0.11	Mean in Log scale	-2.[illegible]
SD in original scale	0.14[illegible]	SD in Log scale	0.74
95% KM (BCA) UCL in original scale	0.14	95% Percentile Bootstrap UCL	0.15
95% Exact Bootstrap UCL	0.1[illegible]	95% Bootstrap t UCL	0.1
95% H-UCL in Log scale	0.1		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in original scale	0.114	Mean in Log scale	-2.5
SD in original scale	0.14[illegible]	SD in Log scale	0.74
95% UCL in original scale	0.14	95% H-Stat UCL	0.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 0.14

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulations summarized in Singh, Maslia and Armbya, 2002.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX B-3
FLENNIKEN BRANCH SURFACE SOIL

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	tb_cc.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations: 13	Number of Distinct Observations: 11

Raw Statistics	Log-transformed Statistics
Minimum: 4500	Minimum of Log Data: 8.412
Maximum: 18000	Maximum of Log Data: 9.798
Mean: 11592	Mean of Log Data: 9.268
Geometric Mean: 10593	SD of Log Data: 0.467
Median: 11000	
SD: 4622	
Std. Error of Mean: 1282	
Coefficient of Variation: 0.399	
Skewness: -0.23	

Relevant UCL Statistics

Normal Distribution Test	Lognormal Distribution Test
Shapiro-Wilk Test Statistic: 0.932	Shapiro-Wilk Test Statistic: 0.899
Shapiro-Wilk Critical Value: 0.866	Shapiro-Wilk Critical Value: 0.866
Data appear Normal at 5% Significance Level	Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-t UCL: 13877	95% H-UCL: 15625
95% UCLs (Adjusted for Skewness)	95% Chebyshev (MVUE) UCL: 18468
95% Adjusted-CLT UCL (Chen-1995): 13613	97.5% Chebyshev (MVUE) UCL: 21393
95% Modified-t UCL (Johnson-1978): 13863	99% Chebyshev (MVUE) UCL: 27140

Gamma Distribution Test	Data Distribution
k star (bias corrected): 4.444	Data appear Normal at 5% Significance Level
Theta Star: 2609	
MLE of Mean: 11592	
MLE of Standard Deviation: 5499	
nu star: 115.5	
Approximate Chi Square Value (.05): 91.72	**Nonparametric Statistics**
Adjusted Level of Significance: 0.0301	95% CLT UCL: 13701
Adjusted Chi Square Value: 88.7	95% Jackknife UCL: 13877
	95% Standard Bootstrap UCL: 13691
Anderson-Darling Test Statistic: 0.477	95% Bootstrap-t UCL: 13815
Anderson-Darling 5% Critical Value: 0.736	95% Hall's Bootstrap UCL: 13596
Kolmogorov-Smirnov Test Statistic: 0.188	95% Percentile Bootstrap UCL: 13585
Kolmogorov-Smirnov 5% Critical Value: 0.237	95% BCA Bootstrap UCL: 13546
Data appear Gamma Distributed at 5% Significance Level	95% Chebyshev (Mean, Sd) UCL: 17180
	97.5% Chebyshev (Mean, Sd) UCL: 19597
Assuming Gamma Distribution	99% Chebyshev (Mean, Sd) UCL: 24346
95% Approximate Gamma UCL (Use when n >= 40): 14602	
95% Adjusted Gamma UCL (Use when n >= 40): 15100	

Potential UCL to Use	Use 95% Student's-t UCL: 13877

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 13

Number of Distinct Observations: 12

Raw Statistics

Minimum: 4.1

Maximum: 15

Mean: 8.585

Geometric Mean: 8.009

Median: 8.4

SD: 3.205

Std. Error of Mean: 0.889

Coefficient of Variation: 0.373

Skewness: 0.339

Log-transformed Statistics

Minimum of Log Data: 1.411

Maximum of Log Data: 2.708

Mean of Log Data: 2.081

SD of Log Data: 0.398

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic: 0.968

Shapiro-Wilk Critical Value: 0.866

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro-Wilk Test Statistic: 0.957

Shapiro-Wilk Critical Value: 0.866

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL: 10.17

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 10.14

95% Modified-t UCL (Johnson-1978): 10.19

Assuming Lognormal Distribution

95% H-UCL: 10.91

95% Chebyshev (MVUE) UCL: 12.83

97.5% Chebyshev (MVUE) UCL: 14.66

99% Chebyshev (MVUE) UCL: 18.24

Gamma Distribution Test

k star (bias corrected): 5.718

Theta Star: 1.501

nu star: 148.7

MLE of Mean: 8.585

MLE of Standard Deviation: 3.59

nu hat: 148.7

Approximate Chi Square Value (.05): 121.5

Adjusted Level of Significance: 0.0301

Adjusted Chi Square Value: 118

Anderson-Darling Test Statistic: 0.212

Anderson-Darling 5% Critical Value: 0.735

Kolmogorov-Smirnov Test Statistic: 0.113

Kolmogorov-Smirnov 5% Critical Value: 0.237

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 10.51

95% Adjusted Gamma UCL (Use when n < 40): 10.82

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 10.05

95% Jackknife UCL: 10.17

95% Standard Error of Mean: 0.97

95% Bootstrap (%) UCL: 10.29

95% Hall's Bootstrap UCL: 10.27

95% Percentile Bootstrap UCL: 9.962

95% BCa Bootstrap UCL: 10

95% Chebyshev(Mean, Sd) UCL: 12.46

97.5% Chebyshev(Mean, Sd) UCL: 14.14

99% Chebyshev(Mean, Sd) UCL: 17.43

Potential UCL to Use

Use 95% Student's-t UCL: 10.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

PCB-1260 (Aroclor 1260)

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
		Percent Non-Detects	11.11%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.017	Minimum Detected	-4.075
Maximum Detected	0.23	Maximum Detected	-1.47
Mean of Detected	0.0716	Mean of Detected	-3.002
SD of Detected	0.0706	SD of Detected	0.901
Minimum Non-Detect	0.013	Minimum Non-Detect	-4.343
Maximum Non-Detect	0.013	Maximum Non-Detect	-4.343

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.78	Shapiro Wilk Test Statistic	0.951
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0644	Mean	-3.228
SD	0.0696	SD	1.081
95% DL/2 Student's-t UCL	0.108	95% H-Stat DL/2 UCL	0.263
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0604	Mean in Log Scale	-3.251
SD	0.0709	SD in Log Scale	1.127
95% MLE Student's-t UCL	0.104	Mean in Original Scale	0.0643
95% MLE Tiku UCL	0.103	SD in Original Scale	0.0697
		95% BCA UCL	0.107
		95% Percentile Bootstrap UCL	0.102
		95% BCA Bootstrap UCL	0.121
		95% H UCL	0.298

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.029	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.0696	
nu star	16.46	
A-D Test Statistic	0.316	Nonparametric Statistics
5% A-D Critical Value	0.728	Kaplan-Meier (KM) Method
K-S Test Statistic	0.728	Mean 0.0656
5% K-S Critical Value	0.299	SD 0.0646
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 0.023
		95% KM (t) UCL 0.108
Assuming Gamma Distribution		95% KM (z) UCL 0.103
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 0.108
Minimum	0.000001	95% KM (bootstrap t) UCL 0.153
Maximum	0.23	95% KM (BCA) UCL 0.108
Mean	0.0637	95% KM (Percentile Bootstrap) UCL 0.104
Median	0.038	95% KM (Chebyshev) UCL 0.166
SD	0.0703	97.5% KM (Chebyshev) UCL 0.209
k star	0.372	99% KM (Chebyshev) UCL 0.295
Theta Star	0.171	
nu star	6.688	Potential UCLs to Use
approx Chi2	2.001	95% KM (BCA) UCL 0.108
95% Gamma approximate UCL (use when n >= 40)	0.213	
95% adjusted Gamma UCL (use when n < 40)	0.283	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2008).

For additional insight, the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Chromium

General Statistics

Total Number of Observation	1[illegible]	Number of Distinct Observation	1[illegible]
		Number of Missing Observation	1
Minimum	11	Mean	[illegible]
Maximum	4[illegible]	Median	[illegible]1
SD	10[illegible]	Std. Error of Mean	[illegible]
Coefficient of Variation	0.4[illegible]	Skewness	1.[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.[illegible]	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.15[illegible]	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.[illegible]	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]1
		95% Modified-t UCL (Johnson-1978)	[illegible]4

Gamma GOF Test

A-D Test Statistic	0.[illegible]5	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7[illegible]5	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.[illegible]7	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.57[illegible]	k star (bias corrected MLE)	5.104
Theta hat (MLE)	[illegible].51	Theta star (bias corrected MLE)	4.517
nu hat (MLE)	171	nu star (bias corrected)	1[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	10.1
		approximate Chi Square Value (0.05)	107.[illegible]
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	10[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible].59	95% Adjusted Gamma UCL (use when n<50)	[illegible].49

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9[illegible]5	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.[illegible]	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.09[illegible]	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.[illegible]	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible].[illegible]	Mean of logged Data	[illegible].1
Maximum of Logged Data	[illegible].71	SD of logged Data	0.404

Assuming Lognormal Distribution

95% H-UCL	[illegible]4.5	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]4.4	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	4[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]7.7	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]7.49	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible].51	95% Percentile Bootstrap UCL	[illegible]7.54
95% BCa Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	40[illegible]	99% Chebyshev (Mean, Sd) UCL	50[illegible]

Suggested UCL to Use

95% Student's-t UCL	[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulation results will not cover all Real-world data sets;
For additional insight the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Cobalt

General Statistics

Total Number of Observation	10	Number of Distinct Observation	7
		Number of Missing Observation	[illegible]
Minimum	[illegible]	Mean	10.[illegible]
Maximum	15	Median	11
SD	[illegible].45	Std. Error of Mean	[illegible].71
Coefficient of Variation	[illegible].06	Skewness	[illegible].4

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible].95[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible].4[illegible]	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible].1[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible].[illegible]	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1[illegible].14	95% Adjusted-CLT UCL (Chen-1995)	1[illegible].1[illegible]
		95% Modified-t UCL (Johnson-1978)	1[illegible].[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible].41	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	[illegible].7[illegible]5	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible].146	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	[illegible].[illegible]6	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible].6[illegible]	k star (bias corrected MLE)	1[illegible].[illegible]4
Theta hat (MLE)	[illegible].41[illegible]	Theta star (bias corrected MLE)	[illegible].9[illegible]5
nu hat (MLE)	5[illegible].[illegible]7	nu star (bias corrected)	[illegible].5[illegible]
MLE Mean (bias corrected)	10.[illegible]4	MLE Sd (bias corrected)	[illegible].54[illegible]
		approximate Chi Square Value (0.05)	[illegible].5
Adjusted Level of Significance	[illegible].[illegible]7	Adjusted Chi Square Value	[illegible].4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1[illegible].5	95% Adjusted Gamma UCL (use when n<50)	1[illegible].[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible].954	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	[illegible].4[illegible]	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible].156	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	[illegible].[illegible]	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible].[illegible]7	Mean of logged Data	[illegible].[illegible]
Maximum of Logged Data	[illegible].7[illegible]	SD of logged Data	[illegible].[illegible]

Assuming Lognormal Distribution

95% H-UCL	1[illegible].44	90% Chebyshev (MVUE) UCL	1[illegible].[illegible]5
95% Chebyshev (MVUE) UCL	14[illegible].[illegible]	97.5% Chebyshev (MVUE) UCL	15.[illegible]
99% Chebyshev (MVUE) UCL	1[illegible].[illegible]5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1[illegible].[illegible]	95% Jackknife UCL	1[illegible].14
95% Standard Bootstrap UCL	11.[illegible]	95% Bootstrap-t UCL	1[illegible].[illegible]
95% Hall's Bootstrap UCL	1[illegible].[illegible]	95% Percentile Bootstrap UCL	11.[illegible]7
95% BCa Bootstrap UCL	1[illegible].[illegible]7		
90% Chebyshev(Mean, Sd) UCL	1[illegible].[illegible]	95% Chebyshev(Mean, Sd) UCL	1[illegible].[illegible]
97.5% Chebyshev(Mean, Sd) UCL	15.[illegible]	99% Chebyshev(Mean, Sd) UCL	17.95

Suggested UCL to Use

95% Student's-t UCL	1[illegible].14

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulation results will not cover all Real-world data sets;
For additional insight the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Iron

General Statistics

Total Number of Observation	1[illegible]	Number of Distinct Observation	[illegible]
		Number of Missing Observation	1
Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	Std. Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]
		95% Modified-t UCL (Johnson-1978)	[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	[illegible]	Data Not Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]	95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data Not Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of logged Data	[illegible]
Maximum of Logged Data	[illegible]	SD of logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCa Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]	99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Student's-t UCL	[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulation results will not cover all Real World data sets;
For additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Manganese

General Statistics

Total Number of Observation	1[illegible]	Number of Distinct Observation	11
		Number of Missing Observation	1
Minimum	4.0[illegible]	Mean	[illegible]
Maximum	1[illegible].00	Median	[illegible]
SD	[illegible]	Std. Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	[illegible]	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**
5% Lilliefors Critical Value	[illegible]	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]
		95% Modified-t UCL (Johnson-1978)	[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]	95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	[illegible]	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	[illegible]	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of logged Data	[illegible]
Maximum of Logged Data	[illegible]	SD of logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCa Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]	99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Student's-t UCL	[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulations results will not cover all Real World data sets;
For additional insight the user may want to consult a statistician.

APPENDIX B-4
FLENNIKEN BRANCH TOTAL SOIL

Appendix B-4
ProUCL Output - Flenniken Branch Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	tb_ts.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations: 13	Number of Distinct Observations: 11

Raw Statistics	Log-transformed Statistics
Minimum: 4500	Minimum of Log Data: 8.412
Maximum: 18000	Maximum of Log Data: 9.798
Mean: 11592	Mean of Log Data: 9.268
Geometric Mean: 10593	SD of Log Data: 0.467
Median: 11000	
SD: 4622	
Std. Error of Mean: 1282	
Coefficient of Variation: 0.399	
Skewness: -0.23	

Relevant UCL Statistics

Normal Distribution Test	Lognormal Distribution Test
Shapiro-Wilk Test Statistic: 0.932	Shapiro-Wilk Test Statistic: 0.899
Shapiro-Wilk Critical Value: 0.866	Shapiro-Wilk Critical Value: 0.866
Data appear Normal at 5% Significance Level	Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-t UCL: 13877	95% H-UCL: 15625
95% UCLs (Adjusted for Skewness)	95% Chebyshev (MVUE) UCL: 18468
95% Adjusted-CLT UCL (Chen-1995): 13613	97.5% Chebyshev (MVUE) UCL: 21393
95% Modified-t UCL (Johnson-1978): 13863	99% Chebyshev (MVUE) UCL: 27140

Gamma Distribution Test	Data Distribution
k-star (bias corrected): 4.444	Data appear Normal at 5% Significance Level
Theta Star: 2609	
MLE of Mean: 11592	
MLE of Standard Deviation: 5499	
nu star: 115.5	
Approximate Chi Square Value (.05): 91.72	**Nonparametric Statistics**
Adjusted Level of Significance: 0.0301	95% CLT UCL: 13701
Adjusted Chi Square Value: 88.7	95% Jackknife UCL: 13877
	95% Standard Bootstrap UCL: 13572
Anderson-Darling Test Statistic: 0.477	95% Bootstrap-t UCL: 13793
Anderson-Darling 5% Critical Value: 0.736	95% Hall's Bootstrap UCL: 13547
Kolmogorov-Smirnov Test Statistic: 0.188	95% Percentile Bootstrap UCL: 13523
Kolmogorov-Smirnov 5% Critical Value: 0.237	95% BCA Bootstrap UCL: 13746
Data appear Gamma Distributed at 5% Significance Level	95% Chebyshev (Mean, Sd) UCL: 17180
	97.5% Chebyshev (Mean, Sd) UCL: 19597
Assuming Gamma Distribution	99% Chebyshev (Mean, Sd) UCL: 24346
95% Approximate Gamma UCL (Use when n >= 40): 14602	
95% Adjusted Gamma UCL (Use when n >= 40): 15100	

Potential UCL to Use — Use 95% Student's-t UCL: 13877

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Appendix B-4
ProUCL Output - Flenniken Branch Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 13	Number of Distinct Observations: 12

Raw Statistics	Log-transformed Statistics
Minimum: 4.1	Minimum of Log Data: 1.411
Maximum: 15	Maximum of Log Data: 2.708
Mean: 8.585	Mean of Log Data: 2.081
Geometric Mean: 8.009	SD of Log Data: 0.398
Median: 8.4	
SD: 3.205	
Std. Error of Mean: 0.889	
Coefficient of Variation: 0.373	
Skewness: 0.339	

Relevant UCL Statistics

Normal Distribution Test	Lognormal Distribution Test
Shapiro-Wilk Test Statistic: 0.968	Shapiro-Wilk Test Statistic: 0.957
Shapiro-Wilk Critical Value: 0.866	Shapiro-Wilk Critical Value: 0.866
Data appear Normal at 5% Significance Level	**Data appear Lognormal at 5% Significance Level**

Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-UCL: 10.17	95% H-UCL: 10.91
95% UCLs (Adjusted for Skewness)	95% Chebyshev (MVUE) UCL: 12.83
95% Adjusted-CLT UCL (Chen-1995): 10.14	97.5% Chebyshev (MVUE) UCL: 14.66
95% Modified-UCL (Johnson-1978): 10.18	99% Chebyshev (MVUE) UCL: 18.24

Gamma Distribution Test	Data Distribution
k star (bias corrected): 5.718	**Data appear Normal at 5% Significance Level**
Theta Star: 1.501	
MLE of Mean: 8.585	
MLE of Standard Deviation: 3.59	
nu star: 148.7	
Approximate Chi Square Value (.05): 121.5	**Nonparametric Statistics**
Adjusted Level of Significance: 0.0301	95% CLT UCL: 10.05
Adjusted Chi Square Value: 118	95% Jackknife UCL: 10.17
	95% Standard Bootstrap UCL: 9.968
Anderson-Darling Test Statistic: 0.212	95% Bootstrap-t UCL: 10.28
Anderson-Darling 5% Critical Value: 0.735	95% Hall's Bootstrap UCL: 10.21
Kolmogorov-Smirnov Test Statistic: 0.113	95% Percentile Bootstrap UCL: 10.08
Kolmogorov-Smirnov 5% Critical Value: 0.237	95% BCA Bootstrap UCL: 10.02
Data appear Gamma Distributed at 5% Significance Level	95% Chebyshev (Mean, Sd) UCL: 12.46
	97.5% Chebyshev (Mean, Sd) UCL: 14.14
Assuming Gamma Distribution	99% Chebyshev (Mean, Sd) UCL: 17.43
95% Approximate Gamma UCL (Use when n = 40): 10.51	
95% Adjusted Gamma UCL (Use when n = 40): 10.82	

Potential UCL to Use	Use 95% Student's-UCL: 10.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-4
ProUCL Output - Flenniken Branch Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

PCB-1260 (Aroclor 1260)

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
		Percent Non-Detects	11.11%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.017	Minimum Detected	-4.075
Maximum Detected	0.23	Maximum Detected	-1.47
Mean of Detected	0.0716	Mean of Detected	-3.002
SD of Detected	0.0706	SD of Detected	0.901
Minimum Non-Detect	0.013	Minimum Non-Detect	-4.343
Maximum Non-Detect	0.013	Maximum Non-Detect	-4.343

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.78	Shapiro Wilk Test Statistic	0.951
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0644	Mean	-3.228
SD	0.0696	SD	1.081
95% DL/2 Student's-t UCL	0.108	95% H-Stat DL/2 UCL	0.263
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0604	Mean in Log Scale	-3.251
SD	0.0709	SD in Log Scale	1.127
95% MLE Student's-t UCL	0.104	Mean in Original Scale	0.0643
95% MLE Chebyshev UCL	0.103	SD in Original Scale	0.0697
		95% Student's-t UCL	0.107
		95% Percentile Bootstrap UCL	0.103
		95% BCA Bootstrap UCL	0.117
		95% H-UCL	0.298

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.029	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.0696	
nu star	16.46	
A-D Test Statistic	0.316	Nonparametric Statistics
5% A-D Critical Value	0.728	Kaplan-Meier (KM) Method
K-S Test Statistic	0.728	Mean 0.0656
5% K-S Critical Value	0.299	SD 0.0646
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 0.023
		95% KM (t) UCL 0.108
Assuming Gamma Distribution		95% KM (z) UCL 0.103
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 0.108
Minimum	0.000001	95% KM (bootstrap t) UCL 0.153
Maximum	0.23	95% KM (BCA) UCL 0.103
Mean	0.0637	95% KM (Percentile Bootstrap) UCL 0.106
Median	0.038	95% KM (Chebyshev) UCL 0.166
SD	0.0703	97.5% KM (Chebyshev) UCL 0.209
k star	0.372	99% KM (Chebyshev) UCL 0.295
Theta Star	0.171	
nu star	6.688	Potential UCLs to Use
approx Chi2	2.001	95% KM (BCA) UCL 0.103
95% Gamma approximate UCL (use when n >= 40)	0.213	
95% adjusted Gamma UCL (use when n < 40)	0.283	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2008).

For additional insight, the user may want to consult a statistician.

APPENDIX B-5
SHALLOW GROUNDWATER

Appendix B-5
ProUCL Output - Shallow Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File: [illegible]

Full Precision: OFF

Confidence Coefficient: 95%

Number of Bootstrap Operations: 2000

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation: [illegible]

From File: [illegible]

Full Precision: OFF

Confidence Coefficient: 95%

Number of Bootstrap Operations: 2000

(m - and/or p-)Xylene

General Statistics

Total Number of Observations	40	Number of Distinct Observations	14
Number of Detects	17	Number of Non-Detects	23
Number of Distinct Detects	10	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Average Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTs and MLEs may be improved using gamma distribution in KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (0.0115)	[illegible]
approximate Chi Square Value (0.115, df)	[illegible]	adjusted Chi Square Value (0.115, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% EPA - E Approach UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HOR (UCL log ROS)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% HOR (t) UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2,4-Trimethylbenzene

General Statistics

Total Number of Observations	19	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	15
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.12	Minimum Non-Detect	0.5
Maximum Detect	4	Maximum Non-Detect	5
Variance Detects	2.7	Percent Non-Detects	78.9%
Mean Detects	1.54	Total Detects	11.6
Median Detects	1.2	Total Detect Frequency	0.609
Skewness Detects	0.0[illegible]	Kurtosis Detects	5.[illegible]
Mean of Logged Detects	0.4[illegible]	SD of Logged Detects	1.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.[illegible]	Standard Error of Mean	0.15
SD	1.[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.7	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.[illegible]	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	0.0[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	5.[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.7[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.2[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.[illegible]4	k star (bias corrected MLE)	0.[illegible]
Theta hat (MLE)	2.[illegible]4	Theta star (bias corrected MLE)	5.17
nu hat (MLE)	5.15	nu star (bias corrected)	2.[illegible]
MLE Mean (bias corrected)	1.[illegible]4	MLE Sd (bias corrected)	2.[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.[illegible]	nu hat (KM)	1.[illegible]
approximate Chi Square Value (1, α)	5.[illegible]	adjusted Chi Square Value (1, β)	5.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	1.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	2.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values for UCLs and ETLs

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.[illegible]	Mean	0.41
Maximum	4	Median	0.51
SD	1.[illegible]	CV	1.[illegible]
k hat (MLE)	0.471	k star (bias corrected MLE)	0.4[illegible]
Theta hat (MLE)	1.[illegible]1	Theta star (bias corrected MLE)	2.14
nu hat (MLE)	15.[illegible]	nu star (bias corrected)	17.[illegible]
MLE Mean (bias corrected)	0.41	MLE Sd (bias corrected)	1.[illegible]
		adjusted Level of significance (β)	0.0[illegible]
approximate Chi Square Value (17, α)	[illegible]	adjusted Chi Square Value (17, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	1.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.7[illegible]4	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.74	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.75	Mean in Log Scale	1.[illegible]4
SD in Original Scale	1.12	SD in Log Scale	1.41
95% UCL (assumes normality of ROS data)	1.[illegible]5	95% Percentile Bootstrap UCL	1.4[illegible]
95% BCA Bootstrap UCL	1.[illegible]7	95% Bootstrap t UCL	1.5[illegible]
95% H-UCL (Log ROS)	2.4[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	1.[illegible]	95% KM (UCL of mean, Land)	2.[illegible]
KM (SD of logged)	1.41	95% KM (95% H-UCL)	2.[illegible]4
KM (standard error of mean of logged)	0.[illegible]1		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.[illegible]4	Mean in Log Scale	0.141
SD in Original Scale	1.[illegible]	SD in Log Scale	1.[illegible]4
95% UCL (assumes normality of DL/2 data)	2.15	95% Hall's UCL	[illegible]14

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.7	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006).

However simulation results will not cover all Real World data sets; in addition, recommendations based on the sample data size may change.

2,4-Dinitrotoluene

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
Number of Detects	4	Number of Non-Detects	0
Number of Distinct Detects	4	Number of Distinct Non-Detects	0
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Mean Detects	[illegible]	Percent Non-Detects	[illegible]%
Median Detects	[illegible]	SD Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (4.[illegible], 0.1)	[illegible]	adjusted Chi Square Value (4.[illegible], 0.1)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be impacted using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level (0.[illegible])	[illegible]
approximate Chi Square Value ([illegible], 0.1)	[illegible]	adjusted Chi Square Value ([illegible], 0.1)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM UCL (KM Log)	[illegible]
KM (SD of logged)	[illegible]	95% KM (Jackknife) UCL (KM Log)	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% KM (t) UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Aluminum

General Statistics

Total Number of Observations: 4 | Number of Distinct Observations: [illegible]

Number of Detects: [illegible] | Number of Non-Detects: [illegible]

Number of Distinct Detects: [illegible] | Number of Distinct Non-Detects: [illegible]

Minimum Detect: 4 | Minimum Non-Detect: [illegible]

Maximum Detect: [illegible] | Maximum Non-Detect: [illegible]

Mean Detects: 4.E+4 | Percent Non-Detects: [illegible] %

Median Detects: [illegible] | Detects: 4 [illegible]

Median Detects: [illegible] | [illegible] Detects: [illegible]

Skewness Detects: [illegible] | Kurtosis Detects: [illegible]

Mean of Logged Detects: [illegible] | Dev of Logged Detects: [illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: [illegible] | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: [illegible] | Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic: [illegible] | **Lilliefors GOF Test**

5% Lilliefors Critical Value: [illegible] | Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: [illegible] | Standard Error of Mean: [illegible]

[illegible]

95% KM (t) UCL: [illegible] | 95% KM (Percentile Bootstrap) UCL: [illegible]

95% KM (z) UCL: [illegible] | 95% KM (BCA Bootstrap) UCL: [illegible]

95% KM (Chebyshev) UCL: [illegible] | 95% KM (Chebyshev) UCL: [illegible]

97.5% KM (Chebyshev) UCL: [illegible] | 99% KM (Chebyshev) UCL: [illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: [illegible] | **Anderson-Darling GOF Test**

5% A-D Critical Value: [illegible] | Detected Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic: [illegible] | **Kolmogrov-Smirnoff GOF**

5% K-S Critical Value: [illegible] | Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): [illegible] | k star (bias corrected MLE): [illegible]

Theta hat (MLE): [illegible] | Theta star (bias corrected MLE): [illegible]

nu hat (MLE): [illegible] | nu star (bias corrected): [illegible]

MLE Mean (bias corrected): [illegible] | MLE Sd (bias corrected): [illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): [illegible] | nu hat (KM): [illegible]

approximate Chi Square Value (.05, [illegible]): [illegible] | adjusted Chi Square Value (.05, [illegible]): [illegible]

95% Gamma approximate KM UCL (use when n>=50): [illegible] | 95% Gamma adjusted KM UCL (use when n<50): [illegible]

Gamma ROS Statistics using Imputed Non-Detects: [illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ET

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum: [illegible] | Mean: [illegible]

Maximum: [illegible] | Median: [illegible]

SD: [illegible] | CV: [illegible]

k hat (MLE): [illegible] | k star (bias corrected MLE): [illegible]

Theta hat (MLE): [illegible] | Theta star (bias corrected MLE): [illegible]

nu hat (MLE): [illegible] | nu star (bias corrected): [illegible]

MLE Mean (bias corrected): [illegible] | MLE Sd (bias corrected): [illegible]

Adjusted Level of Significance (alpha): [illegible]

approximate Chi Square Value (.05, [illegible]): [illegible] | adjusted Chi Square Value (.05, [illegible]): [illegible]

95% Gamma approximate UCL (use when n>=50): [illegible] | 95% Gamma adjusted UCL (use when n<50): [illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: [illegible] | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: [illegible] | Detected Data appear Lognormal at 5% Significance Level

Lilliefors Test Statistic: [illegible] | **Lilliefors GOF Test**

5% Lilliefors Critical Value: [illegible] | Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale: [illegible] | Mean in Log Scale: [illegible]

Dev in Original Scale: [illegible] | Dev in Log Scale: [illegible]

95% UCL (assumes normality of ROS data): [illegible] | 95% Percentile Bootstrap UCL: [illegible]

95% ET - Exponential UCL: [illegible] | 95% Bootstrap UCL: [illegible]

95% HOL (LN ROS): [illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged): [illegible] | 95% KM (UP) (KM of Log): [illegible]

KM (Dev of logged): [illegible] | 95% KM (Jackknife) (KM of Log): [illegible]

KM (Standard Error of Mean of logged): [illegible]

DL/2 Statistics

DL/2 Normal | **DL/2 Log-Transformed**

Mean in Original Scale: [illegible] | Mean in Log Scale: [illegible]

Dev in Original Scale: [illegible] | Dev in Log Scale: [illegible]

95% UCL (assumes normality): [illegible] | 95% Student's-t UCL: [illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Percentile Bootstrap) UCL: [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Maritz and Lee (2010)

However simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Summary

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	[illegible]
Number of Distinct Detects	5	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	1	Maximum Non-Detect	[illegible]
Average Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	1.	IQR Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detects is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (adj)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD of logged)	[illegible]	95% critical H value (KM-Log)	[illegible]
KM (standard error of mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Assets

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1
Number of Detects	1	Number of Non-Detects	3
Number of Distinct Detects	1	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	5
Maximum Detect	1	Maximum Non-Detect	100
Variance Detects	NA	Percent Non-Detects	100.00%
Mean Detects	1	DL/2 Detects	0.5
Median Detects	1	DL Detects	1.5
Skewness Detects	NA	Kurtosis Detects	NA
Mean of Logged Detects	0.0	DL/2 Logged Detects	-0.693

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.305	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.4	Standard Error of Mean	0.2
SD	0.5	95% KM (t) UCL	0.837
95% KM (z) UCL	0.8	95% KM (Percentile Bootstrap) UCL	0.8
95% KM (jackknife) UCL	0.91	95% KM (BCA Bootstrap) UCL	1.05
90% KM (Chebyshev) UCL	1.19	95% KM (Chebyshev) UCL	1.54
97.5% KM (Chebyshev) UCL	2.05	99% KM (Chebyshev) UCL	3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.43	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.3	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.305	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.63	k star (bias corrected MLE)	0.424
Theta hat (MLE)	1.6	Theta star (bias corrected MLE)	1.7
nu hat (MLE)	5.04	nu star (bias corrected)	3.4
MLE Mean (bias corrected)	1.07	MLE Sd (bias corrected)	1.37

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.667	nu hat (KM)	6.004
approximate Chi Square Value (0.05, df)	2.53	adjusted Chi Square Value (0.05, df)	2.31
95% Gamma approximate KM UCL (use when n>=50)	1.5	95% Gamma adjusted KM UCL (use when n<50)	1.6

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when total sample size is 3 or less

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	0.01	Mean	0.5
Maximum	1	Median	0.1
SD	1.15	CV	1.97
k hat (MLE)	0.2	k star (bias corrected MLE)	0.19
Theta hat (MLE)	2.4	Theta star (bias corrected MLE)	2.6
nu hat (MLE)	2.7	nu star (bias corrected)	2.3
MLE Mean (bias corrected)	0.5	MLE Sd (bias corrected)	1.14
		adjusted Level of significance (α)	0.0344
approximate Chi Square Value (2.3, α)	0.1	adjusted Chi Square Value (2.3, α)	0.01
95% Gamma approximate UCL (use when n>=50)	14.3	95% Gamma adjusted UCL (use when n<50)	14.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.305	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.5	Mean in Log scale	-1.44
SD in Original scale	1.5	SD in Log scale	0.5
95% KM (BCA) UCL (assumes normality of ROS data)	1.54	95% Percentile Bootstrap UCL	1.7
95% KM (t) UCL	1.44	95% Bootstrap UCL	1.7
95% KM (Log ROS) UCL	11.7		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	-1.51	95% KM (UCL of mean, logged)	0.1
KM (SD of logged)	0.94	95% KM (BCA UCL of mean, logged)	0.174
KM (Standard Error of Mean of logged)	0.14		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	1	Mean in Log scale	-0.11
SD in Original scale	1	SD in Log scale	0.41
95% UCL (assumes normality of DL/2 data)	1.64	95% H-stat UCL	1.11

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	1.4	95% KM (Bootstrap t) UCL	1.4

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Summary

General Statistics

Total Number of Observations	40	Number of Distinct Observations	15
Number of Detects	1[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	1[illegible]	Number of Distinct Non-Detects	4
Minimum Detect	0.04	Minimum Non-Detect	0.05
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	0.0[illegible]8	Percent Non-Detects	70%
Mean Detects	1.[illegible]4	DL Detects	0.[illegible]1
Median Detects	0.[illegible]5	UL Detects	0.[illegible]
Skewness Detects	0.[illegible]4	Kurtosis Detects	[illegible]
Mean of Logged Detects	0.0[illegible]5	SD of Logged Detects	0.[illegible]1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]4	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]4	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]1	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]5	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.[illegible]4	Standard Error of Mean	0.0[illegible]5
SD	0.[illegible]5	95% KM (BCA) UCL	0.[illegible]7
95% KM (t) UCL	0.[illegible]1	95% KM (Percentile Bootstrap) UCL	0.[illegible]4
95% KM (z) UCL	0.[illegible]1	95% KM (Bootstrap t) UCL	0.[illegible]4
90% KM (Chebyshev) UCL	0.[illegible]4	95% KM (Chebyshev) UCL	0.[illegible]4
97.5% KM (Chebyshev) UCL	0.[illegible]7	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.[illegible]4	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	1.[illegible]	MLE Sd (bias corrected)	0.[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	0.[illegible]	95% Gamma adjusted KM UCL (use when n>50)	0.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield artificially inflated UCL and ETs

For gamma distributed detected data, BTs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	0.05	Mean	0.[illegible]
Maximum	[illegible]	Median	0.[illegible]
SD	0.[illegible]	CV	0.[illegible]
k hat (MLE)	0.[illegible]	k star (bias corrected MLE)	0.[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	0.[illegible]	MLE Sd (bias corrected)	0.[illegible]
		adjusted Level (= significance level)	0.0484
approximate Chi Square Value (0.[illegible], df)	41.[illegible]	adjusted Chi Square Value (0.[illegible], df)	41.[illegible]
95% Gamma approximate UCL (use when n>=50)	0.[illegible]	95% Gamma adjusted UCL (use when n>50)	0.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.0[illegible]	SD in Log scale	0.[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	0.[illegible]	95% Percentile Bootstrap UCL	0.[illegible]
95% KM (Cheb) UCL	0.[illegible]	95% Bootstrap t UCL	0.[illegible]
95% HOM UCL (log ROS)	0.[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UPR1 of Log)	0.[illegible]
KM (SD of logged)	0.[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
KM (Standard Error of Mean of logged)	0.0[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	0.[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.[illegible]	SD in Log scale	0.[illegible]
95% DL/2 (t) UCL (assumes normality)	0.[illegible]	95% Hall's Bootstrap UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.[illegible]	95% KM (Percentile Bootstrap) UCL	0.[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Beryllium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	15
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	4	Number of Distinct Non-Detects	11
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	Date Detects	[illegible]
Median Detects	[illegible]	Date Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Date of Logged Detects	[illegible]

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	[illegible]		
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	[illegible]		
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (14, α)	[illegible]	adjusted Chi Square Value (14, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect values or at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values for UCLs and ETLs

For gamma distributed detected data, BTSs and BCAs UCLs may be improved by using gamma distribution in KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (14.014, α)	[illegible]	adjusted Chi Square Value (14.014, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (Log ROS) UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UCL of mean, logged)	[illegible]
KM (SD of logged)	[illegible]	95% KM (Chebyshev UCL, logged)	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Basic statistics

General Statistics

Total Number of Observations	40	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	5
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	1.4	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	5
Variance Detects	[illegible]	Percent Non-Detects	40%
Mean Detects	[illegible]	Standard Deviation Detects	[illegible]
Median Detects	[illegible]	Range of Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	1.544
Mean of Logged Detects	[illegible]	Standard Deviation of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has 50% NDs with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may produce unreliable adjusted gamma UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be impacted adversely when gamma distribution is not the estimate

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% Hall's UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	[illegible]	95% KM (Jackknife) UCL (log)	[illegible]
KM (SD of logged)	[illegible]	95% KM (all) UCL (log)	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cadmium

General Statistics

Total Number of Observations	4
Number of Distinct Observations	4
Number of Detects	4
Number of Non-Detects	0
Number of Distinct Detects	4
Number of Distinct Non-Detects	0
Minimum Detect	0.14
Minimum Non-Detect	[illegible]
Maximum Detect	14.00
Maximum Non-Detect	[illegible]
Average Detect	12.1 4
Pooled Average Non-Detects	[illegible]
Mean Detects	14.4
SD Detects	[illegible]
Median Detects	[illegible]
IQR Detects	[illegible]
Skewness Detects	[illegible]
Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]
SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]4
5% Shapiro Wilk Critical Value	0.[illegible]
Lilliefors Test Statistic	0.411
5% Lilliefors Critical Value	0.14

Shapiro Wilk GOF Test

Detected Data Not Normal at 5% Significance Level

Lilliefors GOF Test

Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]
Standard Error of Mean	[illegible]
SD	[illegible]
95% KM (t) UCL	[illegible]
95% KM (z) UCL	[illegible]
95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (BCA Bootstrap) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]
99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]
5% A-D Critical Value	[illegible]
K-S Test Statistic	[illegible]

Anderson-Darling GOF Test

Detected Data Not Gamma Distributed at 5% Significance Level

Kolmogrov-Smirnoff GOF

Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]
k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]
Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]
nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]
MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]
nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]
adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]
95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detects is small such as < 1.0

For such situations, GROS method may be unstable, with inflated values of UCLs and ETLs

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]
Mean	[illegible]
Maximum	[illegible]
Median	[illegible]
SD	[illegible]
CV	[illegible]
k hat (MLE)	[illegible]
k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]
Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]
nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]
MLE Sd (bias corrected)	[illegible]
Adjusted Level of Significance (0.05)	[illegible]
Adjusted Chi Square Value (1.[illegible], df)	[illegible]
approximate Chi Square Value (1.[illegible], df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]
95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]
5% Shapiro Wilk Critical Value	[illegible]
Lilliefors Test Statistic	[illegible]
5% Lilliefors Critical Value	[illegible]

Shapiro Wilk GOF Test

Detected Data appear Lognormal at 5% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]
Mean in Log scale	[illegible]
SD in Original scale	[illegible]
SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]
95% Percentile Bootstrap UCL	[illegible]
95% HW UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]
95% KM (BCA) UCL	[illegible]
KM SD (logged)	[illegible]
95% KM (Percentile Bootstrap) UCL	[illegible]
KM Standard Error of Mean (logged)	[illegible]

DL/2 Statistics

DL/2 Normal	DL/2 Log-Transformed
Mean in Original scale	[illegible]
Mean in Log scale	[illegible]
SD in Original scale	[illegible]
SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]
95% Hall's UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) Bootstrap UCL [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Chloroform

General Statistics

Total Number of Observations	40	Number of Distinct Observations	10
Number of Detects	4	Number of Non-Detects	1
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.5
Maximum Detect	0.4	Maximum Non-Detect	0.5
Mean Detects	0.2625	Percent Non-Detects	97.5%
Median Detects	0.2	Mean Non-Detects	0.5
Skewness Detects	0.0	Kurtosis Detects	1.75
Mean of Logged Detects	-1.61	Mean of Logged Non-Detects	-0.693

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.285	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.197	Standard Error of Mean	0.0425
SD	0.198	95% KM (BCA) UCL	0.244
95% KM (t) UCL	0.258	95% KM (Percentile Bootstrap) UCL	0.24
95% KM (z) UCL	0.277	95% KM (Bootstrap t) UCL	0.284
90% KM (Chebyshev) UCL	0.311	95% KM (Chebyshev) UCL	0.349
97.5% KM (Chebyshev) UCL	0.404	99% KM (Chebyshev) UCL	0.573

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.4	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.1	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.96	k star (bias corrected MLE)	0.435
Theta hat (MLE)	0.1	Theta star (bias corrected MLE)	0.605
nu hat (MLE)	15.5	nu star (bias corrected)	17.4
MLE Mean (bias corrected)	0.197	MLE Sd (bias corrected)	0.345

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.425	nu hat (KM)	34
approximate Chi Square Value (34, α)	21.8	adjusted Chi Square Value (34, β)	20.7
95% Gamma approximate KM UCL (use when n>=50)	0.41	95% Gamma adjusted KM UCL (use when n<50)	0.429

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or when all ND data are at a single DL

GROS may not be used when data set has only 2 distinct detected values or small sample size

Fitted Gamma distribution on GROS may not pass goodness of fit test

For gamma distributed detected data, BTs and 95% UCLs may be impacted using gamma distribution on KM estimates

Minimum	0.01	Mean	0.194
Maximum	0.4	Median	0.15
SD	0.107	CV	0.553
k hat (MLE)	0.783	k star (bias corrected MLE)	0.71
Theta hat (MLE)	0.248	Theta star (bias corrected MLE)	0.273
nu hat (MLE)	62.7	nu star (bias corrected)	56.8
MLE Mean (bias corrected)	0.194	MLE Sd (bias corrected)	0.231
		Adjusted Level of Significance (β)	0.0484
approximate Chi Square Value (56.8, α)	40.3	adjusted Chi Square Value (56.8, β)	38.7
95% Gamma approximate KM UCL (use when n>=50)	0.258	95% Gamma adjusted KM UCL (use when n<50)	0.271

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.285	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.156	Mean in Log scale	-2.14
SD in Original scale	0.195	SD in Log scale	1.14
95% KM (t) UCL (assumes normality of ROS data)	0.251	95% Percentile Bootstrap UCL	0.24
95% KM (BCA) UCL	0.27	95% Bootstrap t UCL	0.5
95% KM (Hall's bootstrap) UCL	0.28		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged Data)	-2	95% KM (BCA) UCL	0.18
KM (SD of logged Data)	1.18	95% KM (Bootstrap t) UCL	0.267
KM (Standard Error of Mean of logged Data)	0.54		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	0.17	Mean in Log scale	-2.14
SD in Original scale	0.198	SD in Log scale	1.11
95% UCL (assumes normality)	0.277	95% H-stat UCL	4.551

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.25	95% KM (Percentile Bootstrap) UCL	0.24

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nad'ar Maro, and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	15
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	4
Minimum Detect	1	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	[illegible]	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Std. of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM Chebyshev UCL	[illegible]	95% KM Chebyshev UCL	[illegible]
97.5% KM Chebyshev UCL	[illegible]	99% KM Chebyshev UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (alpha)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nar Nile and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cobalt

General Statistics

Total Number of Observations	4	Number of Distinct Observations	2
Number of Detects	14	Number of Non-Detects	24
Number of Distinct Detects	1	Number of Distinct Non-Detects	10
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detects	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	[illegible] Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Std. of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, α)	[illegible]	adjusted Chi Square Value (1, N, α)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (1, α, β)	[illegible]	adjusted Chi Square Value (1, N, α, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged Data)	[illegible]	95% KM (UMVUE) UCL (Log)	[illegible]
KM (SD of logged Data)	[illegible]	95% KM (Approx Fiducial) UCL (Log)	[illegible]
KM (Standard Error of Mean of logged Data)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Bootstrap t) UCL [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Copper

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Mean Detects	[illegible]	Percent Non-Detects	[illegible]
Median Detects	[illegible]	Mode Detects	[illegible]
Standard Deviation Detects	[illegible]	Skewness Detects	[illegible]
Mean of Logged Detects	[illegible]	Standard Deviation of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (t) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (BCA) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level (= α/2)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% HM-UMVUE UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (Log ROS) UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UPR) UCL	[illegible]
KM (SD of logged)	[illegible]	95% KM (t-1) UCL	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide

General Statistics

Total Number of Observations	4	Number of Distinct Observations	17
Number of Detects	1[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	10	Number of Distinct Non-Detects	7
Minimum Detect	[illegible].4	Minimum Non-Detect	10
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible].4	Percent Non-Detects	[illegible].%
Mean Detects	14.41	SD Detects	1.7
Median Detects	4	CV Detects	[illegible]
Kurtosis Detects	[illegible]4.1	Skewness Detects	1.[illegible]
Mean of Logged Detects	[illegible].7[illegible]	SD of Logged Detects	1.04

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0		
5% Shapiro Wilk Critical Value	0.[illegible]4	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.[illegible]1		
5% Lilliefors Critical Value	0.[illegible]7	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	10.[illegible]	KM Standard Error of Mean	1.[illegible]4
KM SD	4.1	95% KM (BCA) UCL	10.[illegible]
95% KM (t) UCL	10.[illegible]7	95% KM (Percentile Bootstrap) UCL	10.[illegible]
95% KM (z) UCL	10.[illegible]1	95% KM (Bootstrap t) UCL	11.14
90% KM (Chebyshev) UCL	1.[illegible]4	95% KM (Chebyshev) UCL	14
97.5% KM (Chebyshev) UCL	17.[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	0.[illegible]		
5% A-D Critical Value	0.7[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	0.[illegible]4		
5% K-S Critical Value	0.[illegible]1	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.[illegible]1	k star (bias corrected MLE)	1.07[illegible]
Theta hat (MLE)	11.[illegible]4	Theta star (bias corrected MLE)	14.[illegible]7
nu hat (MLE)	1[illegible]7.4	nu star (bias corrected)	[illegible].4[illegible]
MLE Mean (bias corrected)	14.41	MLE Sd (bias corrected)	14.7[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.[illegible]4[illegible]	nu hat (KM)	[illegible].4[illegible]
approximate Chi Square Value (34, α)	5.14	adjusted chi square value (34, β)	5.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	10.[illegible]5	95% Gamma adjusted KM UCL (use when n<50)	10.44

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.[illegible]	Mean	[illegible].[illegible]4
Maximum		Median	[illegible].4
SD	[illegible]	CV	1.01[illegible]
k hat (MLE)	0.41	k star (bias corrected MLE)	0.[illegible]4
Theta hat (MLE)	[illegible].44	Theta star (bias corrected MLE)	10.1
nu hat (MLE)	7.11	nu star (bias corrected)	[illegible].7[illegible]4
MLE Mean (bias corrected)	7.[illegible]4	MLE Sd (bias corrected)	4.[illegible]
		adjusted Level of significance (β)	0.0[illegible]7
approximate Chi Square Value (7.[illegible], α)	4.4[illegible]4	adjusted Chi Square Value (7.[illegible], β)	4.[illegible]4
95% Gamma approximate KM UCL (use when n>=50)	11.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	1.[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.[illegible]5		
5% Shapiro Wilk Critical Value	0.[illegible]4	Detected Data appear Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.[illegible]4		
5% Lilliefors Critical Value	0.[illegible]5[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	4.[illegible]1	Mean in Log scale	1.7[illegible]4
SD in Original scale	[illegible]5.[illegible]	SD in Log scale	0.[illegible]4
95% KM (BCA) UCL (assumes normality of ROS data)	10.[illegible]7	95% Percentile Bootstrap UCL	10.[illegible]
95% KM (Chebyshev) UCL	11.[illegible]	95% Bootstrap t UCL	11.[illegible]
95% HW UCL (Log ROS)	10.4[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	1.7[illegible]3	95% KM UCL (KM Log)	4.7[illegible]
KM SD (logged)	0.[illegible]54	95% Critical H Value (KM Log)	[illegible].144
KM Standard Error of Mean (logged)	0.11[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	4.11	Mean in Log scale	1.4[illegible]1
SD in Original scale	[illegible].1[illegible]	SD in Log scale	0.[illegible]44
95% UCL (assumes normality)	11.[illegible]	95% H-stat UCL	10.[illegible]7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	10.[illegible]7	95% GROS adjusted Gamma UCL	1.[illegible]
95% adjusted Gamma KM UCL	10.44		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all real world data sets; for additional insight, the user may want to consult a statistician.

Ethylbenzene

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	4	Number of Non-Detects	0
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.34	Minimum Non-Detect	0.5
Maximum Detect	1	Maximum Non-Detect	5
Mean Detects	0.8	Percent Non-Detects	74.4%
Median Detects	0.44	Detects	2.51
Skewness Detects	0.11	Kurtosis Detects	2.4
Mean of Logged Detects	-0.58	Dev of Logged Detects	1.5

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.74		
5% Shapiro Wilk Critical Value	0.24	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.2		
5% Lilliefors Critical Value	0.5	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.4	Standard Error of Mean	0.104
SD	0.4	95% KM (BCA) UCL	0.7
95% KM (t) UCL	0.4	95% KM (Percentile Bootstrap) UCL	0.4
95% KM (z) UCL	0.4	95% KM (Bootstrap t) UCL	0.54
90% KM (Chebyshev) UCL	0.6	95% KM (Chebyshev) UCL	0.2
97.5% KM (Chebyshev) UCL	0.4	99% KM (Chebyshev) UCL	5.1

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	0.4		
5% A-D Critical Value	0.44	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	0.2		
5% K-S Critical Value	0.24	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.2	k star (bias corrected MLE)	0.21
Theta hat (MLE)	4.71	Theta star (bias corrected MLE)	5.51
nu hat (MLE)	14.5	nu star (bias corrected)	11.7
MLE Mean (bias corrected)	0.4	MLE Sd (bias corrected)	0.4

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.4	nu hat (KM)	0.5
approximate Chi Square Value (0.05, df)	3.04	adjusted Chi Square Value (0.05, df)	1.7
95% Gamma approximate KM UCL (use when n>=50)	1.4	95% Gamma adjusted KM UCL (use when n<50)	2.08

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when data set has only 2 detected data values or small sample size (< 10)

For such situations, GROS method may yield artificially inflated values UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.4
Maximum	1	Median	0.5
SD	0.48	CV	1.2
k hat (MLE)	0.42	k star (bias corrected MLE)	0.41
Theta hat (MLE)	2	Theta star (bias corrected MLE)	2
nu hat (MLE)	14	nu star (bias corrected)	14.7
MLE Mean (bias corrected)	0.4	MLE Sd (bias corrected)	0.94
		adjusted Level of Significance (0.05)	0.04
approximate Chi Square Value (14.7, alpha)	5.05	adjusted Chi Square Value (14.7, alpha)	4.4
95% Gamma approximate KM UCL (use when n>=50)	0.74	95% Gamma adjusted KM UCL (use when n<50)	0.81

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.8		
5% Shapiro Wilk Critical Value	0.24	Detected Data Not Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.4		
5% Lilliefors Critical Value	0.5	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.4	Mean in Log Scale	-0.8
SD in Original Scale	0.5	SD in Log Scale	0.5
95% KM (BCA) UCL (assumes normality of ROS data)	0.7	95% Percentile Bootstrap UCL	0.74
95% KM (Chebyshev) UCL	0.47	95% Bootstrap t UCL	0.4
95% KM (Log ROS) UCL	0.5		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Hero) Logged	-0.57	95% KM (UPH) UCL Log	0.74
KM (SD) Logged	0.74	95% Normal KM Value (UPH) Log	2.17
KM Standard Error of Mean Logged	0.4		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.51	Mean in Log Scale	-0.5
SD in Original Scale	0.4	SD in Log Scale	0.94
95% KM (t) UCL (assumes normality)	0.71	95% Hall's Bootstrap UCL	4.44

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.4	95% KM (Percentile Bootstrap) UCL	0.4

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nad'ie and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride

General Statistics

Total Number of Observations: 4 | Number of Distinct Observations: 2

Number of Detects: 2 | Number of Non-Detects: 2

Number of Distinct Detects: 2 | Number of Distinct Non-Detects: 1

Minimum Detect: 7.5 | Minimum Non-Detect: 10.00

Maximum Detect: 10.00 | Maximum Non-Detect: 10.00

Variance Detects: 1.125E+00 | Percent Non-Detects: 50.00%

Mean Detects: 8.750 | Date Detects: 10/07/2008

Median Detects: 8.750 | Date Non-Detects: 11/04/2008

Skewness Detects: 0.000 | Kurtosis Detects: 0.000

Mean of Logged Detects: 0.000 | Date of Logged Detects: 04/05/2008

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: 0.750 | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: 0.767 | Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic: 0.244 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.374 | Detected Data Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: 8.750 | Standard Error of Mean: 0.433

SD: 0.612 | 95% KM (BCA) UCL: 9.424

95% KM (t) UCL: 9.534 | 95% KM (Percentile Bootstrap) UCL: 9.375

95% KM (z) UCL: 9.437 | 95% KM (BCA Bootstrap) UCL: 9.438

95% KM (Chebyshev) UCL: 10.437 | 95% KM (Chebyshev) UCL: 11.400

97.5% KM (Chebyshev) UCL: 12.104 | 99% KM (Chebyshev) UCL: 15.145

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: 0.375 | **Anderson-Darling GOF Test**

5% A-D Critical Value: 0.734 | Detected Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic: 0.250 | **Kolmogrov-Smirnoff GOF**

5% K-S Critical Value: 0.320 | Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): 0.243 | k star (bias corrected MLE): 0.188

Theta hat (MLE): 36.02 | Theta star (bias corrected MLE): 46.57

nu hat (MLE): 1.947 | nu star (bias corrected): 1.503

MLE Mean (bias corrected): 8.750 | MLE Sd (bias corrected): 20.17

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): 0.500 | nu hat (KM): 4.000

approximate Chi Square Value (4.00, α): 0.711 | adjusted Chi Square Value (4.00, β): 0.356

95% Gamma approximate KM UCL (use when n>=50): 12.104 | 95% Gamma adjusted KM UCL (use when n<50): 18.874

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and multiple DLs

GROS may not be used when data set has only 2 detected data values or small sample size

For such situations, GROS method may yield inflated values for UCL and ET's

For gamma distributed detected data, BTs and UCLs may be improved using gamma distribution in KM estimates

Minimum: 7.5 | Mean: 14.14

Maximum: 10.00 | Median: 8.750

SD: 1.414 | CV: 0.100

k hat (MLE): 195.2 | k star (bias corrected MLE): 195.2

Theta hat (MLE): 0.072 | Theta star (bias corrected MLE): 0.072

nu hat (MLE): 780 | nu star (bias corrected): 780

MLE Mean (bias corrected): 14.14 | MLE Sd (bias corrected): 1.020

Adjusted Level of Significance (β): 0.0481

approximate Chi Square Value (780.00, α): 735.7 | adjusted Chi Square Value (780.00, β): 735.1

95% Gamma approximate KM UCL (use when n>=50): 14.701 | 95% Gamma adjusted KM UCL (use when n<50): 14.744

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: 0.750 | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: 0.767 | Detected Data Not Lognormal at 5% Significance Level

Lilliefors Test Statistic: 0.244 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.374 | Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale: 8.750 | Mean in Log Scale: 2.150

SD in Original Scale: 0.642 | SD in Log Scale: 0.075

95% KM (BCA) UCL assumes normality of ROS data: 9.424 | 95% Percentile Bootstrap UCL: 9.375

95% KM (t) UCL: 9.534 | 95% Bootstrap UCL: 9.500

95% KM (Log ROS) UCL: 10.000

DL/2 Statistics

DL/2 Normal | **DL/2 Log-Transformed**

Mean in Original Scale: 8.750 | Mean in Log Scale: 2.150

SD in Original Scale: 0.642 | SD in Log Scale: 0.075

95% KM (t) UCL assumes normality: 9.534 | 95% Hall's Bootstrap UCL: 10.040

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL: 11.400

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon the results of the simulation studies summarized in Singh, Maritz and Lee (2010)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Iron											
2												
3						**General Statistics**						
4				Total Number of Observations	4				Number of Distinct Observations	5		
5												
6				Number of Detects	5				Number of Non-Detects	1		
7				Number of Distinct Detects	4				Number of Distinct Non-Detects	1		
8				Minimum Detect	7.1				Minimum Non-Detect	10.0		
9				Maximum Detect	17.0				Maximum Non-Detect	10.0		
10				Variance Detects	15.4145				Percent Non-Detects	41.67%		
11				Mean Detects	12.74				SD Detects	4.1		
12				Median Detects	13.00				CV Detects	0.32		
13				Skewness Detects	0.477				Kurtosis Detects	2		
14				Mean of Logged Detects	2.515				SD of Logged Detects	0.441		
15												
16						**Normal GOF Test on Detects Only**						
17				Shapiro Wilk Test Statistic	0.94			**Shapiro Wilk GOF Test**				
18				5% Shapiro Wilk Critical Value	0.762			Detected Data Appear Normal at 5% Significance Level				
19				Lilliefors Test Statistic	0.207			**Lilliefors GOF Test**				
20				5% Lilliefors Critical Value	0.377			Detected Data Appear Normal at 5% Significance Level				
21						**Detected Data Not Normal at 5% Significance Level**						
22												
23						**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**						
24				Mean	12.2				Standard Error of Mean	2.424		
25				SD	3.41				95% KM (BCA) UCL	15.4		
26				95% KM (t) UCL	15.14				95% KM (Percentile Bootstrap) UCL	15.11		
27				95% KM (z) UCL	14.94				95% KM (Bootstrap t) UCL	19.4		
28				90% KM (Chebyshev) UCL	17.1				95% KM (Chebyshev) UCL	21		
29				97.5% KM (Chebyshev) UCL	23.7				99% KM (Chebyshev) UCL	29.5		
30												
31						**Gamma GOF Tests on Detected Observations Only**						
32				A-D Test Statistic	0.4			**Anderson-Darling GOF Test**				
33				5% A-D Critical Value	0.741			Detected data appear Gamma Distributed at 5% Significance Level				
34				K-S Test Statistic	0.33			**Kolmogrov-Smirnoff GOF**				
35				5% K-S Critical Value	0.3			Detected data appear Gamma Distributed at 5% Significance Level				
36						**Detected data appear Gamma Distributed at 5% Significance Level**						
37												
38						**Gamma Statistics on Detected Data Only**						
39				k hat (MLE)	10.55				k star (bias corrected MLE)	10.14		
40				Theta hat (MLE)	1.207				Theta star (bias corrected MLE)	1.255		
41				nu hat (MLE)	84				nu star (bias corrected)	81		
42				MLE Mean (bias corrected)	12.74				MLE Sd (bias corrected)	4.1		
43												
44						**Gamma Kaplan-Meier (KM) Statistics**						
45				k hat (KM)	11.25				nu hat (KM)	90		
46				approximate Chi Square Value (0.05, df)	71.54			adjusted Chi Square Value (0.05, df)		71.17		
47				95% Gamma approximate KM UCL (use when n>=50)	14.15			95% Gamma adjusted KM UCL (use when n<50)		14.7		
48												
49						**Gamma ROS Statistics using Imputed Non-Detects**						
50				GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs								
51				GROS may not be used when kstar of detected data is small such as < 0.1								
52				For such situations, GROS method may yield artifactual values of UCLs and BTVs								
53				For gamma distributed detected data, BTVs and UCLs may be improved by using gamma distribution in KM estimates								
54				Minimum	0.01				Mean	15.41		
55				Maximum	17.00				Median	17		
56				SD	5.7				CV	0.374		
57				k hat (MLE)	0.347				k star (bias corrected MLE)	0.315		
58				Theta hat (MLE)	44.45				Theta star (bias corrected MLE)	48.9		
59				nu hat (MLE)	1.4				nu star (bias corrected)	1.3		
60				MLE Mean (bias corrected)	15.41				MLE Sd (bias corrected)	8.84		
61								Adjusted Level of Significance (β)		0.0344		
62				approximate Chi Square Value (1.3, df)	5.43			adjusted Chi Square Value (1.3, df)		5.11		
63				95% Gamma approximate KM UCL (use when n>=50)	4.41			95% Gamma adjusted KM UCL (use when n<50)		5.4		
64												
65						**Lognormal GOF Test on Detected Observations Only**						
66				Shapiro Wilk Test Statistic	0.977			**Shapiro Wilk GOF Test**				
67				5% Shapiro Wilk Critical Value	0.762			Detected Data appear Lognormal at 5% Significance Level				
68				Lilliefors Test Statistic	0.181			**Lilliefors GOF Test**				
69				5% Lilliefors Critical Value	0.377			Detected Data appear Lognormal at 5% Significance Level				
70						**Detected Data appear Lognormal at 5% Significance Level**						
71												
72						**Lognormal ROS Statistics Using Imputed Non-Detects**						
73				Mean in Original scale	12.4				Mean in Log scale	2.47		
74				SD in Original scale	3.1				SD in Log scale	0.71		
75				95% KM (BCA) UCL (assumes normality of ROS data)	14.75				95% Percentile Bootstrap UCL	15.1		
76				95% KM (t) UCL (assumes normality of ROS data)	14.75				95% Bootstrap t UCL	19.4		
77				95% HW UCL (LN of ROS data)	14.1							
78												
79						**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**						
80				KM (Mean of logged data)	2.57				95% KM (UPR) UCL	19.4		
81				KM (SD of logged data)	0.75				95% KM (Chebyshev) UCL	31.2		
82				KM (standard Error of Mean of logged data)	0.27							
83												
84						**DL/2 Statistics**						
85				**DL/2 Normal**					**DL/2 Log-Transformed**			
86				Mean in Original scale	12.5				Mean in Log scale	2.34		
87				SD in Original scale	3.11				SD in Log scale	0.715		
88				95% UCL (assumes normality)	15.1				95% H-stat UCL	21.2		
89				DL/2 is not a recommended method, provided for comparisons and historical reasons								
90												
91						**Nonparametric Distribution Free UCL Statistics**						
92						**Detected Data appear Gamma Distributed at 5% Significance Level**						
93												
94						**Suggested UCL to Use**						
95				95% KM (BCA) UCL	15.4				95% GROS Adjusted Gamma UCL	14.7		
96				95% Adjusted Gamma KM UCL	14.7							
97												
98				Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL								
99				Recommendations are based upon data size, data distribution, and skewness								
100				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)								
101				However, simulation results will not cover all Real World data sets; for additional insight, the user may want to consult a statistician.								
102												

Level

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
Number of Detects	14	Number of Non-Detects	0
Number of Distinct Detects	14	Number of Distinct Non-Detects	0
Minimum Detect	[illegible]	Minimum Non-Detect	0
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Mean Detects	[illegible]	Percent Non-Detects	[illegible]
Median Detects	[illegible]	SD Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level (= alpha)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% critical H value (KM-log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight, the user may want to consult a statistician.

Manganese

General Statistics

Total Number of Observations: 4
Number of Distinct Observations: 4
Number of Detects: 2
Number of Non-Detects: 2
Number of Distinct Detects: 2
Number of Distinct Non-Detects: 2
Minimum Detect: [illegible]
Minimum Non-Detect: 1
Maximum Detect: [illegible]
Maximum Non-Detect: [illegible]
Percent Detects: 1.[illegible]E+[illegible]
Percent Non-Detects: [illegible]%
Mean Detects: 14.[illegible]
Standard Deviation Detects: [illegible]
Median Detects: [illegible]
Skewness Detects: [illegible]
Kurtosis Detects: [illegible]
Mean of Logged Detects: [illegible]
Standard Deviation of Logged Detects: [illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: [illegible]
Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value: [illegible]
Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic: [illegible]
Lilliefors GOF Test
5% Lilliefors Critical Value: [illegible]
Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: [illegible]
Standard Error of Mean: [illegible]
SD: [illegible]
95% KM (t) UCL: [illegible]
95% KM (percentile bootstrap) UCL: [illegible]
95% KM (z) UCL: [illegible]
95% KM (BCA bootstrap) UCL: [illegible]
95% KM (Chebyshev) UCL: [illegible]
95% KM (Chebyshev) UCL: [illegible]
97.5% KM (Chebyshev) UCL: [illegible]
99% KM (Chebyshev) UCL: [illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: [illegible]
Anderson-Darling GOF Test
5% A-D Critical Value: [illegible]
Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic: [illegible]
Kolmogrov-Smirnoff GOF
5% K-S Critical Value: [illegible]
Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): [illegible]
nu hat (KM): [illegible]
approximate Chi Square Value (.[illegible], [illegible]): [illegible]
adjusted Chi Square Value (.[illegible], [illegible]): [illegible]
95% Gamma approximate KM UCL (use when n>=50): [illegible]
95% Gamma adjusted KM UCL (use when n>50): [illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits or several different DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations GROS method may yield inflated values of UCLs and BTSs
For gamma distributed detected data, BTSs and UCLs may be improved using gamma distribution in KM estimates

Minimum: [illegible]
Mean: [illegible]
Maximum: [illegible]
Median: [illegible]
SD: [illegible]
CV: [illegible]
k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]
Adjusted Level of Significance (alpha): [illegible]
approximate Chi Square Value (.[illegible], [illegible]): [illegible]
adjusted Chi Square Value (.[illegible], [illegible]): [illegible]
95% Gamma approximate UCL (use when n>=50): [illegible]
95% Gamma adjusted UCL (use when n>50): [illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: [illegible]
Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value: [illegible]
Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic: [illegible]
Lilliefors GOF Test
5% Lilliefors Critical Value: [illegible]
Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale: [illegible]
Mean in Log scale: [illegible]
SD in Original scale: [illegible]
SD in Log scale: [illegible]
95% UCL (assumes normality of ROS data): [illegible]
95% Percentile Bootstrap UCL: [illegible]
95% BCA Bootstrap UCL: [illegible]
95% Hall's Bootstrap UCL: [illegible]
95% UCL (Log ROS): [illegible]

DL/2 Statistics

DL/2 Normal	DL/2 Log-Transformed
Mean in Original scale: [illegible]	Mean in Log scale: [illegible]
SD in Original scale: [illegible]	SD in Log scale: [illegible]
95% UCL (assumes normality): [illegible]	95% H-stat (UCL): [illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL: [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010).
However, simulation results will not cover all Real World data sets; in addition, advice regarding the use of maximum, mean, median, standard deviation, and other statistics

Mercury

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1[illegible]
Number of Detects	14	Number of Non-Detects	24
Number of Distinct Detects	14	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]44%
Mean Detects	[illegible]	DL/2 Detects	[illegible]
Median Detects	[illegible]	[illegible] Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	14.3
Mean of Logged Detects	[illegible]	DL/2 Logged Detects	[illegible]

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	[illegible]		
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	[illegible]		
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied observations at multiple DLs

GROS may not be used when k star of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (alpha)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UPR1 of Log)	[illegible]
KM (SD of logged)	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight, the user may want to consult a statistician.

Kapitalizaro

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1[illegible]
Number of Detects	11	Number of Non-Detects	[illegible]
Number of Distinct Detects	11	Number of Distinct Non-Detects	[illegible]
Minimum Detect	0.74	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	5.11
Variance Detects	[illegible]	Percent Non-Detects	71.74%
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	[illegible] Detects	11.5[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	1.4[illegible]
Mean of Logged Detects	1.[illegible]	Std. Dev. of Logged Detects	0.7[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.1[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.[illegible]	KM Standard Error of Mean	0.[illegible]
KM SD	1.[illegible]	95% KM (BCA) UCL	1.[illegible]
95% KM (t) UCL	1.4	95% KM (Percentile Bootstrap) UCL	1.4
95% KM (z) UCL	1.[illegible]	95% KM (Bootstrap t) UCL	2.[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	4.[illegible]
97.5% KM (Chebyshev) UCL	5.[illegible]	99% KM (Chebyshev) UCL	6.[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.4[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.2[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.[illegible]	k star (bias corrected MLE)	2.[illegible]
Theta hat (MLE)	1.[illegible]	Theta star (bias corrected MLE)	1.[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	4[illegible].5
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	1[illegible]
approximate Chi Square Value (1[illegible], 0.05)	15[illegible]	adjusted Chi Square Value (1[illegible], 0.05)	154.1
95% Gamma approximate KM UCL (use when n>=50)	2.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	2.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and UCLs may be improved using gamma distribution in KM estimates

Minimum	0.[illegible]	Mean	2.444
Maximum	[illegible]	Median	2.1[illegible]
SD	1.[illegible]	CV	0.[illegible]
k hat (MLE)	.44	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	4.1
MLE Mean (bias corrected)	2.444	MLE Sd (bias corrected)	[illegible]
		adjusted Level (= significance level)	[illegible]
approximate Chi Square Value (4.[illegible], [illegible])	[illegible]	adjusted Chi Square Value (4.[illegible], [illegible])	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	2.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	2.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.1[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	2.[illegible]	Mean in Log scale	[illegible]
SD in Original scale	1.4[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	2.[illegible]	95% Percentile Bootstrap UCL	2.[illegible]
95% KM (t) UCL (assumes normality of ROS data)	2.[illegible]	95% Bootstrap t UCL	2.[illegible]
95% HW UCL (Log ROS)	2.1		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged Data)	[illegible]	95% KM (BCA) UCL (KM Log)	[illegible]
KM (SD of logged Data)	[illegible]	95% KM (Chebyshev) UCL (KM Log)	2.[illegible]
KM (Standard Error of Mean of logged Data)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	4.2[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	4.[illegible]	95% H-stat UCL	4.[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	1.4	95% KM (Percentile Bootstrap) UCL	1.4

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations: 4 | Number of Distinct Observations: 7

Number of Detects: 1 | Number of Non-Detects: 1

Number of Distinct Detects: 1 | Number of Distinct Non-Detects: 1

Minimum Detect: 1 | Minimum Non-Detect: 40

Maximum Detect: 1 | Maximum Non-Detect: 100

Mean of Detects: 1.000 | Percent Non-Detects: 75.00%

Median of Detects: 1.000 | Standard Deviation of Detects: 0.000

Median of Detects: 1 | Skewness of Detects: 0.000

Kurtosis of Detects: 0.000

Mean of Logged Detects: 0.000 | Standard Deviation of Logged Detects: 0.000

Normal GOF Test on Detects Only

Shapiro-Wilk Test Statistic: 0.500 | **Shapiro-Wilk GOF Test**

5% Shapiro-Wilk Critical Value: 0.424 | Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic: 0.707 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.354 | Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: 1.000 | Standard Error of Mean: 0.000

SD: 0.000 | 95% KM (BCA) UCL: 1.000

95% KM (t) UCL: 1.000 | 95% KM (Percentile Bootstrap) UCL: 1.000

95% KM (z) UCL: 1.000 | 95% KM (Bootstrap t) UCL: 1.000

90% KM (Chebyshev) UCL: 1.000 | 95% KM (Chebyshev) UCL: 1.000

97.5% KM (Chebyshev) UCL: 1.000 | 99% KM (Chebyshev) UCL: 1.000

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: 1.000 | **Anderson-Darling GOF Test**

5% A-D Critical Value: 0.757 | Detected Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic: 0.500 | **Kolmogrov-Smirnoff GOF**

5% K-S Critical Value: 0.364 | Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): 0.000 | k star (bias corrected MLE): 0.000

Theta hat (MLE): 0.000 | Theta star (bias corrected MLE): 0.000

nu hat (MLE): 0.000 | nu star (bias corrected): 0.000

MLE Mean (bias corrected): 0.000 | MLE Sd (bias corrected): 0.000

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): 0.000 | nu hat (KM): 0.000

approximate Chi Square Value (0.05, df): 0.000 | adjusted Chi Square Value (0.05, df): 0.000

95% Gamma approximate KM UCL (use when n>=50): 0 | 95% Gamma adjusted KM UCL (use when n<50): 0

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Minimum: 0.000 | Mean: 0.000

Maximum: 0.000 | Median: 0

SD: 0.000 | CV: 0.000

k hat (MLE): 0.000 | k star (bias corrected MLE): 0.000

Theta hat (MLE): 0.000 | Theta star (bias corrected MLE): 0.000

nu hat (MLE): 0.000 | nu star (bias corrected): 0.000

MLE Mean (bias corrected): 0.000 | MLE Sd (bias corrected): 0.000

adjusted Level of Significance (adj): 0.0444

approximate Chi Square Value (0.05, df): 0.000 | adjusted Chi Square Value (0.05, df): 0.000

95% Gamma approximate UCL (use when n>=50): 0 | 95% Gamma adjusted UCL (use when n<50): 0

Lognormal GOF Test on Detected Observations Only

Shapiro-Wilk Test Statistic: 0.500 | **Shapiro-Wilk GOF Test**

5% Shapiro-Wilk Critical Value: 0.424 | Detected Data appear Lognormal at 5% Significance Level

Lilliefors Test Statistic: 0.707 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.354 | Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale: 1.000 | Mean in Log Scale: 0.000

SD in Original Scale: 0.000 | SD in Log Scale: 0.000

95% KM (BCA) UCL (assumes normality of ROS data): 1.000 | 95% Percentile Bootstrap UCL: 1.000

95% KM (Cheb) UCL: 1.000 | 95% Bootstrap t UCL: 1.000

95% KM (Log ROS) UCL: 0.000

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of Logged): 0.000 | 95% KM (UPR) UCL: 0.000

KM (SD of Logged): 0.000 | 95% KM (Jackknife) UCL: 0.000

KM (Standard Error of Mean of Logged): 0.000

DL/2 Statistics

DL/2 Normal | **DL/2 Log-Transformed**

Mean in Original Scale: 1.000 | Mean in Log Scale: 0.000

SD in Original Scale: 0.000 | SD in Log Scale: 0.000

95% KM (t) UCL (assumes normality): 1.000 | 95% Hall's UCL: 1.000

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Bootstrap t) UCL: 1.000

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (1999).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nitrate as N

General Statistics

Total Number of Observations: [illegible]
Number of Distinct Observations: [illegible]
Number of Detects: [illegible]
Number of Non-Detects: [illegible]
Number of Distinct Detects: [illegible]
Number of Distinct Non-Detects: 1
Minimum Detect: [illegible]
Minimum Non-Detect: [illegible]
Maximum Detect: [illegible]
Maximum Non-Detect: [illegible]
Mean of Detects: [illegible]
Percent Non-Detects: [illegible]%
Median Detects: [illegible]
Standard Deviation of Detects: [illegible]
Skewness of Detects: [illegible]
Kurtosis of Detects: [illegible]
Mean of Logged Detects: [illegible]
Standard Deviation of Logged Detects: [illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: [illegible]
5% Shapiro Wilk Critical Value: [illegible]
Data not Normal at 5% Significance Level

Shapiro Wilk GOF Test

Lilliefors Test Statistic: [illegible]
5% Lilliefors Critical Value: [illegible]
Data not Normal at 5% Significance Level

Lilliefors GOF Test

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: [illegible]
Standard Error of Mean: [illegible]
SD: [illegible]
95% KM (t) UCL: [illegible]
95% KM (z) UCL: [illegible]
95% KM (jackknife) UCL: [illegible]
95% KM (bootstrap t) UCL: [illegible]
95% KM (BCA bootstrap) UCL: [illegible]
95% KM (percentile bootstrap) UCL: [illegible]
95% KM (bootstrap t) UCL: [illegible]
95% KM (percentile bootstrap) UCL: [illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: [illegible]
5% A-D Critical Value: [illegible]
Detected data appear Gamma Distributed at 5% Significance Level

Anderson-Darling GOF Test

K-S Test Statistic: [illegible]
5% K-S Critical Value: [illegible]
Detected data appear Gamma Distributed at 5% Significance Level

Kolmogrov-Smirnoff GOF

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): [illegible]
nu hat (KM): [illegible]
approximate Chi Square Value (.05): [illegible]
adjusted Chi Square Value (.05): [illegible]
95% Gamma approximate KM UCL (use when n>=50): [illegible]
95% Gamma adjusted KM UCL (use when n>50): [illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and multiple DLs
GROS may not be used when total # of detected data is small such as < 10
For such situations GROS method may yield artificially inflated UCL and ET s
For gamma distributed detected data ET s and UCLs may be improved using gamma distribution in KM estimates

Minimum: [illegible]
Mean: [illegible]
Maximum: [illegible]
Median: [illegible]
SD: [illegible]
CV: [illegible]
k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]
Adjusted Level of Significance (adj): [illegible]
approximate Chi Square Value (.05): [illegible]
adjusted Chi Square Value (.05): [illegible]
95% Gamma approximate KM UCL (use when n>=50): [illegible]
95% Gamma adjusted KM UCL (use when n>50): [illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: [illegible]
5% Shapiro Wilk Critical Value: [illegible]
Detected Data appear Lognormal at 5% Significance Level

Shapiro Wilk GOF Test

Lilliefors Test Statistic: [illegible]
5% Lilliefors Critical Value: [illegible]
Detected Data appear Lognormal at 5% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale: [illegible]
Mean in Log scale: [illegible]
SD in Original scale: [illegible]
SD in Log scale: [illegible]
95% KM (BCA) UCL (assumes normality of ROS data): [illegible]
95% Percentile Bootstrap UCL: [illegible]
95% KM (t) UCL: [illegible]
95% KM (Percentile Bootstrap) UCL: [illegible]
95% KM (Bootstrap t) UCL: [illegible]
95% KM (H-UCL) UCL: [illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged data): [illegible]
95% KM (H-UCL) UCL: [illegible]
KM (SD of logged data): [illegible]
95% KM (Chebyshev) UCL: [illegible]
KM (Standard Error of Mean of logged data): [illegible]

DL/2 Statistics

DL/2 Normal

Mean in Original scale: [illegible]
SD in Original scale: [illegible]
95% KM (t) UCL (assumes normality of ROS data): [illegible]

DL/2 Log-Transformed

Mean in Log scale: [illegible]
SD in Log scale: [illegible]
95% H-UCL (DL/2 log-transformed): [illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Percentile Bootstrap) UCL: [illegible]
95% GROS adjusted Gamma UCL: [illegible]
95% adjusted Gamma KM UCL: [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL
Recommendations are based upon data size, data distribution, and skewness
These recommendations are based upon the results in the similar to studies summarized in Singh, Maichle and Lee (2006)
However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nitrite as N

General Statistics

Total Number of Observations	14
Number of Distinct Observations	12
Number of Detects	11
Number of Non-Detects	3
Number of Distinct Detects	10
Number of Distinct Non-Detects	2
Minimum Detect	1.00
Minimum Non-Detect	5.00
Maximum Detect	5.00
Maximum Non-Detect	5.00
Variance Detects	1.561E+
Percent Non-Detects	21.43%
Mean Detects	2.818
Standard Deviation Detects	1.250
Median Detects	2.00
Skewness Detects	0.774
Kurtosis Detects	0.5
Mean of Logged Detects	0.741
Standard Deviation of Logged Detects	0.468

Normal GOF Test on Detects Only

Shapiro Wilk Test	
Shapiro Wilk Test Statistic	0.848
5% Shapiro Wilk Critical Value	0.842
Detected Data Appear Normal at 5% Significance Level	
Lilliefors GOF Test	
Lilliefors Test Statistic	0.256
5% Lilliefors Critical Value	0.257
Detected Data Appear Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.2
Standard Error of Mean	0.218
SD	1.207
95% KM (BCA) UCL	4.500
95% KM (t) UCL	4.412
95% KM (Percentile Bootstrap) UCL	4.417
95% KM (z) UCL	4.4
95% KM (Bootstrap t) UCL	10.000
90% KM (Chebyshev) UCL	5.143
95% KM (Chebyshev) UCL	6.000
97.5% KM (Chebyshev) UCL	7.143
99% KM (Chebyshev) UCL	9.000

Gamma GOF Tests on Detected Observations Only

Anderson-Darling GOF Test	
A-D Test Statistic	0.596
5% A-D Critical Value	0.737
Detected Data Appear Gamma Distributed at 5% Significance Level	
Kolmogrov-Smirnoff GOF	
K-S Test Statistic	0.256
5% K-S Critical Value	0.264
Detected Data Appear Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.[illegible]
k star (bias corrected MLE)	1.[illegible]
Theta hat (MLE)	1.614
Theta star (bias corrected MLE)	1.844
nu hat (MLE)	34.[illegible]
nu star (bias corrected)	40.[illegible]
MLE Mean (bias corrected)	2.028
MLE Sd (bias corrected)	1.941

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	1.[illegible]
nu hat (KM)	46.[illegible]
approximate Chi Square Value (34, .05)	1.[illegible]
adjusted Chi Square Value (46, .05)	32.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	3.[illegible]
95% Gamma adjusted KM UCL (use when n<50)	3.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or when many distinct detect and multiple DLs

GROS may not be used when k star of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	0.00
Mean	2.17
Maximum	5.00
Median	2.00
SD	1.47
CV	0.677
k hat (MLE)	0.918
k star (bias corrected MLE)	0.942
Theta hat (MLE)	2.367
Theta star (bias corrected MLE)	2.304
nu hat (MLE)	51.57
nu star (bias corrected)	52.93
MLE Mean (bias corrected)	2.17
MLE Sd (bias corrected)	2.11
Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (52.93, .α)	34.77
Adjusted Chi Square Value (52.93, .β)	32.44
95% Gamma approximate UCL (use when n>=50)	3.[illegible]
95% Gamma adjusted UCL (use when n<50)	3.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.877
5% Shapiro Wilk Critical Value	0.842
Detected Data Appear Lognormal at 5% Significance Level	
Lilliefors GOF Test	
Lilliefors Test Statistic	0.1[illegible]
5% Lilliefors Critical Value	0.256
Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	2.140
Mean in Log scale	-0.[illegible]
SD in Original scale	1.414
SD in Log scale	0.[illegible]
95% UCL (assumes normality of ROS data)	4.113
95% Percentile Bootstrap UCL	4.14
95% EPA - Exponential UCL	3.144
95% Bootstrap t UCL	4.4[illegible]
95% H-UCL (Log ROS)	3.1[illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	-0.[illegible]
95% KM (BCA) UCL	3.[illegible]
KM (SD of logged)	0.[illegible]
95% KM (Percentile Bootstrap) UCL	3.[illegible]
KM (standard Error of Mean of logged)	0.[illegible]

DL/2 Statistics

DL/2 Normal	**DL/2 Log-Transformed**
Mean in Original scale	2.[illegible]
Mean in Log scale	-0.[illegible]
SD in Original scale	1.414
SD in Log scale	0.[illegible]
95% UCL (assumes normality)	4.[illegible]
95% Hall's UCL	4.[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 3.[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Perchloroethylene

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	7	Number of Non-Detects	4
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	1.1	Minimum Non-Detect	1.0
Maximum Detect	4	Maximum Non-Detect	10.0
Average Detects	1.444	Percent Non-Detects	36%
Mean Detects	2.71	Detects	1
Median Detects	2	Non-Detects	14.1
Skewness Detects	0.44	Kurtosis Detects	21.5
Mean of Logged Detects	0.72	Mean of Logged Non-Detects	0.44

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.71	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.35	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.71	Standard Error of Mean	0.72
SD	0.45	95% KM (BCA) UCL	0.4
95% KM (t) UCL	0.8	95% KM (Percentile Bootstrap) UCL	2.44
95% KM (z) UCL	2.44	95% KM (Bootstrap t) UCL	2.48
90% KM Chebyshev UCL	5.05	95% KM Chebyshev UCL	4.03
97.5% KM Chebyshev UCL	4.71	99% KM Chebyshev UCL	6.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.17	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.144	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.2	k star (bias corrected MLE)	1.94
Theta hat (MLE)	0.7	Theta star (bias corrected MLE)	0.444
nu hat (MLE)	7.4	nu star (bias corrected)	5.57
MLE Mean (bias corrected)	2.71	MLE Sd (bias corrected)	1.9

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.62	nu hat (KM)	5.2
approximate Chi Square Value (5, α)	1.48	adjusted Chi Square Value (5, α)	1.45
95% Gamma approximate KM UCL (use when n>=50)	2.8	95% Gamma adjusted KM UCL (use when n<50)	2.87

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detection limits or multiple DLs

GROS may not be used when data set has fewer than 5 detected data or small sample size (< 1)

For such situations, GROS method may yield artificially inflated values UCLs and ETLs

For gamma distributed detected data, BTSs and BCA UCLs may be more reliable than gamma distribution based KM estimates

Minimum	0.5	Mean	4
Maximum	10	Median	2.1
SD	3.04	CV	0.76
k hat (MLE)	0.98	k star (bias corrected MLE)	0.91
Theta hat (MLE)	4.7	Theta star (bias corrected MLE)	4.4
nu hat (MLE)	15	nu star (bias corrected)	14
MLE Mean (bias corrected)	4	MLE Sd (bias corrected)	4.11
		desired Level (α)	0.05
approximate Chi Square Value (14, α)	6.7	adjusted Chi Square Value (14, α)	6.1
95% Gamma approximate UCL (use when n>=50)	7.8	95% Gamma adjusted UCL (use when n<50)	8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.71	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.35	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	4.2	Mean in Log scale	0.7
SD in Original scale	3.18	SD in Log scale	0.84
95% KM (BCA) UCL (assumes normality of ROS data)	7.3	95% Percentile Bootstrap UCL	7.4
95% KM (Chebyshev) UCL	7.3	95% Bootstrap t UCL	7.77
95% KM (Log ROS) UCL	8		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged ND)	0.7	95% KM (UPR1 Log)	2.4
KM (SD of logged ND)	0.818	95% KM (Jackknife Log)	2.62
KM (standard Error of Mean of logged ND)	0.194		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	3.1	Mean in Log scale	-0.74
SD in Original scale	4.04	SD in Log scale	0.94
95% UCL (assumes normality)	4.41	95% Hall's UCL	9.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	4.8
95% KM (Percentile Bootstrap) UCL	2.44

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nad Maichle and Lee (2010).

However simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
Number of Detects	11	Number of Non-Detects	3
Number of Distinct Detects	11	Number of Distinct Non-Detects	3
Minimum Detect	0.2	Minimum Non-Detect	0.5
Maximum Detect	11.0	Maximum Non-Detect	0.5
Variance Detects	14.04	Percent Non-Detects	21.43%
Mean Detects	2.014	Detects	24%
Median Detects	0.7	Non-Detects	100%
Skewness Detects	2.055	Kurtosis Detects	7.04
Mean of Logged Detects	-0.44	Std Dev of Logged Detects	1.49

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data Not Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.42	Standard Error of Mean	0.77
SD	2.55	95% KM (BCA) UCL	3.54
95% KM (t) UCL	3.45	95% KM (Percentile Bootstrap) UCL	3.54
95% KM (z) UCL	3.5	95% KM (Bootstrap t) UCL	3.65
90% KM (Chebyshev) UCL	4.07	95% KM (Chebyshev) UCL	4.64
97.5% KM (Chebyshev) UCL	5.4	99% KM (Chebyshev) UCL	6.71

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.45	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.74	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.24	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.95	k star (bias corrected MLE)	0.85
Theta hat (MLE)	2.15	Theta star (bias corrected MLE)	2.37
nu hat (MLE)	26.4	nu star (bias corrected)	23.8
MLE Mean (bias corrected)	2.04	MLE Sd (bias corrected)	2.21

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.951	nu hat (KM)	26.4
approximate Chi Square Value (0.05)	16.79	adjusted Chi Square Value (0.05)	15.81
95% Gamma approximate KM UCL (use when n>=50)	3.23	95% Gamma adjusted KM UCL (use when n<50)	3.34

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detects is small such as < 1.0

For such situations, GROS method may yield inflated values of UCL and ET's

For gamma distributed detected data, BTA's and UCL may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.15
Maximum	11.0	Median	1.3
SD	2.85	CV	1.325
k hat (MLE)	0.577	k star (bias corrected MLE)	0.52
Theta hat (MLE)	3.73	Theta star (bias corrected MLE)	4.13
nu hat (MLE)	16.18	nu star (bias corrected)	14.56
MLE Mean (bias corrected)	2.15	MLE Sd (bias corrected)	2.94
		adjusted Level of significance (0)	0.0467
approximate Chi Square Value (14.56, 0.05)	5.23	adjusted Chi Square Value (14.56, 0.0467)	4.444
95% Gamma approximate UCL (use when n>=50)	4.56	95% Gamma adjusted UCL (use when n<50)	4.815

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.78	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.44	Mean in Log Scale	0.7
SD in Original Scale	2.84	SD in Log Scale	1.48
95% UCL (assumes normality of ROS data)	3.84	95% Percentile Bootstrap UCL	3.8
95% BCA Bootstrap UCL	3.93	95% Bootstrap t UCL	3.91
95% H-UCL (Log ROS)	3.8		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	0.7	95% H-UCL (KM -Log)	3.2
KM (SD of logged)	1.02	95% critical H value (KM-Log)	2.4
KM (standard error of mean of logged)	0.3		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.74	Mean in Log Scale	0.41
SD in Original Scale	2.8	SD in Log Scale	1.48
95% UCL (assumes normality)	3.97	95% H-UCL	12.47

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3.45	95% KM (Percentile Bootstrap) UCL	3.54

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Selenium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects		Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	Detect	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Dev of Logged Detects	[illegible]

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	[illegible]		
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	[illegible]		
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be much higher when using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Adjusted Level of Significance (0.05)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM -log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nar Nile and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Tetrachloroethene (Tetrachloroethylene)

General Statistics

Total Number of Observations	40	Number of Distinct Observations	14
Number of Detects	19	Number of Non-Detects	21
Number of Distinct Detects	12	Number of Distinct Non-Detects	2
Minimum Detect	0.1	Minimum Non-Detect	0.5
Maximum Detect	1	Maximum Non-Detect	5
Variance Detects	0.0[illegible]	Percent Non-Detects	52.5%
Mean Detects	0.5[illegible]	SD Detects	0.[illegible]
Median Detects	0.[illegible]	CV Detects	1.[illegible]
Kurtosis Detects	0.[illegible]	Skewness Detects	1.45[illegible]
Mean of Logged Detects	0.[illegible]	SD of Logged Detects	1.[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.41	Standard Error of Mean	0.[illegible]
SD	0.[illegible]	95% KM (BCA) UCL	1
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	0.[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	0.19[illegible]
90% KM (Chebyshev) UCL	0.[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	0.[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.14	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.[illegible]	k star (bias corrected MLE)	0.4[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.[illegible]
nu hat (MLE)	1.[illegible]	nu star (bias corrected)	14.[illegible]
MLE Mean (bias corrected)	0.[illegible]	MLE Sd (bias corrected)	0

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.4[illegible]	nu hat (KM)	14.[illegible]
approximate Chi Square Value (14, .05)	0.[illegible]	adjusted Chi Square Value (14, .05)	0.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	0.4	95% Gamma adjusted KM UCL (use when n<50)	0.5[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection levels or several multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values for UCLs and ETLs

For gamma distributed detected data, BTSs and UCLs may be improved using gamma distribution in KM estimates

Minimum	0.0[illegible]	Mean	0.[illegible]
Maximum	1	Median	0.[illegible]
SD	0.4[illegible]	CV	1.[illegible]
k hat (MLE)	0.[illegible]	k star (bias corrected MLE)	0.[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.44[illegible]
nu hat (MLE)	2.[illegible]	nu star (bias corrected)	2.1[illegible]
MLE Mean (bias corrected)	0.[illegible]	MLE Sd (bias corrected)	0.[illegible]
		Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (2.1[illegible], .05)	1.[illegible]	Adjusted Chi Square Value (2.1[illegible], .0[illegible])	1.14[illegible]
95% Gamma approximate UCL (use when n>=50)	0.4[illegible]	95% Gamma adjusted UCL (use when n<50)	0.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.54	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.5[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.41	SD in Log scale	1.7[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	0.101	95% Bootstrap t UCL	0.5[illegible]
95% HW UCL (Log ROS)	0.[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.4[illegible]	SD in Log scale	1.[illegible]
95% KM (t) UCL (assumes normality)	0.5[illegible]	95% Hall's UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon the results of the simulation studies summarized in Singh, Maritz and Lee (2010)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Thallium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	14
Number of Detects	4	Number of Non-Detects	0
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	[illegible]	Minimum Non-Detect	1
Maximum Detect	[illegible]	Maximum Non-Detect	120
Variance Detects	1[illegible]4	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	DL/2 Statistic	[illegible]
Median Detects	[illegible]	[illegible] Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	1[illegible]44
Mean of Logged Detects	[illegible]	Dev of Logged Detects	1[illegible]4

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 50% Non-Detects or less and multiple DLs

GROS may not be used when k star of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM UCL (KM Log)	[illegible]
KM (SD of logged)	[illegible]	95% Critical H Value (KM Log)	[illegible]
KM (Standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Trichloroethene (Trichloroethylene)

General Statistics

Total Number of Observations	40	Number of Distinct Observations	11
Number of Detects	11	Number of Non-Detects	11
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.24	Minimum Non-Detect	0.5
Maximum Detect	4	Maximum Non-Detect	5
Variance Detects	1.1	Percent Non-Detects	75%
Mean Detects	1.05	Percent Detects	25%
Median Detects	1.45	Total Detects	11.4
Skewness Detects	0.971	Kurtosis Detects	1.01
Mean of Logged Detects	-0.21	Std Dev of Logged Detects	1.34

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.74	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.14	Standard Error of Mean	0.34
SD	1.51	95% KM (BCA) UCL	2.04
95% KM (t) UCL	1.94	95% KM (Percentile Bootstrap) UCL	1.84
95% KM (z) UCL	1.94	95% KM (Bootstrap t) UCL	2.41
90% KM (Chebyshev) UCL	2.41	95% KM (Chebyshev) UCL	2.89
97.5% KM (Chebyshev) UCL	3.4	99% KM (Chebyshev) UCL	4.37

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.41	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.74	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.34	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.11	k star (bias corrected MLE)	0.9
Theta hat (MLE)	1.19	Theta star (bias corrected MLE)	1.3
nu hat (MLE)	22.7	nu star (bias corrected)	17.7
MLE Mean (bias corrected)	1.35	MLE Sd (bias corrected)	1.3

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.747	nu hat (KM)	59.7
approximate Chi Square Value (59.7, α)	44	adjusted Chi Square Value (59.7, β)	42.49
95% Gamma approximate KM UCL (use when n>=50)	1.7	95% Gamma adjusted KM UCL (use when n>50)	1.8

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when k star of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be incorrect when using gamma distribution on ROS estimates

Minimum	0.001	Mean	1.1
Maximum	5.04	Median	0.94
SD	1.24	CV	1.13
k hat (MLE)	0.79	k star (bias corrected MLE)	0.748
Theta hat (MLE)	1.44	Theta star (bias corrected MLE)	1.47
nu hat (MLE)	63.2	nu star (bias corrected)	60
MLE Mean (bias corrected)	1.1	MLE Sd (bias corrected)	1.27
		Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (60, α)	41	Adjusted Chi Square Value (60, β)	39.14
95% Gamma approximate UCL (use when n>=50)	1.45	95% Gamma adjusted UCL (use when n>50)	1.57

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.1	Mean in Log Scale	-0.041
SD in Original Scale	1.14	SD in Log Scale	1.74
95% UCL (assumes normality of ROS data)	1.91	95% Percentile Bootstrap UCL	1.74
95% BCA Bootstrap UCL	1.97	95% Bootstrap t UCL	1.98
95% H-UCL (Log ROS)	2.41		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.46	Mean in Log Scale	0.4
SD in Original Scale	1.19	SD in Log Scale	1.04
95% UCL (assumes normality)	2.18	95% H-UCL (LN)	5.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.94	95% KM (Percentile Bootstrap) UCL	1.84

Note: Suggestion is regarding the selection of a 95% UCL except when data has inadequate sample size or sample size is very small (such as < 10), or two or more DLs, or a high DL/CV value (> 2).

For recommendations based on data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile, and Lee (2010)

However simulations results will not cover all real world data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	11	Number of Non-Detects	0
Number of Distinct Detects	11	Number of Distinct Non-Detects	0
Minimum Detect	1.1	Minimum Non-Detect	5.0
Maximum Detect	1100	Maximum Non-Detect	5.0
Variance Detects	5.4E+5	Percent Non-Detects	0.00%
Mean Detects	99.1	Detects to Non-Detects Ratio	1.0e+7
Median Detects	5.0	Total Detects	2.0E+4
Skewness Detects	11.4	Kurtosis Detects	4.17
Mean of Logged Detects	5.144	Dev of Logged Detects	2.4

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.412	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.48	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.43	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.4	Standard Error of Mean	2.100
SD	6.5	95% KM (BCA) UCL	7.300
95% KM (t) UCL	6.44	95% KM (Percentile Bootstrap) UCL	6.74
95% KM (z) UCL	6.7	95% KM (Bootstrap t) UCL	14.10
90% KM (Chebyshev) UCL	8.0	95% KM (Chebyshev) UCL	10.5
97.5% KM (Chebyshev) UCL	15.6	99% KM (Chebyshev) UCL	25.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.14	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.3	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.1	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.201	k star (bias corrected MLE)	0.14
Theta hat (MLE)	4.74	Theta star (bias corrected MLE)	4.014
nu hat (MLE)	4.1	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	0.9	MLE Sd (bias corrected)	14.48

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0[illegible]	nu hat (KM)	1.4[illegible]
approximate Theta (scale) (KM)	1.54	adjusted Theta (scale) (KM)	1.4
95% Gamma approximate KM UCL (use when n>=50)	1.100	95% Gamma adjusted KM UCL (use when n<50)	1.14

Gamma KM Mean (derived from k hat (KM)) 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as 0.1

For such situations GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be affected significantly when using gamma distribution for imputed estimates

Minimum	0.01	Mean	2.4
Maximum	1100	Median	0.01
SD	9.1	CV	3.947
k hat (MLE)	0.0[illegible]	k star (bias corrected MLE)	0.111
Theta hat (MLE)	1.4	Theta star (bias corrected MLE)	2.42
nu hat (MLE)	2.4	nu star (bias corrected)	2.614
MLE Mean (bias corrected)	2.4	MLE Sd (bias corrected)	47.01
		adjusted Level of significance (0.)	0.0144
approximate Theta (scale) (MLE)	[illegible]	adjusted Theta (scale) (MLE)	0.11
95% Gamma approximate UCL (use when n>=50)	4.01	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.48	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	2.4[illegible]	Mean in Log scale	-4.1
Dev in Original scale	1.0[illegible]	Dev in Log scale	2.4
95% UCL (assumes normality of ROS data)	7.[illegible]	95% Percentile Bootstrap UCL	7.411
95% BTS-Bootstrap UCL	8	95% Bootstrap UCL	[illegible]

95% H-UCL (Log ROS) [illegible]

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	2	Mean in Log scale	4.E-1
Dev in Original scale	1.0[illegible]	Dev in Log scale	2.1
95% UCL (assumes normality)	7.[illegible]	95% H-Stat UCL	4.[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a discernible distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 25.4

Note: Suggestions regarding the selection of a 95% UCL are based upon data set characteristics such as skewness, GOF test results, and the number of detected and non-detect observations

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However simulations results will not cover all real world data sets; for additional insight the user may want to consult a statistician

APPENDIX B-6
DEEP GROUNDWATER

Appendix B-6
ProUCL Output - Deep Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

UCL Statistics for Data Sets with Non-Detects

User Selected Options
Date/Time of Computation [illegible]
From File [illegible]
Full Precision OFF
Confidence Coefficient [illegible]%
Number of Bootstrap Operations [illegible]

2,4-Dinitrotoluene

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	14
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15.6% NDs with many tied detect values at multiple DLs
GROS may not be used when kstar of detected data is small such as 0.1
For such situations, GROS method may yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0.01)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
95% HW UCL (LN of ROS data)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% HW UCL (KM Log)	[illegible]
KM SD (logged)	[illegible]	95% Chebyshev (KM Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% HW UCL (assumes normality)	[illegible]	95% Chebyshev UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL
Recommendations are based upon data size, data distribution, and skewness
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Lee (2006)
However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

2,8-Dinitrotoluene

General Statistics

Total Number of Observations	24	Number of Distinct Observations	4
Number of Detects	[illegible]	Number of Non-Detects	1
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	
Minimum Detect		Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible]% Non-Detects or more than 25% Non-Detects

GROS may not be used when kstar of detected data is small such as <0.1

For such situations, GROS method may yield inflated values of UCL and ETL

For gamma distributed detected data, BTSP and BCA UCL may be more accurate when using gamma distribution to impute Non-Detects

Mean	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0.05)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD of logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM (Standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, insight from the graphical and numerical diagnostics on the data may yield additional insight for the best UCL to use

For small sample sizes (n<15), use the 95% Chebyshev UCL

For moderate sample sizes (15<=n<50), use the 97.5% Chebyshev UCL

For large sample sizes (n>=50), use the 99% Chebyshev UCL

For data sets with > 50% NDs and small sample sizes, use 95% Chebyshev UCL

For data sets with > 50% NDs and large sample sizes, use 97.5% Chebyshev UCL

For data sets with > 50% NDs and very large sample sizes, use 99% Chebyshev UCL

Aluminum

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Detects Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, α)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% Non-Detects or less and no single DL

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations GROS method may yield inflated values of UCL and ETL

For gamma distributed detected data, BTSA and BCA UCLs may be improved using gamma distribution in KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, α)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean) of logged Data	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD) of logged Data	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean of logged Data	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However simulation results will not cover all Real World data sets; in addition, although the gamma and lognormal models are good statistical models

Arsenic

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or all Non-Detects

GROS may not be used when kstar of detected data is small such as [illegible]

For such situations GROS method may yield inflated values of UCL and ETs

For gamma distributed detected data BTSs and UCLs may be improved using gamma distribution in KM estimates

Mean	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nar Nie, and Lee (2006)

However simulation results will not cover all real world data sets; in addition, insight into the gamma, lognormal, and normal distributions results in statistical

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation [illegible]

From File [illegible]

Full Precision OFF

Confidence Coefficient 95%

Number of Bootstrap Operations [illegible]

Benzene

General Statistics

Total Number of Observations	24	Number of Distinct Observations	10
Number of Detects		Number of Non-Detects	14
Number of Distinct Detects	9	Number of Distinct Non-Detects	5
Minimum Detect	0.24	Minimum Non-Detect	0.5
Maximum Detect	1.2	Maximum Non-Detect	5
Variance Detects	0.0114	Percent Non-Detects	58.33%
Mean Detects	0.443	SD Detects	0.374
Median Detects	0.35	CV Detects	0.84
Skewness Detects	1.04	Kurtosis Detects	1.104
Mean of Logged Detects	-0.82	SD of Logged Detects	0.701

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.237	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.374	KM Standard Error of Mean	0.0704
KM SD	0.243	95% KM (BCA) UCL	0.5
95% KM (t) UCL	0.51	95% KM (Percentile Bootstrap) UCL	0.5
95% KM (z) UCL	0.5	95% KM (Bootstrap t) UCL	0.52
90% KM (Chebyshev) UCL	0.62	95% KM (Chebyshev) UCL	0.74
97.5% KM (Chebyshev) UCL	0.9	99% KM (Chebyshev) UCL	1.245

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.503	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.243	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.244	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.67	k star (bias corrected MLE)	1.42
Theta hat (MLE)	0.265	Theta star (bias corrected MLE)	0.312
nu hat (MLE)	40.1	nu star (bias corrected)	34.1
MLE Mean (bias corrected)	0.443	MLE Sd (bias corrected)	0.372

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.42	nu hat (KM)	116
approximate Chi Square Value (0.05, DF)	93.4	adjusted Chi Square Value (0.05, DF)	90.1
95% Gamma approximate KM UCL (use when n>=50)	0.4	95% Gamma adjusted KM UCL (use when n<50)	0.47

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% Non-Detects but has more than 10 distinct values

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Mean	0.408	Median	0.374
Maximum	1.2	Minimum	0.0001
SD	0.2	CV	0.49
k hat (MLE)	3.75	k star (bias corrected MLE)	3.1
Theta hat (MLE)	0.109	Theta star (bias corrected MLE)	0.132
nu hat (MLE)	90.4	nu star (bias corrected)	74.4
MLE Mean (bias corrected)	0.414	MLE Sd (bias corrected)	0.234
		Adjusted Level of Significance (β)	0.0214
approximate Chi Square Value (74.4, α)	54.2	adjusted Chi Square Value (74.4, β)	48.04
95% Gamma approximate UCL (use when n>=50)	0.6	95% Gamma adjusted UCL (use when n<50)	0.74

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.237	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.407	Mean in Log scale	-0.77
SD in Original scale	0.2	SD in Log scale	0.67
95% KM (BCA) UCL (assumes normality of ROS data)	0.54	95% Percentile Bootstrap UCL	0.54
95% KM (t) UCL (assumes normality)	0.51	95% Bootstrap t UCL	0.6
95% HW UCL (LN of ROS data)	0.74		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.87	95% KM UCL (KM-Log)	0.4
KM SD (logged)	0.56	95% KM Chebyshev UCL (KM-Log)	1.05
KM Standard Error of Mean (logged)	0.0944		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	0.373	Mean in Log scale	-0.94
SD in Original scale	0.4	SD in Log scale	0.62
95% UCL (assumes normality)	0.49	95% Hall's UCL	1.46

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.54	95% KM (Percentile Bootstrap) UCL	0.5

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all real world data sets; in addition, insight from the graphical and numerical goodness of fit results should also be used

Cadmium

General Statistics

Total Number of Observations	24	Number of Distinct Observations	13
Number of Detects	7	Number of Non-Detects	14
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	0.4	Minimum Non-Detect	0.5
Maximum Detect	8.8	Maximum Non-Detect	2.50
Average Detect	4.5	Percent Non-Detects	58.33%
Geomean Detect	2.7	SD Detects	3.4
Median Detect	3.4	CV Detects	0.73
Skewness Detects	1.414	Kurtosis Detects	1.475
Mean of Logged Detects	0.73	SD of Logged Detects	0.714

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.751	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.81	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.25	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.43	KM Standard Error of Mean	0.45
KM SD	3.45	95% KM (BCA) UCL	4.555
95% KM (t) UCL	4.75	95% KM (Percentile Bootstrap) UCL	4.74
95% KM (z) UCL	4.74	95% KM (Bootstrap t) UCL	5.014
90% KM (Chebyshev) UCL	5.4	95% KM (Chebyshev) UCL	6.44
97.5% KM (Chebyshev) UCL	7.34	99% KM (Chebyshev) UCL	9.461

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.42	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.34	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.42	k star (bias corrected MLE)	1.914
Theta hat (MLE)	1.89	Theta star (bias corrected MLE)	1.741
nu hat (MLE)	34	nu star (bias corrected)	26.7
MLE Mean (bias corrected)	4.7	MLE Sd (bias corrected)	2.97

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.43	nu hat (KM)	100.4
approximate Chi Square Value (100.4, α)	79.1	adjusted Chi Square Value (100.4, β)	77.6
95% Gamma approximate KM-UCL (use when n>=50)	5.431	95% Gamma adjusted KM-UCL (use when n<50)	5.5

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ET's

For gamma distributed detected data, BTs and UCLs may be improved by using gamma distribution for KM estimates

Minimum	0.001	Mean	3.3
Maximum	8.8	Median	1.15
SD	3.45	CV	1.047
k hat (MLE)	1.08	k star (bias corrected MLE)	0.97
Theta hat (MLE)	3.061	Theta star (bias corrected MLE)	3.4
nu hat (MLE)	51.9	nu star (bias corrected)	46.84
MLE Mean (bias corrected)	3.3	MLE Sd (bias corrected)	3.414
		Adjusted Level of Significance (β)	0.044
approximate Chi Square Value (46.84, α)	31.5	adjusted Chi Square Value (46.84, β)	30
95% Gamma approximate UCL (use when n>=50)	5.7	95% Gamma adjusted UCL (use when n<50)	5.97

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.81	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.25	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	3.4	Mean in Log scale	0.445
SD in Original scale	3.4	SD in Log scale	0.9
95% UCL (assumes normality of ROS data)	4.44	95% Percentile Bootstrap UCL	4.7
95% BCA Bootstrap UCL	4.45	95% Bootstrap t UCL	5.5
95% Hall's Bootstrap UCL	4		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	0.444	95% H-UCL (KM-Log)	4.44
KM SD (logged)	0.91	95% Critical H Value (KM-Log)	3.55
KM Standard Error of Mean (logged)	0.55		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	3.4	Mean in Log scale	0.54
SD in Original scale	3.17	SD in Log scale	1.08
95% UCL (assumes normality)	4.4	95% H-stat UCL	6.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	4.75	95% KM (Percentile Bootstrap) UCL	4.74

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

CHloroform

General Statistics

Total Number of Observations	28	Number of Distinct Observations	7
Number of Detects	5	Number of Non-Detects	14
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.35	Minimum Non-Detect	0.5
Maximum Detect	5.4	Maximum Non-Detect	5
Average Detect	2.04	Percent Non-Detects	74.07%
Geomean Detect	1.77	SD Detects	2.44
Median Detect	1.7	CV Detects	0.44
Skewness Detects	0.405	Kurtosis Detects	-2.441
Mean of Logged Detects	0.42	SD of Logged Detects	1.07

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.34	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.144	Standard Error of Mean	0.15
SD	1.72	95% KM (BCA) UCL	2.07
95% KM (t) UCL	2.037	95% KM (Percentile Bootstrap) UCL	2.036
95% KM (z) UCL	1.974	95% KM (Bootstrap t) UCL	2.1
90% KM (Chebyshev) UCL	2.51	95% KM (Chebyshev) UCL	3.4
97.5% KM (Chebyshev) UCL	4.245	99% KM (Chebyshev) UCL	5.44

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.2	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.224	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.254	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.441	k star (bias corrected MLE)	0.35
Theta hat (MLE)	2.594	Theta star (bias corrected MLE)	3.29
nu hat (MLE)	24.14	nu star (bias corrected)	19.44
MLE Mean (bias corrected)	1.27	MLE Sd (bias corrected)	0.6

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.401	nu hat (KM)	14.5
approximate Chi Square Value (14.5, α)	6.1	adjusted Chi Square Value (14.5, β)	5
95% Gamma approximate KM UCL (use when n>=50)	2.05	95% Gamma adjusted KM UCL (use when n<50)	2.14

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be overestimated when gamma distribution is not used for KM estimates

Minimum	0.001	Mean	1.124
Maximum	5.4	Median	0.525
SD	1.35	CV	1.2
k hat (MLE)	0.429	k star (bias corrected MLE)	0.401
Theta hat (MLE)	2.674	Theta star (bias corrected MLE)	2.8
nu hat (MLE)	24.07	nu star (bias corrected)	22.4
MLE Mean (bias corrected)	1.14	MLE Sd (bias corrected)	1.78
		adjusted Level of Significance (β)	0.0224
approximate Chi Square Value (22.4, α)	10.2	adjusted Chi Square Value (22.4, β)	9.4
95% Gamma approximate UCL (use when n>=50)	2.15	95% Gamma adjusted UCL (use when n<50)	2.35

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.1	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.34	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.44	Mean in Log Scale	-0.484
SD in Original Scale	1.514	SD in Log Scale	1.41
95% UCL (assumes normality of ROS data)	1.67	95% Percentile Bootstrap UCL	1.65
95% BCA Bootstrap UCL	1.64	95% Bootstrap t UCL	1.66
95% H-UCL (Log ROS)	2.2		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.47	95% H-UCL (KM-Log)	2.1
KM SD (logged)	1.24	95% Critical H Value (KM-Log)	1.65
KM Standard Error of Mean (logged)	0.44		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.44	Mean in Log Scale	-0.41
SD in Original Scale	1.45	SD in Log Scale	1.54
95% UCL (assumes normality)	2.07	95% H-UCL	4.05

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.07	95% KM (Percentile Bootstrap) UCL	2.06

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, various other factors such as the presence of outliers, number of distinct values, number of detects, and nature of the distribution (multimodal, skewed, etc.) may also impact the performance of the various UCL statistics

Chromium

General Statistics

Total Number of Observations	24	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	21
Number of Distinct Detects	5	Number of Distinct Non-Detects	6
Minimum Detect	1.1	Minimum Non-Detect	10
Maximum Detect	4	Maximum Non-Detect	5000
Average Detect	1.74	Percent Non-Detects	87.5%
Geometric Mean of Detects	1.5	Percent Distinct Detects	5.2%
Median Detect	1	Percent Detects	12.5%
Skewness Detects	1.514	Kurtosis Detects	2.52
Mean of Logged Detects	0.16	Coefficient of Variation Detects	0.907

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.55	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.5	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.4	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.17	Standard Error of Mean	0.047
SD	0.464	95% KM (BCA) UCL	0.2
95% KM (t) UCL	0.23	95% KM (Percentile Bootstrap) UCL	0.25
95% KM (z) UCL	0.21	95% KM (Bootstrap t) UCL	0.25
90% KM (Chebyshev) UCL	0.311	95% KM (Chebyshev) UCL	0.4
97.5% KM (Chebyshev) UCL	0.5	99% KM (Chebyshev) UCL	0.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.6	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.8	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.184	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.4	k star (bias corrected MLE)	0.97
Theta hat (MLE)	2.317	Theta star (bias corrected MLE)	0.448
nu hat (MLE)	1.4	nu star (bias corrected)	7.5
MLE Mean (bias corrected)	0.32	MLE Sd (bias corrected)	0.488

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.444	nu hat (KM)	2.7
approximate Chi Square Value (0.05)	1.7	adjusted Chi Square Value (0.05)	1.2
95% Gamma approximate KM UCL (use when n>=50)	2.01	95% Gamma adjusted KM UCL (use when n<50)	2.4

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute MLE estimates

Minimum	0.001	Mean	0.3
Maximum	5	Median	0.001
SD	0.9	CV	2.4
k hat (MLE)	0.18	k star (bias corrected MLE)	0.14
Theta hat (MLE)	1.8	Theta star (bias corrected MLE)	2.5
nu hat (MLE)	8.7	nu star (bias corrected)	6.5
MLE Mean (bias corrected)	0.3	MLE Sd (bias corrected)	0.9
		adjusted Level of significance (0.01)	0.01
approximate Chi Square Value (4.01, 0.01)	0.7	adjusted Chi Square Value (4.01, 0.01)	0.4
95% Gamma approximate KM UCL (use when n>=50)	2.2	95% Gamma adjusted KM UCL (use when n<50)	2.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.134	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.4	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.04	Mean in Log Scale	1.411
SD in Original Scale	1.1	SD in Log Scale	1.08
95% UCL (assumes normality of ROS data)	1.4	95% Percentile Bootstrap UCL	1.54
95% BCA Bootstrap UCL	1.65	95% Bootstrap t UCL	2.45
95% H-UCL (Log ROS)	1.54		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	1.6	95% H-UCL (KM-Log)	1.54
KM (SD of logged)	0.74	95% Critical H Value (KM-Log)	1.6
KM (Standard Error of Mean of logged)	0.174		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.54	Mean in Log Scale	-1.4
SD in Original Scale	0.1	SD in Log Scale	1.08
95% UCL (assumes normality)	0.7	95% H-stat UCL	2.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.23	95% KM (Percentile Bootstrap) UCL	0.25

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However, simulation results will not cover all Real World data sets; in addition, advice from the project team, knowledge of the site, and other relevant statistical

Cebuk

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible] %
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk GOF Test

Shapiro Wilk Test Statistic	[illegible]	Detected Data Not Normal at 5% Significance Level
5% Shapiro Wilk Critical Value	[illegible]	

Lilliefors GOF Test

Lilliefors Test Statistic	[illegible]	Detected Data appear Normal at 5% Significance Level
5% Lilliefors Critical Value	[illegible]	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

Anderson-Darling GOF Test

A-D Test Statistic	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level
5% A-D Critical Value	[illegible]	

Kolmogrov-Smirnoff GOF

K-S Test Statistic	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level
5% K-S Critical Value	[illegible]	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, α)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or all or almost all Detects

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ETL

For gamma distributed detected data, BTSP and BCA UCL may be improved using gamma distribution for KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk GOF Test

Shapiro Wilk Test Statistic	[illegible]	Detected Data appear Lognormal at 5% Significance Level
5% Shapiro Wilk Critical Value	[illegible]	

Lilliefors GOF Test

Lilliefors Test Statistic	[illegible]	Detected Data appear Lognormal at 5% Significance Level
5% Lilliefors Critical Value	[illegible]	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (BCA) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (H) UCL (LN of ROS data)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% KM (U) UCL (KM Log)	[illegible]
KM SD (logged)	[illegible]	95% KM (A) UCL (KM Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all real world data sets; in addition, insight into the gamma, lognormal, and normal distributions, results statistician

Copper

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be much higher when using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (0.05)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (z) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (jackknife) UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean) of logged data	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD) of logged data	[illegible]	95% critical H value (KM-Log)	[illegible]
KM (Standard Error) of Mean of logged data	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (2006)

However, simulation results will not cover all Real World data sets; in addition, advice from the site statistician

Cyanide

General Statistics

Total Number of Observations	2	Number of Distinct Observations	4
Number of Detects	7	Number of Non-Detects	15
Number of Distinct Detects	5	Number of Distinct Non-Detects	
Minimum Detect	[illegible]	Minimum Non-Detect	10
Maximum Detect	14	Maximum Non-Detect	1
Average Detect	7.[illegible]	Percent Non-Detects	[illegible]
Geometric Mean of Detects	[illegible]	SD of Detects	4.15
Median Detect	4	CV of Detects	0.4[illegible]
Skewness Detects	1.11	Kurtosis Detects	1.47
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	11	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	1.47	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	1.47	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or no more than 50% Non-Detects

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETSs

For gamma distributed detected data, BTSs and BCAs UCLs may be improved using gamma distribution to impute Non-Detects

Minimum	[illegible]	Mean	[illegible]
Maximum	14	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	4	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	11	95% KM (Percentile Bootstrap) UCL	[illegible]

;

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will vary greatly for other data sets. In addition, visualizing the data, histogram, probability plot, etc. along with the above statistics

Iron

General Statistics

Total Number of Observations	24	Number of Distinct Observations	24
Number of Detects	1	Number of Non-Detects	1
Number of Distinct Detects	1	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	1000
Maximum Detect	1000	Maximum Non-Detect	1000
Variance Detects	40,441	Percent Non-Detects	50%
Mean Detects	1,441	Detects	12
Median Detects	400	Distinct Detects	11
Skewness Detects		Non-detects	11
Mean of Logged Detects	6.307	Distinct Logged Detects	11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.441	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.249	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1561	Standard Error of Mean	1306
SD	1420	95% KM (BCA) UCL	N/A
95% KM (t) UCL	4,144	95% KM (Percentile Bootstrap) UCL	5210
95% KM (z) UCL	4,154	95% KM (Bootstrap t) UCL	14,251
90% KM (Chebyshev) UCL	6,455	95% KM (Chebyshev) UCL	8,756
97.5% KM (Chebyshev) UCL	11,450	99% KM (Chebyshev) UCL	17,154

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.424	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.377	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.254	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.857	k star (bias corrected MLE)	0.792
Theta hat (MLE)	2,444	Theta star (bias corrected MLE)	2,645
nu hat (MLE)	41.74	nu star (bias corrected)	38.07
MLE Mean (bias corrected)	2,082	MLE Sd (bias corrected)	2,352

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.882	nu hat (KM)	42.74
approximate Chi Square Value (34, α)	24.77	adjusted Chi Square Value (34, β)	24.741
95% Gamma approximate KM UCL (use when n>=50)	3,425	95% Gamma adjusted KM UCL (use when n<50)	3,487
Gamma ROS Statistics using Imputed Non-Detects			

GROS may not be used when data set has only 15% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and ET's

For gamma distributed detected data, BTs and UCLs may be inflated when using gamma distribution on KM estimates

Minimum	0.001	Mean	147.1
Maximum	1000	Median	15.51
SD	223.0	CV	1.516
k hat (MLE)	0.123	k star (bias corrected MLE)	0.1
Theta hat (MLE)	1,195	Theta star (bias corrected MLE)	1,190
nu hat (MLE)	9.852	nu star (bias corrected)	8.401
MLE Mean (bias corrected)	147.1	MLE Sd (bias corrected)	420
		adjusted Level of significance (β)	0.0214
approximate Chi Square Value (8.401, α)	2.117	adjusted Chi Square Value (8.401, β)	1.487
95% Gamma approximate UCL (use when n>=50)	450.7	95% Gamma adjusted UCL (use when n<50)	542.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.249	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	1561	Mean in Log scale	5.219
SD in Original scale	5551	SD in Log scale	1.9
95% KM (t) UCL (assumes normality of ROS data)	4	95% Percentile Bootstrap UCL	5257
95% EPA (Land) Bootstrap UCL	4,714	95% Bootstrap UCL	2,4
95% H-UCL UCL (ROS)	1,1		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (Logged)	5.45	95% H-UCL (KM-Log)	2,174
KM SD (Logged)	1.9	95% Critical H Value (KM-Log)	4.1
KM Standard Error of Mean (Logged)	0.374		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	1,245	Mean in Log scale	5.1
SD in Original scale	5550	SD in Log scale	1.977
95% UCL (assumes normality)	7,014	95% H-stat UCL	44,4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 1,254

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nar Nile, and Lee (2006)

However simulation results will not cover all Real World data sets; in addition, although the gamma and lognormal distributions

...results statistics can

Level

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, 0.05)	[illegible]	adjusted Chi Square Value (34, 0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or only one or two unique DLs

GROS may not be used when kstar of detected data is small such as [illegible]

For such situations GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and BCAs UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0.05)	[illegible]
approximate Chi Square Value (0.05, [illegible])	[illegible]	adjusted Chi Square Value (0.05, [illegible])	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean) of logged Data	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD) of logged Data	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean of logged Data	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (2006)

However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Manganese

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
		Number of Missing Observations	0
Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	Standard Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL	**95% UCLs (Adjusted for Skewness)**
95% Student's-t UCL [illegible]	95% Adjusted-CLT UCL (Chen-1995) [illegible]
	95% Modified-Johnson UCL (Johnson-1978) [illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	[illegible]	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	[illegible]	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]
95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of Logged Data	[illegible]
Maximum of Logged Data	[illegible]	Sd of Logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]
97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]
95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]
95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]
95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]
95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]
99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002).
However, simulation results will not cover all Real World data sets;
For additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	26	Number of Distinct Observations	
Number of Detects	6	Number of Non-Detects	20
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.0016	Minimum Non-Detect	0.1
Maximum Detect	0.41	Maximum Non-Detect	0.2
Variance Detects	0.0137	Percent Non-Detects	76.92%
Mean Detects	0.1	SD Detects	0.14
Median Detects	0.0645	CV Detects	1.41
Skewness Detects	1.14	Kurtosis Detects	4.27
Mean of Logged Detects	-2.5	SD of Logged Detects	1.24

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.7	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0645	Standard Error of Mean	0.0174
SD	0.137	95% KM (BCA) UCL	0.137
95% KM (t) UCL	0.154	95% KM (Percentile Bootstrap) UCL	0.16
95% KM (z) UCL	0.152	95% KM (Bootstrap t) UCL	0.256
90% KM (Chebyshev) UCL	0.19	95% KM (Chebyshev) UCL	0.229
97.5% KM (Chebyshev) UCL	0.27	99% KM (Chebyshev) UCL	0.387

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.46	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.247	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.4	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.761	k star (bias corrected MLE)	0.641
Theta hat (MLE)	0.1	Theta star (bias corrected MLE)	0.126
nu hat (MLE)	41.7	nu star (bias corrected)	34.7
MLE Mean (bias corrected)	0.1	MLE Sd (bias corrected)	0.1

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.76	nu hat (KM)	41.5
approximate Chi Square Value (34.57, α)	24.1	adjusted Chi Square Value (34.57, β)	24.4
95% Gamma approximate KM-UCL (use when n>=50)	0.134	95% Gamma adjusted KM-UCL (use when n<50)	0.144

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Minimum	0.001	Mean	0.0647
Maximum	0.41	Median	0.0645
SD	0.1	CV	1.55
k hat (MLE)	0.614	k star (bias corrected MLE)	0.564
Theta hat (MLE)	0.154	Theta star (bias corrected MLE)	0.172
nu hat (MLE)	34.4	nu star (bias corrected)	29.57
MLE Mean (bias corrected)	0.0947	MLE Sd (bias corrected)	0.1
		adjusted Level of Significance (β)	0.0414
approximate Chi Square Value (29.57, α)	17.1	adjusted Chi Square Value (29.57, β)	17.56
95% Gamma approximate UCL (use when n>=50)	0.154	95% Gamma adjusted UCL (use when n<50)	0.165

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.7	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0464	Mean in Log Scale	-3.47
SD in Original Scale	0.175	SD in Log Scale	1.12
95% UCL (assumes normality of ROS data)	0.155	95% Percentile Bootstrap UCL	0.15
95% BCA Bootstrap UCL	0.147	95% Bootstrap t UCL	0.171
95% H-UCL (Log ROS)	0.147		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.43	95% H-UCL (KM-Log)	0.16
KM SD (logged)	0.98	95% Critical H Value (KM-Log)	2.75
KM Standard Error of Mean (logged)	0.425		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.126	Mean in Log Scale	-2.4
SD in Original Scale	0.165	SD in Log Scale	0.844
95% UCL (assumes normality)	0.17	95% H-stat UCL	0.147

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	95% KM (Percentile Bootstrap) UCL 0.16

;

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, advantages of the other methods, such as robustness, may not be shown in simulations

Nickel

General Statistics

Total Number of Observations	24	Number of Distinct Observations	22
Number of Detects	15	Number of Non-Detects	11
Number of Distinct Detects	15	Number of Distinct Non-Detects	7
Minimum Detect	1	Minimum Non-Detect	10
Maximum Detect	240	Maximum Non-Detect	2000
Average Detects	52.07	Percent Non-Detects	45.83%
Median Detects	8.5	Detects	0.0417
Mean Detects	1	Distinct Detects	15.04
Skewness Detects	0.01	Kurtosis Detects	0.03
Mean of Logged Detects	2.75	Distinct Logged Detects	1.44

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.224	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	24.04	Standard Error of Mean	10.1
SD	44.2	95% KM (BCA) UCL	44.4
95% KM (t) UCL	47.5	95% KM (Percentile Bootstrap) UCL	46.6
95% KM (z) UCL	46.2	95% KM (Bootstrap t) UCL	67.6
90% KM (Chebyshev) UCL	54.7	95% KM (Chebyshev) UCL	76.9
97.5% KM (Chebyshev) UCL	86.54	99% KM (Chebyshev) UCL	130.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.40	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.154	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.95	k star (bias corrected MLE)	0.871
Theta hat (MLE)	56	Theta star (bias corrected MLE)	27.6
nu hat (MLE)	34.74	nu star (bias corrected)	27.2
MLE Mean (bias corrected)	52.5	MLE Sd (bias corrected)	50.77

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.87	nu hat (KM)	34.8
approximate Chi Square Value (34, α)	24.04	adjusted Chi Square Value (34, β)	23.4
95% Gamma approximate KM UCL (use when n>=50)	65.2	95% Gamma adjusted KM UCL (use when n>50)	65.37

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield artificially inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute MLE estimates

Minimum	10.01	Mean	25.2
Maximum	240	Median	14.44
SD	47.37	CV	1.881
k hat (MLE)	0.414	k star (bias corrected MLE)	0.4
Theta hat (MLE)	61.1	Theta star (bias corrected MLE)	64.66
nu hat (MLE)	19.66	nu star (bias corrected)	20.4
MLE Mean (bias corrected)	25.2	MLE Sd (bias corrected)	40.4
		adjusted Level of Significance (β)	0.04
approximate Chi Square Value (20.4, α)	11.14	adjusted Chi Square Value (20.4, β)	10.04
95% Gamma approximate KM UCL (use when n>=50)	46.4	95% Gamma adjusted KM UCL (use when n>50)	4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.165	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.224	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	25.4	Mean in Log scale	2.42
SD in Original scale	47.44	SD in Log scale	1.44
95% UCL (assumes normality of ROS data)	41.4	95% Percentile Bootstrap UCL	42.4
95% BCA Bootstrap UCL	50.61	95% Bootstrap t UCL	55.4
95% Hall's Bootstrap UCL	50.2		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.415	95% H-UCL (KM-Log)	70.47
KM SD (logged)	1.401	95% Critical H Value (KM-Log)	1.99
KM Standard Error of Mean (logged)	0.44		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	24.87	Mean in Log scale	2.5
SD in Original scale	48.54	SD in Log scale	1.25
95% UCL (assumes normality)	50.5	95% H-stat UCL	2.77

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	44.4	95% GROS adjusted Gamma UCL	4
95% adjusted Gamma KM UCL	64.37		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar examples summarized through Hanley and Lee (2000)

However, simulation results will not cover all Real World data sets; in addition, although the gamma and lognormal distributions are frequently used to model positive environmental data, these two parametric distributions

Selenium

General Statistics

Total Number of Observations	24	Number of Distinct Observations	15
Number of Detects	10	Number of Non-Detects	14
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	4.4	Minimum Non-Detect	2
Maximum Detect	14	Maximum Non-Detect	100
Average Detect	57.1	Percent Non-Detects	58.3%
Geometric Mean of Detects	4	Total No. of Detects	24
Median Detect	54.5	Total No. of Non-Detects	35.5
Skewness Detects	0.75	Kurtosis Detects	0.7
Mean of Logged Detects	4.47	Std. Dev. of Logged Detects	1.06

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.84	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	27.7	Standard Error of Mean	5.21
SD	25.2	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	37.7	95% KM (Percentile Bootstrap) UCL	44
95% KM (z) UCL	37.44	95% KM (BCA) UCL	44
90% KM (Chebyshev) UCL	41.5	95% KM (Chebyshev) UCL	44.5
97.5% KM (Chebyshev) UCL	50.7	99% KM (Chebyshev) UCL	67.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.02	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.77	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.21	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.271	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.714	k star (bias corrected MLE)	1.54
Theta hat (MLE)	32.41	Theta star (bias corrected MLE)	34
nu hat (MLE)	34.1	nu star (bias corrected)	30.14
MLE Mean (bias corrected)	58	MLE Sd (bias corrected)	45

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.44	nu hat (KM)	17.6
approximate Chi Square Value (17, α)	8.14	adjusted Chi Square Value (17, β)	5
95% Gamma approximate KM UCL (use when n>=50)	63.44	95% Gamma adjusted KM UCL (use when n<50)	67.6

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15.1% NDs (with many unique detection limits)

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be overestimated when gamma ROS estimates

Minimum	0.1	Mean	25.6
Maximum	100	Median	20.4
SD	27.57	CV	0.4
k hat (MLE)	1.04	k star (bias corrected MLE)	0.94
Theta hat (MLE)	24.4	Theta star (bias corrected MLE)	27.1
nu hat (MLE)	50.1	nu star (bias corrected)	51.5
MLE Mean (bias corrected)	25.6	MLE Sd (bias corrected)	26.7
		Adjusted Level of Significance (β)	0.0104
approximate Chi Square Value (51.5, α)	34.14	adjusted Chi Square Value (51.5, β)	32
95% Gamma approximate KM UCL (use when n>=50)	84.54	95% Gamma adjusted KM UCL (use when n<50)	87.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.7	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.84	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	22.7	Mean in Log scale	2.51
SD in Original scale	22.77	SD in Log scale	1.15
95% KM (t) UCL (assumes normality of ROS data)	34	95% Percentile Bootstrap UCL	34.4
95% KM (BCA) UCL	38.14	95% KM (bootstrap t) UCL	35.1
95% KM (Chebyshev) UCL	44.4		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	16.76	Mean in Log scale	1.2
SD in Original scale	17.4	SD in Log scale	1.27
95% KM (t) UCL (assumes normality)	31.15	95% H-stat (Land) UCL	104.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	37	95% KM (Percentile Bootstrap) UCL	44

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Thallium

General Statistics

Total Number of Observations	28	Number of Distinct Observations	
Number of Detects	4	Number of Non-Detects	20
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	0.1	Minimum Non-Detect	1
Maximum Detect	4	Maximum Non-Detect	1.0
Average Detects	1.401	Percent Non-Detects	[illegible] %
Mean Detects	1.4	SD Detects	1.4014
Median Detects	0.74	CV Detects	1.1
Skewness Detects	1.100	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	1.7[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.44	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.74	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.5	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.74	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.07	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.4	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogov-Smirnoff GOF**	
5% K-S Critical Value	0.405	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.7[illegible]	k star (bias corrected MLE)	0.44
Theta hat (MLE)	5.5	Theta star (bias corrected MLE)	111.7
nu hat (MLE)	[illegible]	nu star (bias corrected)	2.74
MLE Mean (bias corrected)	1.4	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.1[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detect values.

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute MLE estimates

Mean	0.0[illegible]	Median	[illegible]
Maximum	4	Median	0.0[illegible]
SD	0.1[illegible]	CV	[illegible]
k hat (MLE)	0.1[illegible]	k star (bias corrected MLE)	0.1[illegible]
Theta hat (MLE)	44.[illegible]	Theta star (bias corrected MLE)	4[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	1.1
		adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.74	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	7.7[illegible]	Mean in Log scale	[illegible]
SD in Original scale	1.5[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	0.44	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	0.411		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.74	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002).

However, simulation results will not cover all real world data sets; in addition, insight from the graphical and numerical goodness of fit results should also be used.

Zinc

General Statistics

Total Number of Observations	24	Number of Distinct Observations	19
Number of Detects	20	Number of Non-Detects	4
Number of Distinct Detects	20	Number of Distinct Non-Detects	1
Minimum Detect	1.8	Minimum Non-Detect	5.0
Maximum Detect	1100	Maximum Non-Detect	5.0
Average of Detects	114	Percent Non-Detects	16.67%
Mean of Detects	120.4	Total of Detects	2408
Median of Detects	56.5	SD of Detects	246.4
Skewness of Detects	3.8	Kurtosis of Detects	14.04
Mean of Logged Detects	4.4	SD of Logged Detects	1.48

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.567	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.173	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	80.22	Standard Error of Mean	25.56
SD	117.7	95% KM (BCA) UCL	127.1
95% KM (t) UCL	125.4	95% KM (Percentile Bootstrap) UCL	124.8
95% KM (z) UCL	122.5	95% KM (Bootstrap t) UCL	137.4
90% KM (Chebyshev) UCL	158.4	95% KM (Chebyshev) UCL	193.8
97.5% KM (Chebyshev) UCL	232.4	99% KM (Chebyshev) UCL	345

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.204	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.784	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.431	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.207	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.104	k star (bias corrected MLE)	0.924
Theta hat (MLE)	109	Theta star (bias corrected MLE)	130.4
nu hat (MLE)	43.9	nu star (bias corrected)	36.94
MLE Mean (bias corrected)	120.4	MLE Sd (bias corrected)	125.9

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.965	nu hat (KM)	46.37
approximate Chi Square Value (46.37, α)	31.47	adjusted Chi Square Value (46.37, β)	31.46
95% Gamma approximate KM UCL (use when n>=50)	137.7	95% Gamma adjusted KM UCL (use when n<50)	144

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ET

For gamma distributed detected data, BTs and UCLs may be improved by using gamma distribution in KM estimates

Mean	110.1	Median	70.74
Maximum	1100	Minimum	1.8
SD	120.4	Total	2640
k hat (MLE)	0.9	k star (bias corrected MLE)	0.924
Theta hat (MLE)	122.5	Theta star (bias corrected MLE)	119.4
nu hat (MLE)	43.2	nu star (bias corrected)	44.31
MLE Mean (bias corrected)	107.4	MLE Sd (bias corrected)	113.5
		adjusted Level of significance (β)	0.0483
approximate Chi Square Value (44.31, α)	30.4	adjusted Chi Square Value (44.31, β)	29.97
95% Gamma approximate KM UCL (use when n>=50)	124	95% Gamma adjusted KM UCL (use when n<50)	135

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.173	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	114	Mean in Log Scale	4.11
SD in Original Scale	119.2	SD in Log Scale	0.798
95% KM (t) UCL (assumes normality of ROS data)	134.3	95% Percentile Bootstrap UCL	132.5
95% KM (BCA) UCL	135	95% Bootstrap t UCL	142
95% KM (Hall's bootstrap) UCL	147.4		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	115.3	Mean in Log Scale	4.17
SD in Original Scale	119.4	SD in Log Scale	1.101
95% KM (t) UCL (assumes normality)	154.4	95% H-stat UCL	213

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 124	95% KM (Percentile Bootstrap) UCL 124

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nelson, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride

General Statistics

Total Number of Observations	2	Number of Distinct Observations	17
Number of Detects	14	Number of Non-Detects	[illegible]
Number of Distinct Detects	14	Number of Distinct Non-Detects	[illegible]
Minimum Detect	1	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute NDs

Mean	[illegible]	Median	[illegible]
Maximum	[illegible]	Minimum	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (0.05)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (z) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL in Log ROS	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM -log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar studies summarized in Singh, Nar Nie, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, insight from the graphical and numerical statistics

Nitrate as N

General Statistics

Total Number of Observations	25	Number of Distinct Observations	20
Number of Detects	20	Number of Non-Detects	5
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	5.00	Minimum Non-Detect	1.00
Maximum Detect	41.00	Maximum Non-Detect	1.00
Variance Detects	50.16E+	Percent Non-Detects	20.00%
Mean Detects	14.55	Detects	25.00
Median Detects	7.400	Non-Detects	75.00
Skewness Detects	[illegible]	Kaplan-Meier Detects	14.4
Mean of Logged Detects	2.641	Distinct Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.174	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	11.74	Standard Error of Mean	1.481
SD	14.01	95% KM (BCA) UCL	30.76
95% KM (t) UCL	31.34	95% KM (Percentile Bootstrap) UCL	29.24
95% KM (z) UCL	30.74	95% KM (Bootstrap t) UCL	55.02
90% KM (Chebyshev) UCL	37.12	95% KM (Chebyshev) UCL	43.4
97.5% KM (Chebyshev) UCL	49.13	99% KM (Chebyshev) UCL	59.56

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.724	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.195	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.724	k star (bias corrected MLE)	0.647
Theta hat (MLE)	19.44	Theta star (bias corrected MLE)	22.05
nu hat (MLE)	29.4	nu star (bias corrected)	25.84
MLE Mean (bias corrected)	14.25	MLE Sd (bias corrected)	17.57

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.7	nu hat (KM)	34.4
approximate Chi Square Value (34, α)	22.4	adjusted Chi Square Value (34, β)	21.1
95% Gamma approximate KM-UCL (use when n>=50)	25.44	95% Gamma adjusted KM-UCL (use when n<50)	24.3

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many tied non-detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield artificially inflated values of UCL and ET's

For gamma distributed detected data, BTA's and UCL may be improved by using gamma distribution to impute NDs

Mean	11.01	Median	11.01
Maximum	41.00	Minimum	1.00
SD	14.01	Variance	196.2
k hat (MLE)	0.45	k star (bias corrected MLE)	0.424
Theta hat (MLE)	24.4	Theta star (bias corrected MLE)	25.94
nu hat (MLE)	22.5	nu star (bias corrected)	21.22
MLE Mean (bias corrected)	11.01	MLE Sd (bias corrected)	17.04
		adjusted Level of significance (β)	0.0[illegible]
approximate Chi Square Value (21.22, α)	12.4[illegible]	adjusted Chi Square Value (21.22, β)	9.444
95% Gamma approximate UCL (use when n>=50)	27.44	95% Gamma adjusted UCL (use when n<50)	24.97

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.11	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.174	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	11.05	Mean in Log scale	2.05
SD in Original scale	14.4	SD in Log scale	1.071
95% UCL (assumes normality of ROS data)	31.7	95% Percentile Bootstrap UCL	29.4
95% BCA Bootstrap UCL	34.41	95% Bootstrap t UCL	[illegible]
95% Hall's bootstrap UCL	50.[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.5	95% H-UCL (KM-Log)	34
KM SD (logged)	1.71	95% Critical H Value (KM-Log)	2
KM Standard Error of Mean (logged)	0.75		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	11.74	Mean in Log scale	0.[illegible]
SD in Original scale	14.07	SD in Log scale	1.414
95% UCL (assumes normality)	31.11	95% H-stat UCL	1.0[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 43.4	95% GROS adjusted Gamma UCL 24.97
95% adjusted Gamma KM UCL 24.3	

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar examples presented in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, insight from the graphical analysis and other statistical

APPENDIX B-7
FISH TISSUE - ALL SPECIES

Appendix B-7
ProUCL Output - Fish Tissue - All Species
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File: all_species_v1
Full Precision: OFF
Confidence Coefficient: 95
Number of Bootstrap Operations: 2000

Chromium

General Statistics

Number of Valid Data	10	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	5
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.26	Minimum Detected	-1.347
Maximum Detected	0.95	Maximum Detected	-0.0513
Mean of Detected	0.51	Mean of Detected	-0.815
SD of Detected	0.298	SD of Detected	0.506
Minimum Non-Detect	0.014	Minimum Non-Detect	-4.204
Maximum Non-Detect	0.12	Maximum Non-Detect	-2.12

Note: Data have a mixture of Detects and Non-Detects - For all methods, use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Large MDLs are treated as ND

Number treated as Non-Detect: 5
Number treated as Detected: 5
Single DL Non-Detect Percentage: 50.00%

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro-Wilk Test Statistic	0.877	Shapiro-Wilk Test Statistic	0.901
5% Shapiro-Wilk Critical Value	0.762	5% Shapiro-Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.242	Mean	-2.07
SD	0.298	SD	1.17
95% DL/2 Student's-t UCL	0.398	95% H-Stat DL/2 UCL	0.702
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0625	Mean in Log Scale	-1.79
SD	0.51	SD in Log Scale	1.051
95% MLE Student's-t UCL	0.[illegible]	Mean in Original Scale	0.254
95% MLE Tiku UCL	0.[illegible]	SD in Original Scale	0.[illegible]
		95% H-UCL	0.404
		95% Percentile Bootstrap UCL	0.406
		95% BCA Bootstrap UCL	0.407
		95% H-UCL	0.674

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k hat (bias corrected)	1.717	**Data appear Normal at 5% Significance Level**
Theta Hat	0.297	
nu hat	17.17	
A-D Test Statistic	0.[illegible]	**Nonparametric Statistics**
5% A-D Critical Value	0.[illegible]	Kaplan-Meier (KM) Method
K-S Test Statistic	0.[illegible]	Mean
5% K-S Critical Value	0.[illegible]	SD
Data appear Gamma Distributed at 5% Significance Level		SE of Mean
		95% KM (t) UCL
Assuming Gamma Distribution		95% KM (z) UCL
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL
Minimum	0.000001	95% KM (bootstrap t) UCL
Maximum	0.95	95% KM (BCA) UCL
Mean	0.[illegible]	95% KM (Percentile Bootstrap) UCL
Median	0.000001	95% KM (Chebyshev) UCL
SD	0.[illegible]	97.5% KM (Chebyshev) UCL
k hat	0.14[illegible]	99% KM (Chebyshev) UCL
Theta hat	1.4[illegible]	
nu hat	[illegible].7	**Potential UCLs to Use**
apo/Ba	0.5[illegible]	95% KM (t) UCL
95% Gamma Approximate UCL (use when n >= 40)	1.4[illegible]	95% KM (Percentile Bootstrap) UCL
95% Adjusted Gamma UCL (use when n < 40)	1.95[illegible]	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Appendix B-7
ProUCL Output - Fish Tissue - All Species
Smokey Mountain Smelters
Knoxville, Tennessee

Mercury

General Statistics

Number of Valid Data	12	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	7
		Percent Non-Detect	58.33

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	0.29	Maximum Detected	-1.238
Mean of Detected	0.166	Mean of Detected	-1.862
SD of Detected	0.0779	SD of Detected	0.432
Minimum Non-Detect	0.096	Minimum Non-Detect	-2.323
Maximum Non-Detect	0.23	Maximum Non-Detect	-1.47

Note: Data have multiple DL - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods)
Observations < Large ND are treated as ND

Number treated as Non-Detect	11
Number treated as Detected	1
Single DL Non-Detect Percentage	91.67

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro-Wilk Test Statistic	0.876	Shapiro-Wilk Test Statistic	0.926
5% Shapiro-Wilk Critical Value	0.762	5% Shapiro-Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.115	Mean	-2.293
SD	0.0666	SD	0.522
95% DL/2 (t) UCL	0.151	95% H-Stat (DL/2) UCL	0.163
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.25
		SD in Log Scale	0.46
		Mean in Original Scale	0.116
		SD in Original Scale	0.0656
		95% t UCL	0.152
		95% Percentile Bootstrap UCL	0.149
		95% BCA Bootstrap UCL	0.16
		95% H-UCL	0.157

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k-star (bias corrected)	2.753	**Data appear Normal at 5% Significance Level**	
Theta Star	0.061		
nu star	27.53		
A-D Test Statistic	0.361	**Nonparametric Statistics**	
5% A-D Critical Value	0.66	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.66	Mean	0.132
5% K-S Critical Value	0.356	SD	0.0556
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0164
		95% KM (t) UCL	0.165
Assuming Gamma Distribution		95% KM (z) UCL	0.162
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.161
Minimum	0.000001	95% KM (bootstrap) UCL	0.21
Maximum	0.29	95% KM (BCA) UCL	0.206
Mean	0.096	95% KM (Percentile Bootstrap) UCL	0.176
Median	0.076	95% KM (Chebyshev) UCL	0.212
SD	0.0617	97.5% KM (Chebyshev) UCL	0.247
k star	0.322	99% KM (Chebyshev) UCL	0.315
Theta star	0.304		
Nu star	7.732	**Potential UCLs to Use**	
AppChi2	2.561	95% KM (t) UCL	0.165
95% Gamma Approximate UCL (Use when n >= 40)	0.294	95% KM (Percentile Bootstrap) UCL	0.176
95% Adjusted Gamma UCL (Use when n < 40)	0.352		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Appendix B-7
ProUCL Output - Fish Tissue - All Species
Smokey Mountain Smelters
Knoxville, Tennessee

Selenium

General Statistics

Number of Valid Observation [illegible]

Number of Distinct Observation [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of log Data [illegible]

SD of log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]

95% Modified-t UCL (Johnson-1978) [illegible]

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected) [illegible]

Theta Star [illegible]

MLE of Mean [illegible]

MLE of Standard Deviation [illegible]

nu star [illegible]

Approximate Chi Square Value (.05) [illegible]

Adjusted Level of Significance [illegible]

Adjusted Chi Square Value [illegible]

Anderson-Darling Test Statistic [illegible]

Anderson-Darling 5% Critical Value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov 5% Critical Value [illegible]

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n >= 40) [illegible]

95% Adjusted Gamma UCL (use when n < 40) [illegible]

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCa Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

Use 95% Approximate Gamma UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX B-8
SOIL GAS

Appendix B-8
ProUCL Output - Soil Gas
Smokey Mountain Smelters
Knoxville, Tennessee

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation [illegible]

From File [illegible]

Full Precision OFF

Confidence Coefficient [illegible]%

Number of Bootstrap Operations [illegible]

1,2,4-Trimethylbenzene

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	11
Number of Detects	1	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Average Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Kurtosis Detects	[illegible]	Skewness Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and BCAs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006).

However, simulation results will not cover all Real World data sets; in addition, relying on the recommended UCL alone may not be adequate in some cases.

Statistics

General Statistics

Total Number of Observations	25	Number of Distinct Observations	14
Number of Detects	4	Number of Distinct Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	1	Minimum Non-Detect	5
Maximum Detect	56	Maximum Non-Detect	300
Variance Detect	218.5	Percent Non-Detects	54.16%
Mean Detect	27	All Detects	14.44
Median Detect	24	All Non-Detects	115.5
Skewness Detect	1.155	Kurtosis Detect	0.741
Mean of Logged Detects	3.2	All Logged Detects	3.04

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	15.4	Standard Error of Mean	3.4
SD	16.5	95% KM (t) UCL	21.1
95% KM (z) UCL	20.1	95% KM (Percentile Bootstrap) UCL	21.3
95% KM (BCA) UCL	20.7	95% KM (Bootstrap t) UCL	22.1
90% KM (Chebyshev) UCL	25.2	95% KM (Chebyshev) UCL	29.7
97.5% KM (Chebyshev) UCL	35	99% KM (Chebyshev) UCL	46.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.245	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.166	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.444	k star (bias corrected MLE)	3.04
Theta hat (MLE)	6.184	Theta star (bias corrected MLE)	8.9
nu hat (MLE)	355.7	nu star (bias corrected)	243.2
MLE Mean (bias corrected)	27	MLE Sd (bias corrected)	15.44

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	3.304	nu hat (KM)	5.2
approximate Chi Square Value (5, α)	2.01	adjusted Chi Square Value (5, α)	1.45
95% Gamma approximate KM-UCL (use when n>=50)	23	95% Gamma adjusted KM-UCL (use when n<50)	32.4

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.001	Mean	11.77
Maximum	56	Median	4.231
SD	16.71	CV	1.42
k hat (MLE)	0.525	k star (bias corrected MLE)	0.48
Theta hat (MLE)	22.43	Theta star (bias corrected MLE)	24.4
nu hat (MLE)	26.24	nu star (bias corrected)	23.52
MLE Mean (bias corrected)	11.77	MLE Sd (bias corrected)	17.54
		Adjusted Level of Significance (β)	0.0167
Approximate Chi Square Value (0.01, df)	4.517	Adjusted Chi Square Value (0.01, df)	4.21
95% Gamma approximate UCL (use when n>=50)	23.4	95% Gamma adjusted UCL (use when n<50)	31.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.75	Mean in Log Scale	2.5
Sd in Original Scale	17.1	Sd in Log Scale	1.115
95% UCL (assumes normality of ROS data)	14.4	95% Percentile Bootstrap UCL	14
95% BCA Bootstrap UCL	21.5	95% Bootstrap t UCL	23.16
95% H-UCL (Log ROS)	24.01		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.67	95% H-UCL (KM -Log)	23.4
KM SD (logged)	0.7756	95% Critical H Value (KM-Log)	2.241
KM Standard Error of Mean (logged)	0.134		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	14	Mean in Log Scale	2.47
SD in Original Scale	16.16	SD in Log Scale	1.591
95% UCL (assumes normality)	13.7	95% H-Stat UCL	16.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	21.1	95% KM (Percentile Bootstrap) UCL	21.3

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Dilutions

General Statistics

Total Number of Observations	22	Number of Distinct Observations	11
Number of Detects	8	Number of Non-Detects	14
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	1.00	Minimum Non-Detect	2.00
Maximum Detect	1.00	Maximum Non-Detect	40.0
Average Detects	1.40	Percent Non-Detects	63.6%
Mean Detects	47.7	SD Detects	4.46
Median Detects	7	IQR Detects	11.41
Skewness Detects	1.76	Kurtosis Detects	1.85
Mean of Logged Detects	0.81	SD of Logged Detects	0.934

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.315	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	14.4	Standard Error of Mean	4.44
SD	21.8	95% KM (BCA) UCL	35.7
95% KM (t) UCL	37.4	95% KM (Percentile Bootstrap) UCL	37
95% KM (z) UCL	37.7	95% KM (Bootstrap t) UCL	41.4
90% KM (Chebyshev) UCL	46.6	95% KM (Chebyshev) UCL	56.1
97.5% KM (Chebyshev) UCL	67.2	99% KM (Chebyshev) UCL	87.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.251	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.1	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.96E	k star (bias corrected MLE)	0.8E
Theta hat (MLE)	2.1	Theta star (bias corrected MLE)	4.7
nu hat (MLE)	31.4	nu star (bias corrected)	13.5
MLE Mean (bias corrected)	47.7	MLE Sd (bias corrected)	4.94

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.42	nu hat (KM)	21.5
approximate Chi Square Value (0.05, df)	11.4	adjusted Chi Square Value (0.05, df)	11.45
95% Gamma approximate KM UCL (use when n>=50)	8.94	95% Gamma adjusted KM UCL (use when n<50)	9.24

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Minimum	0.001	Mean	1.01
Maximum	1.0	Median	0.001
SD	0.8	CV	2.4
k hat (MLE)	0.56E	k star (bias corrected MLE)	0.584
Theta hat (MLE)	4.1	Theta star (bias corrected MLE)	7.34
nu hat (MLE)	5.8	nu star (bias corrected)	6.14
MLE Mean (bias corrected)	1.01	MLE Sd (bias corrected)	2.74
		Adjusted Level of Significance (β)	0.0115
Approximate Chi Square Value (.01, df)	2.26	Adjusted Chi Square Value (.01, df)	2.014
95% Gamma approximate KM UCL (use when n>=50)	4.115	95% Gamma adjusted KM UCL (use when n<50)	4.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.315	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.4	Mean in Log Scale	1.11
SD in Original Scale	24.4	SD in Log Scale	1.14
95% UCL (assumes normality of ROS data)	35.5	95% Percentile Bootstrap UCL	35.5
95% BCA Bootstrap UCL	41.4	95% Bootstrap t UCL	81.4
95% H-UCL (Log ROS)	11.24		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.61	95% H-UCL (KM -Log)	25.4
KM SD (logged)	0.81	95% Critical H Value (KM-Log)	2.1
KM Standard Error of Mean (logged)	0.14		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	54.2	Mean in Log Scale	2.46
SD in Original Scale	11.4	SD in Log Scale	1.67
95% UCL (assumes normality)	130.1	95% H-UCL (KM -Log)	1.2E+

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	37.4	95% KM (Percentile Bootstrap) UCL	37

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX C
VAPOR INTRUSION CALCULATIONS

Table C-1
Vapor Intrusion Calculations - On-Site Worker - RME
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71432	Benzene	2.1E+01	2.10E+00	**1.3E-06**	1.6E-02	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	**2.3E-06**	2.8E-03	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**2.5E+00**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**2.3E-05**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**8.1E-04**	**1.2E+01**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	6.5E-07	7.3E-04	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	7.1E-02			7.00E-03	P	
			Total	8.3E-04	1.5E+01					

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	25
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	250
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table C-2
Vapor Intrusion Calculations - On-Site Worker - CTE
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		Csg	Cia	CR	HQ	IUR		RfC		
		(ug/m^3)	(ug/m^3)			(ug/m^3)$^{-1}$		(mg/m^3)		i
71432	Benzene	2.1E+01	2.10E+00	1.6E-07	1.9E-03	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	2.7E-07	3.4E-04	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**3.0E-01**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**2.8E-06**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**9.7E-05**	**1.5E+00**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	7.8E-08	8.7E-05	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	8.6E-03			7.00E-03	P	
			Total	1.0E-04	1.8E+00					

Notes:

(1) **Inhalation Pathway Exposure Parameters (CTE):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	13	ED_C_SG	12	ED_SG	12
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	125	EF_SG	125
Exposure time	(hr/day)	ET_R_SG	16	ET_C_SG	4	ET_SG	4

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table C-3
Vapor IntrusionCalculations - Residential - RME
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71432	Benzene	2.1E+01	2.10E+00	**5.8E-06**	6.7E-02	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	**9.8E-06**	1.2E-02	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**1.1E+01**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**1.0E-04**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**3.5E-03**	**5.2E+01**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	**2.8E-06**	3.0E-03	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	**3.0E-01**			7.00E-03	P	
			Total	3.6E-03	6.3E+01					

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	26
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	26
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	350
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table C-4
Vapor Intrusion Calculations - Residential - CTE
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71432	Benzene	2.1E+01	2.10E+00	**2.2E-06**	2.6E-02	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	**3.8E-06**	4.5E-03	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**4.1E+00**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**3.9E-05**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**1.4E-03**	**2.0E+01**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	**1.1E-06**	1.2E-03	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	**1.2E-01**			7.00E-03	P	
				1.4E-03	2.4E+01					

Notes:

(1) **Inhalation Pathway Exposure Parameters (CTE):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	26
Exposure duration	(yrs)	ED_R_SG	15	ED_C_SG	12	ED_SG	15
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	125	EF_SG	350
Exposure time	(hr/day)	ET_R_SG	16	ET_C_SG	4	ET_SG	16

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

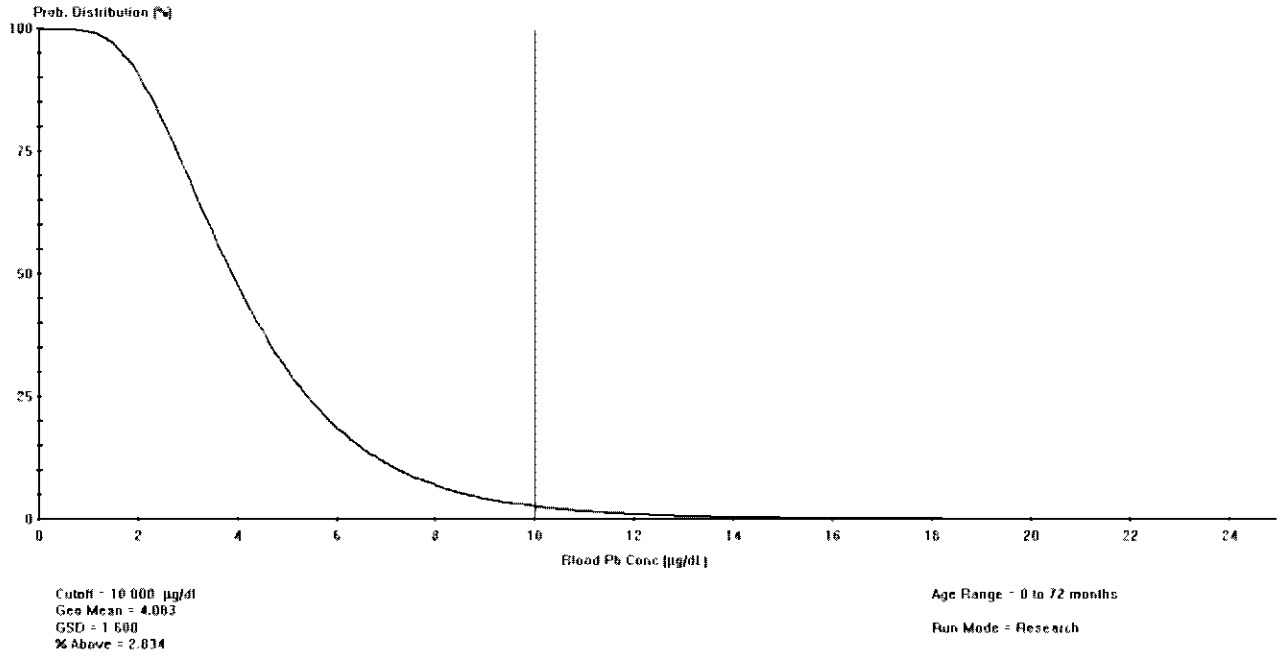
Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

APPENDIX D
IEUBK LEAD MODEL OUTPUTS

Appendix D
IEUBK Lead Results
Smokey Mountain Smelters
Knoxville, Tennessee

Shallow Groundwater



LEAD MODEL FOR WINDOWS Version 1.1

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Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

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****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors	Ventilation Rate	Lung Absorption	Outdoor Air Pb Conc

	(hours)	(m^3/day)	(%)	(µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 20.600 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

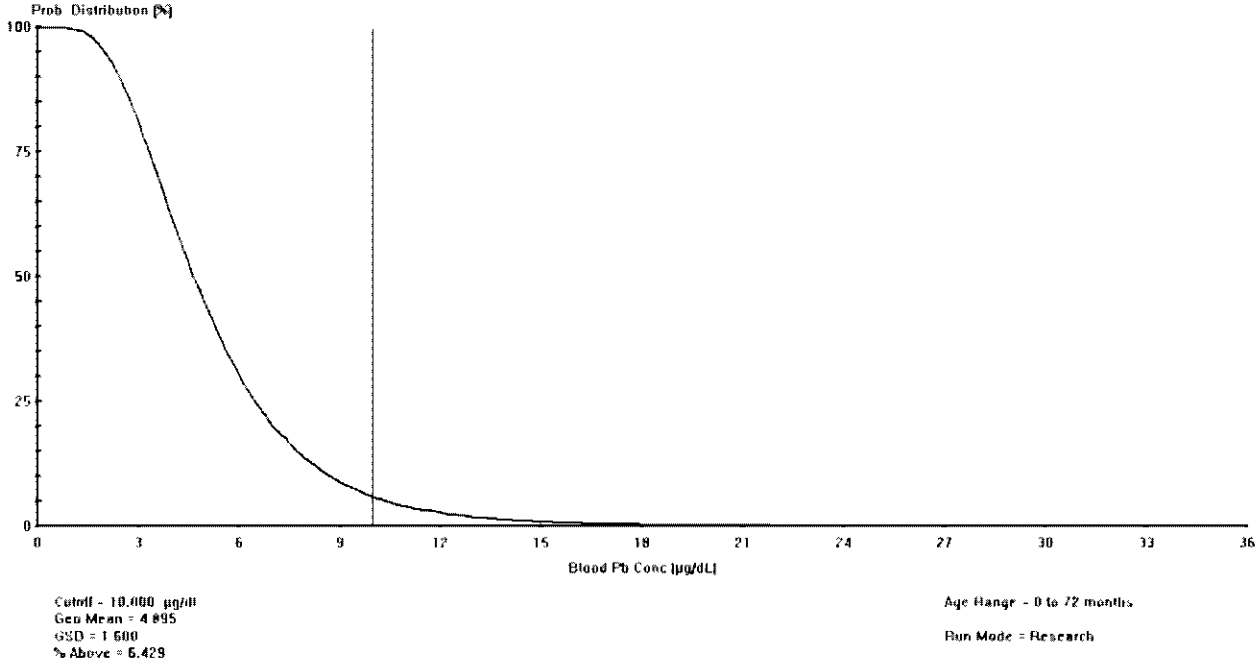
Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.043	0.000	1.901
1-2	0.034	0.883	0.000	4.639
2-3	0.062	0.972	0.000	4.887
3-4	0.067	0.942	0.000	5.042
4-5	0.067	0.917	0.000	5.329
5-6	0.093	0.971	0.000	5.661
6-7	0.093	1.057	0.000	5.785

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.060	7.026	3.8
1-2	6.293	11.850	4.8
2-3	6.374	12.294	4.6
3-4	6.452	12.503	4.4
4-5	4.868	11.181	3.9
5-6	4.414	11.139	3.5
6-7	4.187	11.122	3.2

Deep Groundwater



LEAD MODEL FOR WINDOWS Version 1.1

==========

Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

******** Air ********

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100

4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 32.200 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000

2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.031	0.000	2.938
1-2	0.034	0.864	0.000	7.101
2-3	0.062	0.953	0.000	7.495
3-4	0.067	0.926	0.000	7.749
4-5	0.067	0.903	0.000	8.202
5-6	0.093	0.957	0.000	8.719
6-7	0.093	1.042	0.000	8.918

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.014	8.005	4.3
1-2	6.163	14.163	5.7
2-3	6.254	14.765	5.5
3-4	6.345	15.087	5.2
4-5	4.793	13.965	4.7
5-6	4.349	14.119	4.4
6-7	4.130	14.183	4.0

Table E-1R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potentially Ingested	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDI Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD Ref		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
On Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.9E-12	mg/kg-day	1.5E+05	(mg/kg-day)^-1	1.2E-06	2.5E-11	mg/kg-day	7.0E-10	mg/kg-day	0.04
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	3.7E-02	mg/kg-day	1.0E+00	mg/kg-day	0.04
				Arsenic	1.75E+01	mg/kg	3.2E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	4.8E-06	9.0E-06	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Chromium	3.66E+01	mg/kg	1.1E-05	mg/kg-day	5.0E-01	(mg/kg-day)^-1	5.6E-06	3.1E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.05
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	3.2E-04	mg/kg-day	4.0E-02	mg/kg-day	0.008
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	3.3E-02	mg/kg-day	7.0E-01	mg/kg-day	0.05
				Magnesium	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-03	mg/kg-day	2.4E-02	mg/kg-day	0.05
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	5.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.05
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	5.0E-03	mg/kg-day	0.01
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	5.8E-04	mg/kg-day	3.0E-01	mg/kg-day	0.002
			Ingestion Total								1.2E-05					0.3
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-12	mg/kg-day	1.5E+05	(mg/kg-day)^-1	1.4E-07	3.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0004
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.0E+00	mg/kg-day	NA
				Arsenic	1.75E+01	mg/kg	6.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	1.0E-06	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	0.006
				Chromium	3.66E+01	mg/kg	NA	NA	2.0E+01	(mg/kg-day)^-1	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	mg/kg-day	7.0E-04	mg/kg-day	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.1E-06					0.01
	Total On-Site Surface Soil										1.3E-05					0.3
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.2E-13	pg/m3	3.3E+01	(pg/m3)^-1	1.6E-11	1.2E-12	mg/m3	4.0E-08	mg/m3	0.00000003
				Aluminum	4.33E+04	mg/kg	6.3E-04	µg/m3	NA	NA	NA	1.8E-03	mg/m3	5.0E-03	mg/m3	0.0004
				Arsenic	1.75E+01	mg/kg	2.5E-07	µg/m3	4.3E-03	(µg/m3)^-1	1.1E-09	7.1E-07	mg/m3	1.5E-05	mg/m3	0.000005
				Chromium	3.66E+01	mg/kg	5.3E-07	µg/m3	8.4E-02	(µg/m3)^-1	4.5E-08	1.5E-06	mg/m3	1.0E-04	mg/m3	0.000001
				Cobalt	1.73E+01	mg/kg	2.5E-07	µg/m3	9.0E-03	(µg/m3)^-1	2.3E-09	7.0E-07	mg/m3	6.0E-06	mg/m3	0.00001
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.39E+03	mg/kg	NA	NA	NA	NA	NA	5.6E-05	mg/m3	5.0E-05	mg/m3	0.001
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	5.6E-07	µg/m3	NA	µg/m3	NA	1.6E-09	mg/m3	1.0E-04	mg/m3	0.0000016
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								4.8E-08					0.002
	Total On-Site Air										4.8E-08					0.002
Total On-Site Surface Soil											1.3E-05					0.3

Table E-1R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Current Future
Receptor Population: On Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non Cancer Hazard Calculations				
							Intake Exposure Concentration		CDI Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD Ref		
					ulge	Unit	ulge	Unit	ulge	Unit		ulge	Unit	ulge	Unit	Hazard Quotient
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	1.6E-08	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.1E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	3.1E-08	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.2E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	3.4E-08	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.5E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	3.1E-08	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.2E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	2.9E-08	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.1E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.0E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	3.9E-07	8.5E-12	mg/kg-day	7.0E-10	mg/kg-day	0.01
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.01
				Arsenic	1.02E+01	mg/kg	1.9E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	4.7E-06	5.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	2.61E+01	mg/kg	8.0E-06	mg/kg-day	4.2E-02	(mg/kg-day)^-1	4.3E-06	2.4E-05	mg/kg-day	3.0E-03	mg/kg-day	0.008
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.1E-06	mg/kg-day	6.0E-04	mg/kg-day	0.003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	2.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.04
				Magnesium	1.14E+03	mg/kg	NA	NA	NA	NA	NA	9.8E-04	mg/kg-day	1.4E-01	mg/kg-day	0.007
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	9.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.09
			Ingestion Total								9.0E-06					0.2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	8.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	6.2E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)^-1	1.2E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.8E-08	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.3E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.7E-08	mg/kg-day	7.3E-02	(mg/kg-day)^-1	1.2E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.6E-08	mg/kg-day	7.3E-03	(mg/kg-day)^-1	1.2E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.6E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	4.9E-08	1.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	3.9E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	5.8E-07	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.004
				Chromium	2.61E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								7.7E-07					0.005
	Total Flenniken Branch Surface Soil										1.0E-05					0.2

Table E-1R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Equation/Calculation		CF Unit Risk		Cancer Risk	Intake Equation/Calculation		RfD/RfC		
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	Hazard Quotient
	Air	Fugitive Emissions	Inhalation	Benzo[a]anthracene	5.10E-02	mg/kg	7.4E-10	µg/m^3	1.1E-04	(µg/m^3)^-1	8.1E-14	NA	NA	NA	NA	NA
				Benzo[a]pyrene	1.00E-01	mg/kg	1.5E-09	µg/m^3	1.1E-03	(µg/m^3)^-1	1.6E-12	NA	NA	NA	NA	NA
				Benzo[b]fluoranthene	1.10E-01	mg/kg	1.6E-09	µg/m^3	1.1E-04	(µg/m^3)^-1	1.8E-13	NA	NA	NA	NA	NA
				Benzo[k]fluoranthene	1.00E-01	mg/kg	1.5E-09	µg/m^3	1.1E-04	(µg/m^3)^-1	1.6E-13	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.4E-09	µg/m^3	1.1E-05	(µg/m^3)^-1	1.5E-14	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.4E-13	µg/m^3	3.8E+01	(µg/m^3)^-1	5.5E-12	4.0E-16	mg/m^3	4.0E-08	mg/m^3	0.000000001
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	5.6E-07	mg/m^3	5.0E-03	mg/m^3	0.00001
				Arsenic	1.02E+01	mg/kg	1.5E-07	µg/m^3	4.3E-03	(µg/m^3)^-1	6.4E-10	4.1E-10	mg/m^3	1.5E-05	mg/m^3	0.000003
				Chromium	2.81E+01	mg/kg	4.0E-07	µg/m^3	8.4E-02	(µg/m^3)^-1	3.4E-08	1.1E-09	mg/m^3	1.0E-04	mg/m^3	0.000001
				Cobalt	1.22E+01	mg/kg	1.8E-07	µg/m^3	9.0E-03	(µg/m^3)^-1	1.6E-09	4.9E-10	mg/m^3	6.0E-06	mg/m^3	0.000083
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	9.7E-11	mg/m^3	8.0E-04	mg/m^3	0.00000001
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	4.6E-08	mg/m^3	5.0E-05	mg/m^3	0.00009
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.0E-08					0.001
	Total Fugitive Emissions in Air										3.0E-08					0.001
Total Fugitive Emissions in Ambient Air											1.0E-05					0.2

Table E-2R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Current Future
Receptor Population: On Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	1.4E-07	6.2E-12	mg/kg-day	7.0E-10	mg/kg-day	0.009
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	9.2E-03	mg/kg-day	1.0E+00	mg/kg-day	0.009
				Arsenic	1.75E+01	mg/kg	3.8E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	5.8E-07	2.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	3.66E+01	mg/kg	1.3E-06	mg/kg-day	5.0E-01	(mg/kg-day)^-1	6.7E-07	7.8E-06	mg/kg-day	3.0E-03	mg/kg-day	0.003
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	3.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	8.0E-05	mg/kg-day	4.0E-02	mg/kg-day	0.002
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	8.2E-03	mg/kg-day	7.0E-01	mg/kg-day	0.01
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	2.4E-02	mg/kg-day	0.01
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/kg-day	1.0E-05	mg/kg-day	0.01
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	8.4E-06	mg/kg-day	5.0E-03	mg/kg-day	0.002
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	1.4E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0005
			Ingestion Total								1.4E-06					0.06
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.4E-14	mg/kg-day	1.3E+05	(mg/kg-day)^-1	5.8E-09	2.6E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00004
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	2.7E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	4.0E-06	1.6E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0005
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								4.6E-06					0.00009
	Total On Site Surface Soil										1.4E-06					0.06
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.1E-14	pg/m^3	3.3E+01	(pg/m^3)^-1	1.9E-12	2.9E-13	mg/m^3	4.0E-08	mg/m^3	0.000000007
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-04	mg/m^3	5.0E-03	mg/m^3	0.00009
				Arsenic	1.75E+01	mg/kg	3.0E-06	pg/m^3	4.3E-03	(pg/m^3)^-1	1.3E-10	1.8E-07	mg/m^3	1.5E-05	mg/m^3	0.000001
				Chromium	3.66E+01	mg/kg	6.4E-06	pg/m^3	8.4E-02	(pg/m^3)^-1	5.4E-09	3.7E-07	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Cobalt	1.73E+01	mg/kg	3.0E-06	pg/m^3	9.0E-03	(pg/m^3)^-1	2.7E-10	1.8E-07	mg/m^3	6.0E-06	mg/m^3	0.000003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.4E-05	mg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.0E-10	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								5.8E-09					0.00004
	Total On Site Air										5.8E-09					0.00004
Total On Site Surface Soil											1.4E-06					0.06

Table E-2R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Weighted Average
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	1.9E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	3.7E-09	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.7E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.9E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	3.7E-09	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.7E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	3.5E-09	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.6E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.6E-13	mg/kg-day	1.3E+05	(mg/kg-day)^-1	4.7E-08	2.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	3.0E-03	mg/kg-day	1.0E+00	mg/kg-day	0.003
				Arsenic	1.02E+01	mg/kg	3.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	5.6E-07	2.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	2.31E+01	mg/kg	1.0E-06	mg/kg-day	5.0E-01	(mg/kg-day)^-1	5.1E-07	6.0E-06	mg/kg-day	3.0E-03	mg/kg-day	0.002
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	2.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.1E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0009
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	6.5E-03	mg/kg-day	7.0E-01	mg/kg-day	0.009
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-04	mg/kg-day	1.4E-01	mg/kg-day	0.002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.02
			Ingestion Total								1.2E-06					0.06
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	3.4E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.5E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	6.6E-10	mg/kg-day	7.3E+00	(mg/kg-day)^-1	4.8E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	7.3E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	5.3E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	6.6E-10	mg/kg-day	7.3E-02	(mg/kg-day)^-1	4.8E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	6.4E-10	mg/kg-day	7.3E-03	(mg/kg-day)^-1	4.6E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.5E-14	mg/kg-day	1.3E+05	(mg/kg-day)^-1	2.0E-09	8.8E-14	mg/kg-day	7.0E-10	mg/kg-day	0.00001
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	1.6E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	2.3E-06	4.4E-06	mg/kg-day	3.0E-04	mg/kg-day	0.00001
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.1E-08					0.00003
	Total Flenniken Branch Surface Soil										1.2E-06					0.06

Table E-2R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	8.9E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	9.8E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.7E-10	µg/m^3	1.1E-03	(µg/m^3)^-1	1.9E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.9E-10	µg/m^3	1.1E-04	(µg/m^3)^-1	2.1E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.7E-10	µg/m^3	1.1E-04	(µg/m^3)^-1	1.9E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.7E-10	µg/m^3	1.1E-05	(µg/m^3)^-1	1.8E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.7E-14	µg/m^3	3.8E+01	(µg/m^3)^-1	6.6E-13	1.0E-16	mg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.4E-07	mg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.02E+01	mg/kg	1.8E-08	µg/m^3	4.3E-03	(µg/m^3)^-1	7.6E-11	1.0E-10	mg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	2.81E+01	mg/kg	4.9E-08	µg/m^3	8.4E-02	(µg/m^3)^-1	4.1E-09	2.8E-10	mg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.22E+01	mg/kg	2.1E-08	µg/m^3	9.0E-03	(µg/m^3)^-1	1.9E-10	1.2E-10	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.4E-11	mg/m^3	8.0E-04	mg/m^3	0.00000003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-08	mg/m^3	5.0E-05	mg/m^3	0.0002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								4.3E-09					0.0003
	Total Flenniken Branch Air										4.3E-09					0.0003
Total Flenniken Branch Surface Soil											1.2E-06					0.06

Table E-3
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	1.3E-05	(mg/kg-day)	NA	--	NA	3.6E-05	(mg/kg-day)	NA	--	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	3.9E-05	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	1.2E-05	1.1E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.054
				4,4'-DDD	3.20E-02	µg/L	2.4E-07	(mg/kg-day)	2.4E-01	(mg/kg-day)^-1	5.9E-08	6.8E-07	(mg/kg-day)	NA	--	NA
				Benzene	1.12E+00	µg/L	8.5E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	4.7E-07	2.4E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0060
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	1.8E-04	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	2.5E-06	4.9E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.025
				Bromodichloromethane	3.20E-01	µg/L	2.4E-06	(mg/kg-day)	6.2E-02	(mg/kg-day)^-1	1.5E-07	6.8E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00034
				Bromomethane	1.45E+00	µg/L	1.1E-05	(mg/kg-day)	NA	--	NA	3.1E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.022
				Chloroform	9.10E+00	µg/L	7.0E-05	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	2.2E-06	1.9E-04	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.019
				Dibenzofuran	1.60E+00	µg/L	1.2E-05	(mg/kg-day)	NA	--	NA	3.4E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.034
				Dieldrin	3.40E-02	µg/L	2.6E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	4.2E-06	7.3E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.015
				Ethylbenzene	1.90E+00	µg/L	1.5E-05	(mg/kg-day)	1.1E-02	(mg/kg-day)^-1	1.6E-07	4.1E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00041
				Naphthalene	3.14E+00	µg/L	2.4E-05	(mg/kg-day)	NA	--	NA	6.7E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0034
				Pentachlorophenol	3.01E+00	µg/L	2.3E-05	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	9.2E-06	6.4E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.013
				Phenol	1.57E+02	µg/L	1.2E-03	(mg/kg-day)	NA	--	NA	3.4E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.011
				Tetrachloroethene	5.89E+00	µg/L	4.5E-05	(mg/kg-day)	2.1E-03	(mg/kg-day)^-1	9.5E-08	1.3E-04	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.021
				Trichloroethene	1.99E+00	µg/L	1.5E-05	(mg/kg-day)	4.6E-02	(mg/kg-day)^-1	7.0E-07	4.3E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.085
				1,1-Dichloroethylene	8.94E+00	µg/L	6.8E-05	(mg/kg-day)	NA	--	NA	1.9E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.0010
				Aluminum	5.62E+04	µg/L	4.3E-01	(mg/kg-day)	NA	--	NA	1.2E+00	(mg/kg-day)	1.0E+00	(mg/kg-day)	1.2
				Antimony	7.94E+00	µg/L	6.1E-05	(mg/kg-day)	NA	--	NA	1.7E-04	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.42
				Arsenic	1.40E+01	µg/L	1.1E-04	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.6E-04	3.0E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.0
				Barium	1.03E+01	µg/L	7.9E-05	(mg/kg-day)	NA	--	NA	2.2E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.11
				Cadmium	2.34E+00	µg/L	1.8E-05	(mg/kg-day)	NA	--	NA	5.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0
				Chromium	3.14E+01	µg/L	2.4E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.2E-04	6.7E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.22
				Cobalt	1.14E+03	µg/L	8.7E-03	(mg/kg-day)	NA	--	NA	2.4E-02	(mg/kg-day)	3.0E-04	(mg/kg-day)	82
				Copper	2.80E+02	µg/L	2.1E-03	(mg/kg-day)	NA	--	NA	6.0E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.15
				Cyanide	1.07E+01	µg/L	8.2E-05	(mg/kg-day)	NA	--	NA	2.3E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.4
				Iron	2.54E+03	µg/L	1.9E-02	(mg/kg-day)	NA	--	NA	5.4E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.08
				Lead	1.49E+01	µg/L	1.1E-04	(mg/kg-day)	NA	--	NA	3.2E-04	(mg/kg-day)	NA	--	NA
				Manganese	6.91E+04	µg/L	5.3E-01	(mg/kg-day)	NA	--	NA	1.5E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	62
				Mercury	6.99E+00	µg/L	5.3E-05	(mg/kg-day)	NA	--	NA	1.5E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.50
				Molybdenum	1.20E+02	µg/L	9.2E-04	(mg/kg-day)	NA	--	NA	2.6E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.51
				Nickel	7.56E+02	µg/L	5.8E-03	(mg/kg-day)	NA	--	NA	1.6E-02	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.81
				Selenium	1.75E+01	µg/L	1.3E-04	(mg/kg-day)	NA	--	NA	3.7E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.075
				Strontium	1.80E+03	µg/L	1.4E-02	(mg/kg-day)	NA	--	NA	3.9E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.064
				Thallium	2.27E+01	µg/L	1.7E-04	(mg/kg-day)	NA	--	NA	4.9E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	49
				Vanadium	2.30E+01	µg/L	1.8E-04	(mg/kg-day)	NA	--	NA	4.9E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.098
				Zinc	2.33E+04	µg/L	1.8E-01	(mg/kg-day)	NA	--	NA	5.0E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.7
			Ingestion Total								3.1E-04					199
Total Shallow Groundwater											3.1E-04					199

Table E-3
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	9.2E-06	mg/kg-day	9.1E-02	(mg/kg-day)-1	8.3E-07	2.6E-05	mg/kg-day	6.0E-03	mg/kg-day	0.0043
				2,4-Dinitrotoluene	1.29E+01	µg/L	9.8E-05	mg/kg-day	3.1E-01	(mg/kg-day)-1	3.0E-05	2.8E-04	mg/kg-day	2.0E-03	mg/kg-day	0.14
				2,6-Dinitrotoluene	4.66E+00	µg/L	3.6E-05	mg/kg-day	1.5E+00	(mg/kg-day)-1	5.3E-05	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.33
				Benzene	8.61E-01	µg/L	6.6E-06	mg/kg-day	5.5E-02	(mg/kg-day)-1	3.6E-07	1.8E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0046
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	5.1E-04	mg/kg-day	1.4E-02	(mg/kg-day)-1	7.2E-06	1.4E-03	mg/kg-day	2.0E-02	mg/kg-day	0.072
				Bromomethane	2.90E+00	µg/L	2.2E-05	mg/kg-day	NA	--	NA	6.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.044
				Chloroform	2.02E+00	µg/L	1.5E-05	mg/kg-day	3.1E-02	(mg/kg-day)-1	4.8E-07	4.3E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0043
				Dieldrin	3.50E-02	µg/L	2.7E-07	mg/kg-day	1.6E+01	(mg/kg-day)-1	4.3E-06	7.5E-07	mg/kg-day	5.0E-05	mg/kg-day	0.0150
				Heptachlor epoxide	5.40E-02	µg/L	4.1E-07	mg/kg-day	9.1E+00	(mg/kg-day)-1	3.8E-06	1.2E-06	mg/kg-day	1.3E-05	mg/kg-day	0.089
				Naphthalene	1.66E+00	µg/L	1.2E-05	mg/kg-day	NA	--	NA	3.4E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0017
				Pentachlorophenol	2.50E+00	µg/L	1.9E-05	mg/kg-day	4.0E-01	(mg/kg-day)-1	7.6E-06	5.4E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0107
				Tetrachloroethene	5.80E-01	µg/L	4.4E-06	mg/kg-day	4.6E-02	(mg/kg-day)-1	2.0E-07	1.2E-05	mg/kg-day	5.0E-04	mg/kg-day	0.025
				Aluminum	3.86E+03	µg/L	3.0E-02	mg/kg-day	NA	--	NA	8.3E-02	mg/kg-day	1.0E+00	mg/kg-day	0.083
				Arsenic	6.67E+00	µg/L	5.1E-05	mg/kg-day	1.5E+00	(mg/kg-day)-1	7.7E-05	1.4E-04	mg/kg-day	3.0E-04	mg/kg-day	0.48
				Barium	4.80E+00	µg/L	3.7E-05	mg/kg-day	NA	--	NA	1.0E-04	mg/kg-day	2.0E-03	mg/kg-day	0.051
				Cadmium	2.75E+00	µg/L	2.1E-05	mg/kg-day	NA	--	NA	5.9E-05	mg/kg-day	5.0E-04	mg/kg-day	0.12
				Chromium	2.11E+01	µg/L	1.6E-04	mg/kg-day	5.0E-01	(mg/kg-day)-1	8.1E-05	4.5E-04	mg/kg-day	3.0E-03	mg/kg-day	0.15
				Cobalt	1.52E+01	µg/L	1.2E-04	mg/kg-day	NA	--	NA	3.2E-04	mg/kg-day	3.0E-04	mg/kg-day	1.1
				Copper	3.48E+01	µg/L	2.7E-04	mg/kg-day	NA	--	NA	7.4E-04	mg/kg-day	4.0E-02	mg/kg-day	0.019
				Cyanide	1.10E+01	µg/L	8.4E-05	mg/kg-day	NA	--	NA	2.4E-04	mg/kg-day	6.0E-04	mg/kg-day	0.39
				Iron	1.25E+04	µg/L	9.6E-02	mg/kg-day	NA	--	NA	2.7E-01	mg/kg-day	7.0E-01	mg/kg-day	0.38
				Lead	4.66E+00	µg/L	3.6E-05	mg/kg-day	NA	--	NA	1.0E-04	mg/kg-day	NA	--	NA
				Magnesium	1.00E+05	µg/L	7.7E-01	mg/kg-day	NA	--	NA	2.1E+00	mg/kg-day	2.4E-02	mg/kg-day	90
				Mercury	1.54E-01	µg/L	1.2E-06	mg/kg-day	NA	--	NA	3.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.011
				Molybdenum	2.00E+02	µg/L	1.5E-03	mg/kg-day	NA	--	NA	4.3E-03	mg/kg-day	5.0E-03	mg/kg-day	0.86
				Nickel	4.83E+01	µg/L	3.7E-04	mg/kg-day	NA	--	NA	1.0E-03	mg/kg-day	2.0E-02	mg/kg-day	0.052
				Selenium	3.44E+01	µg/L	2.6E-04	mg/kg-day	NA	--	NA	7.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.15
				Strontium	8.60E+03	µg/L	6.6E-02	mg/kg-day	NA	--	NA	1.8E-01	mg/kg-day	6.0E-01	mg/kg-day	0.307
				Thallium	1.74E+01	µg/L	1.3E-04	mg/kg-day	NA	--	NA	3.7E-04	mg/kg-day	1.0E-05	mg/kg-day	37
				Vanadium	2.80E+01	µg/L	2.1E-04	mg/kg-day	NA	--	NA	6.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.12
				Zinc	1.24E+02	µg/L	9.5E-04	mg/kg-day	NA	--	NA	2.7E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0088
			Ingestion Total								2.7E-04					132
Total Deep Groundwater											2.7E-04					132

Table E-4
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	1.6E-06	(mg/kg-day)	NA	--	NA	9.1E-06	(mg/kg-day)	NA	--	NA
				2,4-Dinitrotoluene	5.00E+00	µg/L	4.6E-06	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	1.4E-06	2.7E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.014
				4,4'-DDD	3.20E-02	µg/L	2.9E-08	(mg/kg-day)	2.4E-01	(mg/kg-day)^-1	7.0E-09	1.7E-07	(mg/kg-day)	NA	--	NA
				Benzene	1.12E+00	µg/L	1.0E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	5.6E-08	6.0E-06	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0015
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	2.1E-05	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	3.0E-07	1.2E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00062
				Bromodichloromethane	3.20E-01	µg/L	2.9E-07	(mg/kg-day)	6.2E-02	(mg/kg-day)^-1	1.8E-08	1.7E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.000086
				Bromomethane	1.45E+00	µg/L	1.3E-06	(mg/kg-day)	NA	--	NA	7.8E-06	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.0055
				Chloroform	9.10E+00	µg/L	8.3E-06	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	2.6E-07	4.9E-05	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.0049
				Dichlorodifluoromethane	1.60E+00	µg/L	1.5E-06	(mg/kg-day)	NA	--	NA	8.6E-06	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.0086
				Dieldrin	3.40E-02	µg/L	3.1E-08	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	5.0E-07	1.8E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.0036
				Ethylbenzene	1.93E+00	µg/L	1.8E-06	(mg/kg-day)	1.1E-02	(mg/kg-day)^-1	1.9E-08	1.0E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00010
				Naphthalene	3.14E+00	µg/L	2.9E-06	(mg/kg-day)	NA	--	NA	1.7E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00084
				Pentachlorophenol	3.01E+00	µg/L	2.8E-06	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	1.1E-06	1.6E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.0032
				Phenol	1.57E+02	µg/L	1.4E-04	(mg/kg-day)	NA	--	NA	8.4E-04	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.0028
				Tetrachloroethene	5.82E+00	µg/L	5.4E-06	(mg/kg-day)	2.1E-03	(mg/kg-day)^-1	1.1E-08	3.2E-05	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.0053
				Trichloroethene	1.99E+00	µg/L	1.8E-06	(mg/kg-day)	4.6E-02	(mg/kg-day)^-1	8.4E-08	1.1E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.021
				1,2,3-trichloropropane	8.94E+00	µg/L	8.2E-06	(mg/kg-day)	NA	--	NA	4.8E-05	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.00024
				Aluminum	5.62E+04	µg/L	5.2E-02	(mg/kg-day)	NA	--	NA	3.0E-01	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.30
				Antimony	7.94E+00	µg/L	7.3E-06	(mg/kg-day)	NA	--	NA	4.2E-05	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.11
				Arsenic	1.40E+01	µg/L	1.3E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.9E-05	7.5E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.25
				Barium	1.03E+01	µg/L	9.5E-06	(mg/kg-day)	NA	--	NA	5.5E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.028
				Cadmium	2.34E+00	µg/L	2.1E-06	(mg/kg-day)	NA	--	NA	1.2E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.025
				Chromium	3.14E+01	µg/L	2.9E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.4E-05	1.7E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.056
				Cobalt	1.14E+03	µg/L	1.0E-03	(mg/kg-day)	NA	--	NA	6.1E-03	(mg/kg-day)	3.0E-04	(mg/kg-day)	20
				Copper	2.60E+02	µg/L	2.6E-04	(mg/kg-day)	NA	--	NA	1.5E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.037
				Cyanide	1.07E+01	µg/L	9.8E-06	(mg/kg-day)	NA	--	NA	5.7E-05	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.095
				Iron	2.54E+03	µg/L	2.3E-03	(mg/kg-day)	NA	--	NA	1.4E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.019
				Lead	1.49E+01	µg/L	1.4E-05	(mg/kg-day)	NA	--	NA	8.0E-05	(mg/kg-day)	NA	--	NA
				Manganese	6.91E+04	µg/L	6.3E-02	(mg/kg-day)	NA	--	NA	3.7E-01	(mg/kg-day)	2.4E-02	(mg/kg-day)	15
				Mercury	6.99E+00	µg/L	6.4E-06	(mg/kg-day)	NA	--	NA	3.7E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Molybdenum	1.20E+02	µg/L	1.1E-04	(mg/kg-day)	NA	--	NA	6.4E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.13
				Nickel	7.56E+02	µg/L	6.9E-04	(mg/kg-day)	NA	--	NA	4.0E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.202
				Selenium	1.75E+01	µg/L	1.6E-05	(mg/kg-day)	NA	--	NA	9.3E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.019
				Strontium	1.80E+03	µg/L	1.7E-03	(mg/kg-day)	NA	--	NA	9.6E-03	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.016
				Thallium	2.27E+01	µg/L	2.1E-05	(mg/kg-day)	NA	--	NA	1.2E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	12
				Vanadium	2.30E+01	µg/L	2.1E-05	(mg/kg-day)	NA	--	NA	1.2E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.025
				Zinc	2.33E+04	µg/L	2.1E-02	(mg/kg-day)	NA	--	NA	1.2E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.42
			Ingestion Total								3.7E-05					50
Total Shallow Groundwater											3.7E-05					50

Table E-4
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					size	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							size	Unit	size	Unit		size	Unit	size	Unit	
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	1.1E-06	(mg/kg-day)	9.1E-02	(mg/kg-day)^-1	1.0E-07	6.4E-06	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.00107
				2,4-Dinitrotoluene	1.29E+01	µg/L	1.2E-05	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	3.7E-06	6.9E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.034
				2,6-Dinitrotoluene	4.66E+00	µg/L	4.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	6.4E-06	2.5E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.083
				Benzene	8.61E-01	µg/L	7.9E-07	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	4.3E-08	4.6E-06	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0012
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	6.1E-05	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	8.6E-07	3.6E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.018
				Bromomethane	2.90E+00	µg/L	2.7E-06	(mg/kg-day)	NA	--	NA	1.6E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.011
				Chloroform	2.02E+00	µg/L	1.8E-06	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	5.7E-08	1.1E-05	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.0011
				Dieldrin	3.50E-02	µg/L	3.2E-08	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	5.1E-07	1.9E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.0037
				Heptachlor epoxide	5.40E-02	µg/L	5.0E-08	(mg/kg-day)	9.1E+00	(mg/kg-day)^-1	4.5E-07	2.9E-07	(mg/kg-day)	1.3E-05	(mg/kg-day)	0.022
				Naphthalene	1.60E+00	µg/L	1.5E-06	(mg/kg-day)	NA	--	NA	8.6E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.000043
				Pentachlorophenol	2.50E+00	µg/L	2.3E-06	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	9.2E-07	1.3E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.0027
				Tetrachloroethene	5.80E-01	µg/L	5.3E-07	(mg/kg-day)	4.6E-02	(mg/kg-day)^-1	2.4E-08	3.1E-06	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.0062
				Aluminum	3.86E+03	µg/L	3.5E-03	(mg/kg-day)	NA	--	NA	2.1E-02	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.021
				Arsenic	6.67E+00	µg/L	6.1E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	9.2E-06	3.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Barium	4.80E+00	µg/L	4.4E-06	(mg/kg-day)	NA	--	NA	2.6E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.013
				Cadmium	2.75E+00	µg/L	2.5E-06	(mg/kg-day)	NA	--	NA	1.5E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.029
				Chromium	2.11E+01	µg/L	1.9E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	9.7E-06	1.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.038
				Cobalt	1.52E+01	µg/L	1.4E-05	(mg/kg-day)	NA	--	NA	8.1E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.27
				Copper	3.48E+01	µg/L	3.2E-05	(mg/kg-day)	NA	--	NA	1.9E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.0047
				Cyanide	1.10E+01	µg/L	1.0E-05	(mg/kg-day)	NA	--	NA	5.9E-05	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.098
				Iron	1.25E+04	µg/L	1.2E-02	(mg/kg-day)	NA	--	NA	6.7E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.096
				Lead	4.66E+00	µg/L	4.3E-06	(mg/kg-day)	NA	--	NA	2.5E-05	(mg/kg-day)	NA	--	NA
				Magnesium	1.00E+05	µg/L	9.2E-02	(mg/kg-day)	NA	--	NA	5.4E-01	(mg/kg-day)	2.4E-02	(mg/kg-day)	22
				Mercury	1.54E-01	µg/L	1.4E-07	(mg/kg-day)	NA	--	NA	8.2E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.003
				Molybdenum	2.00E+02	µg/L	1.8E-04	(mg/kg-day)	NA	--	NA	1.1E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.21
				Nickel	4.83E+01	µg/L	4.4E-05	(mg/kg-day)	NA	--	NA	2.6E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.013
				Selenium	3.44E+01	µg/L	3.2E-05	(mg/kg-day)	NA	--	NA	1.8E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.037
				Strontium	8.60E+03	µg/L	7.9E-03	(mg/kg-day)	NA	--	NA	4.6E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.077
				Thallium	1.74E+01	µg/L	1.6E-05	(mg/kg-day)	NA	--	NA	9.3E-05	(mg/kg-day)	1.0E-05	(mg/kg-day)	9.3
				Vanadium	2.80E+01	µg/L	2.6E-05	(mg/kg-day)	NA	--	NA	1.5E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.030
				Zinc	1.24E+02	µg/L	1.1E-04	(mg/kg-day)	NA	--	NA	6.6E-04	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.0022
			Ingestion Total								3.2E-05					33
Total Deep Groundwater											3.2E-05					33

Table E-5
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Gas Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					slope	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Units	slope	Units		slope	Units	slope	Units	
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	µg/m	See "1" Calculations: Table C-1				2.3E-05	See "1" Calculations: Table C-1				---
				1,2,4-Trimethylbenzene	2.19E+00	µg/m					---					0.071
				1,2-Dichloroethane	3.80E+02	µg/m					8.1E-04					12
				Benzene	2.10E+00	µg/m					1.3E-06					0.016
				Chloroform	1.20E+00	µg/m					2.3E-06					0.0028
				Chloromethane	1.00E+03	µg/m					---					2.5
				Ethylbenzene	3.18E+00	µg/m					6.5E-07					0.00073
			Inhalation Total								8.3E-04					15
Total Site Indoor Air											8.3E-04					15

Table E-6
Calculation of COPC Cancer Risks and Noncancer Hazards - On-SiteWorker - Soil Gas Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					slope	Unit	Intake-Exposure Concentration		CSF-Unit Risk		Cancer Risk	Intake-Exposure Concentration		RfD-RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	µg/m	See 1-Calculations Table C-2				2.8E-06	See 1-Calculations Table C-2				...
				1,2,4-Trimethylbenzene	2.19E+00	µg/m					...					0.0036
				1,2-Dichloroethane	3.80E+02	µg/m					9.7E-05					1.5
				Benzene	2.10E+00	µg/m					1.6E-07					0.0019
				Chloroform	1.20E+00	µg/m					2.7E-07					0.00034
				Chloromethane	1.00E+03	µg/m					...					0.30
				Ethylbenzene	3.18E+00	µg/m					7.8E-08					0.000087
			Inhalation Total								1.0E-04					1.8
Total Site Indoor Air											1.0E-04					1.8

Table E-7R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * Slope Factor
Reference Dose = Intake / RfD
Reference Conc = Intake * Unit Risk

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potentially Ingested	EPC Value	EPC Unit	Cancer Risk Calculation Intake/Exposure Concentration Value	Intake/Exposure Concentration Unit	CSF/Unit Risk Value	CSF/Unit Risk Unit	Cancer Risk	Non-Cancer Hazard Calculation Intake/Exposure Concentration Value	Intake/Exposure Concentration Unit	RfD/RfC Value	RfD/RfC Unit	Hazard Quotient
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	3E-12	mg/kg-day	1.3E+05	mg/kg-day-1	3.4E-07	1.3E-11	mg/kg-day	7.0E-10	mg/kg-day	0.03
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.7E-02	mg/kg-day	1.0E+00	mg/kg-day	0.03
				Arsenic	1.75E+01	mg/kg	2E-07	mg/kg-day	1.5E+00	mg/kg-day-1	1.4E-06	6.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	3.66E+01	mg/kg	Multimedia Model not Action See Table 27				5.0E-06	2.3E-05	mg/kg-day	3.0E-03	mg/kg-day	0.0008
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.04
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	2.4E-04	mg/kg-day	4.0E-02	mg/kg-day	0.006
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	8.3E-04	mg/kg-day	2.4E-02	mg/kg-day	0.04
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	4.0E-07	mg/kg-day	1.0E-05	mg/kg-day	0.04
				Vanadium	3.92E+01	mg/kg	4E-06	mg/kg-day	NA	mg/kg-day-1	NA	2.5E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0005
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	4.3E-04	mg/kg-day	3.0E-01	mg/kg-day	0.001
			Ingestion Total								6.7E-06					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	3E-12	mg/kg-day	1.3E+05	mg/kg-day-1	4.2E-06	2.2E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	2E-07	mg/kg-day	1.5E+00	mg/kg-day-1	2.9E-07	1.4E-06	mg/kg-day	3.0E-04	mg/kg-day	0.005
				Chromium	3.66E+01	mg/kg	Multimedia Model not Action See Table 27				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.4E-07					0.008
	Total On Site Surface Soil										7.1E-06					0.2
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4E-14	µg/m^3	3.3E+01	(µg/m^3)^-1	1.3E-12	2.5E-13	µg/m^3	4.0E-08	mg/m^3	0.0000000006
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	3.7E-04	µg/m^3	5.0E-03	mg/m^3	0.000007
				Arsenic	1.75E+01	mg/kg	2E-03	µg/m^3	4.3E-03	(µg/m^3)^-1	9.1E-11	1.5E-07	µg/m^3	1.5E-05	mg/m^3	0.000001
				Chromium	3.66E+01	mg/kg	Multimedia Model not Action See Table 27				1.1E-03	3.1E-07	µg/m^3	1.0E-04	mg/m^3	0.0000003
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-07	µg/m^3	6.0E-06	mg/m^3	0.000002
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-05	µg/m^3	5.0E-05	mg/m^3	0.00002
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	3.3E-10	mg/m^3	1.0E-04	mg/m^3	0.0000003
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.1E-03					0.0000
	Total On Site Air										1.1E-03					0.0000
Total On Site Surface Soil											7.1E-06					0.2

Table E-7R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * CSF
Noncancer Hazard = Intake / RfD
Intake = Exposure Concentration * Intake Factor / Body Weight * Averaging Time

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potentially Ingested	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
					value	Unit	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							value	Unit	value	Unit		value	Unit	value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 27				1.0E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				2.0E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 27				2.2E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				2.0E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 27				1.9E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	9E-12	mg/kg-day	1.5E+05	mg/kg-day)^-1	1.2E-07	6.3E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0009
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	8.8E-03	mg/kg-day	1.0E+00	mg/kg-day	0.0009
				Arsenic	1.02E+01	mg/kg	9E-07	mg/kg-day	1.5E+00	mg/kg-day)^-1	1.4E-06	6.4E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	2.31E+01	mg/kg	Multiple Modes of Action, See Table 27				2.8E-06	1.8E-05	mg/kg-day	3.0E-03	mg/kg-day	0.006
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	7.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.5E-06	mg/kg-day	6.0E-04	mg/kg-day	0.003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	1.9E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	7.2E-04	mg/kg-day	1.4E-01	mg/kg-day	0.005
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	7.0E-07	mg/kg-day	1.0E-05	mg/kg-day	0.07
			Ingestion Total								5.5E-06					0.2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 27				5.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				1.1E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 27				1.2E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				1.1E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 27				1.0E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1E-12	mg/kg-day	1.5E+05	mg/kg-day)^-1	1.4E-08	7.8E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0001
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	1E-07	mg/kg-day	1.5E+00	mg/kg-day)^-1	1.7E-07	8.0E-07	mg/kg-day	3.0E-04	mg/kg-day	0.003
				Chromium	2.31E+01	mg/kg	Multiple Modes of Action, See Table 27				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	1.5E-03	µg/m3	9.0E-03	µg/m3	1.3E-10	1.0E-10	mg/m3	6.0E-06	mg/m3	0.000002
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.1E-07					0.004
	Total Flenniken Branch Surface Soil										5.8E-06					0.2

Table E-7R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoranthracene	5.10E-02	mg/kg	Mutagenic Mode of Action: See Table 37				2.0E-14	NA	NA	NA	NA	NA
				Benzoraxpyrene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 37				4.0E-13	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	Mutagenic Mode of Action: See Table 37				4.4E-14	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 37				4.0E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mutagenic Mode of Action: See Table 37				3.8E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1E-14	µg/m^3	3.8E+01	(µg/m^3)^-1	4.5E-13	8.3E-17	mg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.2E-07	mg/m^3	5.0E-03	mg/m^3	0.00002
				Arsenic	1.02E+01	mg/kg	1E-08	µg/m^3	4.3E-03	(µg/m^3)^-1	5.3E-11	8.5E-11	mg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	2.81E+01	mg/kg	Mutagenic Mode of Action: See Table 37				8.5E-09	2.4E-10	mg/m^3	1.0E-04	mg/m^3	0.000002
				Cobalt	1.22E+01	mg/kg	1.5E-08	µg/m^3	9.0E-03	µg/m^3	1.3E-10	1.0E-10	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.0E-11	mg/m^3	8.0E-04	mg/m^3	0.000000003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	9.6E-09	mg/m^3	5.0E-05	mg/m^3	0.0002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								8.7E-09					0.0002
	Total Flenniken Branch Air										8.7E-09					0.0002
Total Flenniken Branch Surface Soil											5.9E-06					0.2

Table E-8R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Hours/Day) = Optional Figure
Receptor Population = Trespasser
Receptor Age = Adult Teen

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Calculation		CDF Multi Risk		Cancer Risk	Intake Equation/Calculation		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	6.6E-13	mg/kg-day	1.3E+05	mg/kg-day^-1	8.5E-08	4.6E-12	mg/kg-day	7.0E-10	mg/kg-day	0.007
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	6.8E-03	mg/kg-day	1.0E+00	mg/kg-day	0.007
				Arsenic	1.75E+01	mg/kg	2.4E-07	mg/kg-day	1.5E+00	mg/kg-day^-1	3.6E-07	1.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.006
				Chromium	3.00E+01	mg/kg	Mutagenic Mode of Action See Table 3B				1.2E-06	5.8E-06	mg/kg-day	3.0E-03	mg/kg-day	0.002
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	5.9E-05	mg/kg-day	4.0E-02	mg/kg-day	0.001
				Iron	3.33E+04	mg/kg	NA	NA	NA	NA	NA	6.1E-03	mg/kg-day	7.0E-01	mg/kg-day	0.009
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	2.4E-02	mg/kg-day	0.009
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.0E-07	mg/kg-day	1.0E-05	mg/kg-day	0.01
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	6.2E-06	mg/kg-day	5.0E-03	mg/kg-day	0.001
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0004
			Ingestion Total								1.7E-06					0.06
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	2.3E-14	mg/kg-day	1.3E+05	mg/kg-day^-1	3.0E-09	1.6E-13	mg/kg-day	7.0E-10	mg/kg-day	0.0002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	1.4E-08	mg/kg-day	1.5E+00	mg/kg-day^-1	2.1E-08	9.3E-08	mg/kg-day	3.0E-04	mg/kg-day	0.0003
				Chromium	3.00E+01	mg/kg	Mutagenic Mode of Action See Table 3B				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.4E-08					0.0006
	Total On Site Surface Soil										1.7E-06					0.06
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	8.8E-15	µg/m^3	3.3E+01	µg/m^3^-1	3.3E-13	6.1E-14	µg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	9.1E-05	µg/m^3	5.0E-03	mg/m^3	0.00002
				Arsenic	1.75E+01	mg/kg	5.3E-09	µg/m^3	4.3E-03	µg/m^3^-1	2.3E-11	3.7E-06	µg/m^3	1.5E-05	mg/m^3	0.0000002
				Chromium	3.00E+01	mg/kg	Mutagenic Mode of Action See Table 3B				2.3E-09	7.7E-06	µg/m^3	1.0E-04	mg/m^3	0.0000006
				Cobalt	1.73E+01	mg/kg	5.2E-09	µg/m^3	9.0E-03	µg/m^3^-1	4.7E-11	3.7E-06	µg/m^3	6.0E-06	mg/m^3	0.0000006
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.9E-06	µg/m^3	5.0E-05	mg/m^3	0.00006
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	5.2E-11	mg/m^3	1.0E-04	mg/m^3	0.0000005
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								2.3E-09					0.00009
	Total On Site Air										2.3E-09					0.00009
Total On Site Surface Soil											1.7E-06					0.06

Table E-8R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * CSF
Noncancer Hazard = Intake / RfD
Intake = Exposure Concentration * Intake Factor / Averaging Time

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake Equation/ Constant		CSF/ Unit Risk		Cancer Risk	Intake Equation/ Constant		RfD/ RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Mg equation Model or Equation See Table 36				2.5E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				5.0E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mg equation Model or Equation See Table 36				5.4E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				5.0E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mg equation Model or Equation See Table 36				4.8E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	2.2E-15	mg/kg-day	1.5E+05	mg/kg-day^-1	2.9E-06	1.6E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	2.2E-03	mg/kg-day	1.0E+00	mg/kg-day	0.002
				Arsenic	1.02E+01	mg/kg	2.3E-07	mg/kg-day	1.5E+00	mg/kg-day^-1	3.4E-07	1.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.005
				Chromium	2.31E+01	mg/kg	Mg equation Model or Equation See Table 36				9.5E-07	4.4E-06	mg/kg-day	3.0E-03	mg/kg-day	0.001
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	0.006
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.8E-07	mg/kg-day	6.0E-04	mg/kg-day	0.00006
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	4.8E-03	mg/kg-day	7.0E-01	mg/kg-day	0.007
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.8E-04	mg/kg-day	1.4E-01	mg/kg-day	0.001
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	1.7E-07	mg/kg-day	1.0E-05	mg/kg-day	0.02
			Ingestion Total								1.4E-06					0.04
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Mg equation Model or Equation See Table 36				2.9E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				7.6E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mg equation Model or Equation See Table 36				8.4E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				7.6E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mg equation Model or Equation See Table 36				7.3E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	7.9E-15	mg/kg-day	1.5E+05	mg/kg-day^-1	1.0E-09	5.5E-14	mg/kg-day	7.0E-10	mg/kg-day	0.000008
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	8.1E-09	mg/kg-day	1.5E+00	mg/kg-day^-1	1.2E-08	5.7E-08	mg/kg-day	3.0E-04	mg/kg-day	0.0002
				Chromium	2.31E+01	mg/kg	Mg equation Model or Equation See Table 36				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.2E-08					0.0002
	Total Flenniken Branch Surface Soil										1.4E-06					0.04

Table E-8R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Hours/Day): Optional Entry
Receptor Population: Trespasser
Receptor Age: Adult Only

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Calculation		CDI Unit Risk		Cancer Risk	Intake Equation/Calculation		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
	Air	Fleinaken Estate	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	Mulgenia Model of Airborne Dust Table 36				5.0E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mulgenia Model of Airborne Dust Table 36				9.9E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mulgenia Model of Airborne Dust Table 36				1.1E-13	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mulgenia Model of Airborne Dust Table 36				9.9E-15	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	mg/kg	Mulgenia Model of Airborne Dust Table 36				9.5E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.0E-15	µg/m^3	3.3E+01	µg/m^3^-1	1.1E-13	2.1E-17	mg/m^3	4.0E-08	mg/m^3	0.0000000005
				Aluminum	1.29E+04	mg/kg	4.2E-06	µg/m^3	NA	NA	NA	2.9E-06	mg/m^3	5.0E-03	mg/m^3	0.000006
				Arsenic	1.02E+01	mg/kg	3.1E-09	µg/m^3	4.3E-03	µg/m^3^-1	1.3E-11	2.1E-11	mg/m^3	1.5E-05	mg/m^3	0.0000001
				Chromium	2.31E+01	mg/kg	Mulgenia Model of Airborne Dust Table 36				2.1E-09	5.9E-11	mg/m^3	1.0E-04	mg/m^3	0.0000006
				Cobalt	1.22E+01	mg/kg	3.7E-09	µg/m^3	9.0E-03	µg/m^3	3.3E-11	2.6E-11	mg/m^3	6.0E-06	mg/m^3	0.0000004
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.0E-12	mg/m^3	8.0E-04	mg/m^3	0.0000000006
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-09	mg/m^3	5.0E-05	mg/m^3	0.000005
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								2.2E-09					0.000006
	Total Fleinaken Estate Air										2.2E-09					0.000006
Total Fleinaken Estate Exposure Unit											1.4E-06					0.04

Table E-9R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-11	mg/kg-day	1.5E+05	(mg/kg-day)-1	1.4E-06	1.2E-10	mg/kg-day	7.0E-10	mg/kg-day	0.2
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	1.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.2
				Arsenic	1.75E+01	mg/kg	5.8E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	5.8E-06	4.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action See Table 29				3.6E-05	1.6E-04	mg/kg-day	3.0E-03	mg/kg-day	0.05
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	7.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.2
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	1.6E-03	mg/kg-day	4.0E-02	mg/kg-day	0.04
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	1.6E-01	mg/kg-day	7.0E-01	mg/kg-day	0.2
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	5.9E-03	mg/kg-day	2.4E-02	mg/kg-day	0.2
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	2.7E-06	mg/kg-day	1.0E-05	mg/kg-day	0.3
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.03
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	2.9E-03	mg/kg-day	3.0E-01	mg/kg-day	0.01
			Ingestion Total								4.3E-05					2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.1E-13	mg/kg-day	1.5E+05	(mg/kg-day)-1	6.7E-08	6.0E-12	mg/kg-day	7.0E-10	mg/kg-day	0.009
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	3.1E-07	mg/kg-day	1.5E+00	(mg/kg-day)-1	4.6E-07	3.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action See Table 29				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								5.3E-07					0.02
	Total On-Site Surface Soil										4.3E-05					2
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	2.4E-14	pg/m^3	3.3E+01	(pg/m^3)-1	9.0E-13	2.8E-13	pg/m^3	4.0E-08	mg/m^3	0.000000007
				Aluminum	4.33E+04	mg/kg	3.5E-05	pg/m^3	NA	NA	NA	4.1E-04	pg/m^3	5.0E-03	mg/m^3	0.00008
				Arsenic	1.75E+01	mg/kg	1.4E-08	pg/m^3	4.3E-03	(pg/m^3)-1	6.1E-11	1.7E-07	pg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action See Table 29				1.3E-08	3.5E-07	pg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.73E+01	mg/kg	1.4E-08	pg/m^3	9.0E-03	(pg/m^3)-1	1.3E-10	1.6E-07	pg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.3E-05	pg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	3.7E-10	mg/m^3	1.0E-04	mg/m^3	0.000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.3E-08					0.0004
	Total On-Site Air										1.3E-08					0.0004
Total On-Site Surface Soil											4.3E-05					2

Table E-9R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Fleniken Branch																
Soil	Surface Soil	Fleniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				7.3E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.4E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.6E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.4E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.4E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	3.6E-12	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	4.7E-07	4.2E-11	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.06
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	5.9E-02	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.06
				Arsenic	1.02E+01	(mg/kg)	2.2E-06	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	3.4E-06	2.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.09
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 29				2.7E-05	1.2E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.04
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	5.2E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.2
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	1.0E-05	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.02
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.3E-01	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.2
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	4.9E-03	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.03
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	4.7E-06	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.5
			Ingestion Total								3.3E-05					1
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				2.6E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.2E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.7E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.2E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.0E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	1.8E-13	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	2.3E-08	2.0E-12	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.003
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	1.8E-07	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	2.7E-07	2.1E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.007
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 29				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								9.0E-07					0.01
	Total Fleniken Branch Surface Soil										3.4E-05					1

Table E-9R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleming Branch	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				2.4E-14	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				4.7E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.2E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				4.7E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				4.6E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	8.1E-15	pg/m^3	1.3E+01	(pg/m^3)^-1	1.1E-13	9.4E-14	pg/m^3	4.0E-08	mg/m^3	0.0000000002
				Aluminum	1.29E+04	(mg/kg)	NA	NA	NA	NA	NA	1.3E-04	pg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.02E+01	(mg/kg)	8.3E-09	pg/m^3	4.3E-03	(pg/m^3)^-1	3.6E-11	9.7E-06	pg/m^3	1.5E-05	mg/m^3	0.0000006
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.0E-06	2.6E-10	mg/m^3	1.0E-04	mg/m^3	0.0000003
				Cobalt	1.22E+01	(mg/kg)	9.9E-09	pg/m^3	9.0E-03	pg/m^3	8.9E-11	1.2E-10	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	2.3E-05	pg/m^3	8.0E-04	mg/m^3	0.003
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	1.1E-03	mg/m^3	5.0E-05	mg/m^3	0.00002
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.0E-06					0.004
	Total Fleming Branch Air										1.0E-06					0.004
Total Fleming Branch Surface Soil											1.4E-05					1

Table E-10R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	1.3E-12	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.7E-07	1.5E-11	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.02
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	2.0E-02	(mg/kg-day)	1.00E+00	(mg/kg-day)	0.02
				Arsenic	1.75E+01	(mg/kg)	4.8E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	7.1E-07	5.6E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.02
				Chromium	3.66E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4.0				4.4E-06	1.9E-05	(mg/kg-day)	3.00E-03	(mg/kg-day)	0.006
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	9.2E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.03
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	2.0E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	0.005
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	2.0E-02	(mg/kg-day)	7.00E-01	(mg/kg-day)	0.03
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	7.4E-04	(mg/kg-day)	2.40E-02	(mg/kg-day)	0.03
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	3.3E-07	(mg/kg-day)	1.00E-05	(mg/kg-day)	0.03
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	2.1E-05	(mg/kg-day)	5.00E-03	(mg/kg-day)	0.004
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	3.6E-04	(mg/kg-day)	3.00E-01	(mg/kg-day)	0.001
			Ingestion Total								5.3E-06					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	8.5E-14	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.1E-08	9.9E-13	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.001
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	(mg/kg)	5.1E-08	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	7.7E-08	6.0E-07	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.002
				Chromium	3.66E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4.0				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								8.8E-08					0.003
	Total On-Site Surface Soil										5.4E-06					0.2
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	5.9E-15	µg/m^3	3.8E+01	(µg/m3)^-1	2.2E-13	6.8E-14	µg/m^3	4.00E-08	(mg/m^3)	0.000000002
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	1.0E-04	µg/m^3	5.00E-03	(mg/m^3)	0.00002
				Arsenic	1.75E+01	(mg/kg)	3.5E-09	µg/m^3	4.3E-03	(µg/m3)^-1	1.5E-11	4.1E-08	µg/m^3	1.50E-05	(mg/m^3)	0.000003
				Chromium	3.66E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4.0				3.3E-09	8.6E-08	µg/m^3	1.00E-04	(mg/m^3)	0.00000009
				Cobalt	1.73E+01	(mg/kg)	3.5E-09	µg/m^3	9.0E-03	(µg/m3)^-1	3.2E-11	4.1E-08	µg/m^3	6.00E-06	(mg/m^3)	0.000007
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	3.3E-06	µg/m^3	5.00E-05	(mg/m^3)	0.00007
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	9.2E-11	(mg/m^3)	1.00E-04	(mg/m^3)	0.00000009
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.3E-09					0.0001
	Total On-Site Air										3.3E-09					0.0001
Total On-Site Surface Soil											5.4E-06					0.2

Table E-10R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				9.0E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.8E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.9E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.8E-09	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.7E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	4.5E-13	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	5.8E-08	5.2E-12	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.007
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	7.4E-03	(mg/kg-day)	1.00E+00	(mg/kg-day)	0.007
				Arsenic	1.02E+01	(mg/kg)	2.8E-07	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	4.2E-07	3.2E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.01
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				3.4E-06	1.5E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.005
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	6.5E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.02
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	1.3E-06	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.002
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.6E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.02
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	6.0E-04	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.004
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	5.8E-07	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.06
			Ingestion Total								4.1E-06					0.1
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				2.0E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				5.1E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				5.7E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				5.1E-10	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				4.9E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	2.9E-14	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	3.8E-09	3.4E-13	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.0005
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	3.0E-08	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	4.5E-08	3.5E-07	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.001
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.1E-07					0.002
	Total Flenniken Branch Surface Soil										4.2E-06					0.1

Table E-10R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleming Branch	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				6.0E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.2E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.3E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.2E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.1E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	2.0E-15	pg/m^3	3.3E+01	(pg/m^3)^-1	7.6E-14	2.3E-14	pg/m^3	4.00E-08	(mg/m^3	0.0000000006
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	3.3E-05	pg/m^3	5.00E-03	(mg/m^3	0.000007
				Arsenic	1.02E+01	(mg/kg)	2.1E-09	pg/m^3	4.3E-03	(pg/m^3)^-1	8.8E-12	2.4E-06	pg/m^3	1.50E-05	(mg/m^3	0.0000002
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				2.5E-09	6.6E-11	(mg/m^3	1.0E-04	(mg/m^3	0.0000000
				Cobalt	1.22E+01	(mg/kg)	2.4E-09	pg/m^3	9.0E-03	pg/m^3	2.2E-11	2.9E-11	(mg/m^3	6.0E-06	(mg/m^3	0.000005
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	6.9E-04	pg/m^3	8.0E-04	(mg/m^3	0.0009
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	2.7E-09	(mg/m^3	5.0E-05	(mg/m^3	0.00005
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								2.6E-09					0.0009
	Total Fleming Branch Air										2.6E-09					0.0009
Total Fleming Branch Surface Soil											4.2E-06					0.1

Table E-11R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	3.3E-12	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	4.3E-07	1.2E-11	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.02
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	1.7E-02	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.02
				Arsenic	1.75E+01	(mg/kg)	1.2E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.8E-06	4.2E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.01
				Chromium	3.66E+01	(mg/kg)	4.2E-06	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	2.1E-06	1.5E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.005
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	6.2E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.02
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	1.5E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.004
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	1.5E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.02
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	5.6E-04	(mg/kg-day)	2.4E-02	(mg/kg-day)	0.02
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	2.5E-07	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.03
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	1.6E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.003
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	2.7E-04	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.0009
			Ingestion Total								4.3E-06					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	4.2E-13	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	5.5E-08	1.5E-12	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.002
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	(mg/kg)	2.5E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	3.8E-07	8.9E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.003
				Chromium	3.66E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								4.3E-07					0.005
	Total On-Site Surface Soil										4.8E-06					0.2
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	7.9E-14	pg/m^3	3.8E+01	(pg/m3)^-1	3.0E-12	2.8E-13	pg/m^3	4.0E-08	mg/m^3	0.000000007
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	4.1E-04	pg/m^3	5.0E-03	mg/m^3	0.00008
				Arsenic	1.75E+01	(mg/kg)	4.7E-08	pg/m^3	4.3E-03	(pg/m3)^-1	2.0E-10	1.7E-07	pg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	3.66E+01	(mg/kg)	9.9E-08	pg/m^3	8.4E-02	(pg/m3)^-1	8.4E-09	3.5E-07	pg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.73E+01	(mg/kg)	4.7E-08	pg/m^3	9.0E-03	(pg/m3)^-1	4.2E-10	1.6E-07	pg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	1.3E-05	pg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	3.7E-10	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								9.0E-09					0.0004
	Total On-Site Air										9.0E-09					0.0004
Total On-Site Surface Soil											4.8E-06					0.2

Table E-11R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	5.8E-09	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	4.3E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	1.1E-08	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	8.4E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	1.3E-08	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	9.2E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	1.1E-08	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	8.4E-10	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	1.1E-08	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	8.0E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	1.1E-12	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	1.5E-07	4.0E-12	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.006
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	5.6E-03	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.006
				Arsenic	1.02E+01	(mg/kg)	7.0E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	1.0E-06	2.4E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.008
				Chromium	2.81E+01	(mg/kg)	3.2E-06	(mg/kg-day)	5.0E-01	(mg/kg-day)-1	1.6E-06	1.1E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.004
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	4.9E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.02
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	9.6E-07	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.002
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.2E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.02
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	4.6E-04	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.003
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	4.4E-07	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.04
			Ingestion Total								2.9E-06					0.1
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	3.3E-09	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	2.3E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	6.3E-09	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	4.6E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	6.9E-09	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	5.0E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	6.3E-09	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	4.6E-10	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	6.0E-09	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	4.4E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	1.4E-13	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	1.9E-08	5.0E-13	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.0007
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	1.5E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	2.2E-07	5.2E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.002
				Chromium	2.81E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.9E-07					0.002
	Total Flenniken Branch Surface Soil										3.2E-06					0.1

Table E-11R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleming Branch	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	1.4E-10	pg/m^3	1.1E-04	(ug/m3)^-1	1.5E-14	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	2.7E-10	pg/m^3	1.1E-03	(ug/m3)^-1	3.0E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	3.0E-10	pg/m^3	1.1E-04	(ug/m3)^-1	3.3E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	2.7E-10	pg/m^3	1.1E-04	(ug/m3)^-1	3.0E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	2.6E-10	pg/m^3	1.1E-05	(ug/m3)^-1	2.9E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	2.7E-14	pg/m^3	3.8E+01	(ug/m3)^-1	1.0E-12	9.4E-14	pg/m^3	4.0E-08	(mg/m^3)	0.0000000002
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	1.3E-04	pg/m^3	5.0E-03	(mg/m^3)	0.00003
				Arsenic	1.02E+01	(mg/kg)	2.8E-08	pg/m^3	4.3E-03	(ug/m3)^-1	1.2E-10	9.7E-08	pg/m^3	1.5E-05	(mg/m^3)	0.0000006
				Chromium	2.81E+01	(mg/kg)	7.6E-08	pg/m^3	8.4E-02	pg/m^3	6.4E-09	2.6E-10	(mg/m^3)	1.0E-04	(mg/m^3)	0.0000003
				Cobalt	1.22E+01	(mg/kg)	3.3E-08	pg/m^3	9.0E-03	pg/m^3	3.0E-10	1.2E-10	(mg/m^3)	6.0E-06	(mg/m^3)	0.00002
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	2.3E-03	pg/m^3	8.0E-04	(mg/m^3)	0.003
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	1.1E-03	(mg/m^3)	5.0E-05	(mg/m^3)	0.0002
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								6.3E-09					0.004
	Total Fleming Branch Air										6.3E-09					0.004
Total Fleming Branch Surface Soil											3.2E-06					0.1

Table E-12R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.9E-13	mg/kg-day	1.5E+05	mg/kg-day-1	2.4E-08	1.4E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.1E-03	mg/kg-day	1.0E+00	mg/kg-day	0.002
				Arsenic	1.75E+01	mg/kg	6.7E-08	mg/kg-day	1.5E+00	mg/kg-day-1	1.0E-07	5.2E-07	mg/kg-day	3.0E-04	mg/kg-day	0.002
				Chromium	3.66E+01	mg/kg	2.3E-07	mg/kg-day	5.0E-01	mg/kg-day-1	1.2E-07	1.8E-06	mg/kg-day	3.0E-03	mg/kg-day	0.0006
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	8.6E-07	mg/kg-day	3.0E-04	mg/kg-day	0.003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	1.8E-05	mg/kg-day	4.0E-02	mg/kg-day	0.0005
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	1.9E-03	mg/kg-day	7.0E-01	mg/kg-day	0.003
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	6.9E-05	mg/kg-day	2.4E-02	mg/kg-day	0.003
				Thallium	6.50E-01	mg/kg	NA	NA	NA	NA	NA	3.1E-08	mg/kg-day	1.0E-05	mg/kg-day	0.003
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.9E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	3.3E-05	mg/kg-day	3.0E-01	mg/kg-day	0.0001
			Ingestion Total								2.4E-07					0.02
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.3E-14	mg/kg-day	1.5E+05	mg/kg-day-1	1.7E-09	1.0E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	8.1E-09	mg/kg-day	1.5E+00	mg/kg-day-1	1.2E-08	6.3E-08	mg/kg-day	3.0E-04	mg/kg-day	0.0002
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.50E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.4E-08					0.0004
	Total On-Site Surface Soil										2.6E-07					0.02
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	8.8E-15	pg/m^3	3.3E+01	(pg/m^3)^-1	3.3E-13	6.8E-14	pg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	1.0E-04	pg/m^3	5.0E-03	mg/m^3	0.00002
				Arsenic	1.75E+01	mg/kg	5.3E-09	pg/m^3	4.3E-03	(pg/m^3)^-1	2.3E-11	4.1E-08	pg/m^3	1.5E-05	mg/m^3	0.0000003
				Chromium	3.66E+01	mg/kg	1.1E-08	pg/m^3	8.4E-02	(pg/m^3)^-1	9.3E-10	8.6E-08	pg/m^3	1.0E-04	mg/m^3	0.0000009
				Cobalt	1.73E+01	mg/kg	5.3E-09	pg/m^3	9.0E-03	(pg/m^3)^-1	4.7E-11	4.1E-08	pg/m^3	6.0E-06	mg/m^3	0.000007
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	3.3E-06	pg/m^3	5.0E-05	mg/m^3	0.00007
				Thallium	6.50E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	9.2E-11	mg/m^3	1.0E-04	mg/m^3	0.0000009
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.0E-09					0.0001
	Total On-Site Air										1.0E-09					0.0001
Total On-Site Surface Soil											2.6E-07					0.02

Table E-12R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	3.3E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	2.4E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	6.4E-10	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	4.7E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	7.0E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	5.1E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	6.4E-10	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	4.7E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	6.1E-10	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	4.5E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	6.3E-14	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	8.2E-09	4.9E-13	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.00007
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	8.9E-04	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.0007
				Arsenic	1.02E+01	(mg/kg)	3.9E-08	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	5.8E-08	3.0E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.001
				Chromium	2.81E+01	(mg/kg)	1.8E-07	(mg/kg-day)	5.0E-01	(mg/kg-day)-1	9.0E-08	1.4E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.00005
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	8.1E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.002
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	1.2E-07	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.0002
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.5E-03	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.002
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	5.7E-05	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.00004
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	5.5E-06	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.005
			Ingestion Total								1.6E-07					0.01
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	1.0E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	7.5E-11	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	2.0E-10	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	1.5E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	2.2E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	1.6E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	2.0E-10	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	1.5E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	1.9E-10	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	1.4E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	4.6E-15	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	5.9E-10	3.6E-14	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.00005
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	4.7E-09	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	7.0E-09	3.7E-08	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.0001
				Chromium	2.81E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								9.4E-09					0.0002
	Total Flenniken Branch Surface Soil										1.7E-07					0.01

Table E-12R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleetwood Estate	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	1.5E-11	pg/m^3	1.1E-04	(ug/m^3)^-1	1.7E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	3.0E-11	pg/m^3	1.1E-03	(ug/m^3)^-1	3.3E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	3.3E-11	pg/m^3	1.1E-04	(ug/m^3)^-1	3.7E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	3.0E-11	pg/m^3	1.1E-04	(ug/m^3)^-1	3.3E-15	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	2.9E-11	pg/m^3	1.1E-05	(ug/m^3)^-1	3.2E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	3.0E-15	pg/m^3	3.3E+01	(ug/m^3)^-1	1.1E-13	2.3E-14	pg/m^3	4.0E-08	(mg/m^3)	0.0000000006
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	3.3E-05	pg/m^3	5.0E-03	(mg/m^3)	0.000007
				Arsenic	1.02E+01	(mg/kg)	3.1E-09	pg/m^3	4.3E-03	(ug/m^3)^-1	1.3E-11	2.4E-06	pg/m^3	1.5E-05	(mg/m^3)	0.0000002
				Chromium	2.81E+01	(mg/kg)	8.4E-09	pg/m^3	8.4E-02	pg/m^3	7.1E-10	6.6E-11	(mg/m^3)	1.0E-04	(mg/m^3)	0.00000007
				Cobalt	1.22E+01	(mg/kg)	3.7E-09	pg/m^3	9.0E-03	pg/m^3	3.3E-11	2.9E-11	(mg/m^3)	6.0E-06	(mg/m^3)	0.0000005
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	6.9E-04	pg/m^3	8.0E-04	(mg/m^3)	0.00009
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	2.7E-09	(mg/m^3)	5.0E-05	(mg/m^3)	0.000005
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								7.6E-10					0.00009
	Total Fleetwood Estate Air										7.6E-10					0.00009
Total Fleetwood Estate Surface Soil											1.7E-07					0.01

Table E-13R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Exposure Frequency (Days/Year): Two Hundred
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Constant		CDI Total Risk		Cancer Risk	Intake Equation/Constant		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
On Site																
Soil	Total Soil	On Site	Ingestion	Benzo(a)anthracene	8.10E-02	mg/kg	3.3E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	3.7E-09	mg/kg-day	7.3E+00	mg/kg-day^{-1}	2.7E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.9E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	3.7E-09	mg/kg-day	7.3E-02	mg/kg-day^{-1}	2.7E-10	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-03	mg/kg-day^{-1}	2.9E-11	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	2.8E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.0E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.2E-12	mg/kg-day	1.3E+05	mg/kg-day^{-1}	1.5E-07	8.2E-11	mg/kg-day	7.0E-10	mg/kg-day	0.1
				PCB-1232	5.40E-01	mg/kg	2.2E-08	mg/kg-day	2.0E+00	mg/kg-day^{-1}	4.4E-08	NA	NA	NA	NA	NA
				Aluminum	3.20E+04	mg/kg	NA	NA	NA	NA	NA	9.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.09
				Arsenic	1.72E+01	mg/kg	4.2E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	6.2E-07	2.9E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Chromium	3.70E+01	mg/kg	1.5E-06	mg/kg-day	5.0E-01	mg/kg-day^{-1}	7.5E-07	1.0E-04	mg/kg-day	3.0E-03	mg/kg-day	0.03
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	5.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.2
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	9.8E-04	mg/kg-day	4.0E-02	mg/kg-day	0.02
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	1.1E-01	mg/kg-day	7.0E-01	mg/kg-day	0.2
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	3.9E-03	mg/kg-day	2.4E-02	mg/kg-day	0.2
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.8E-06	mg/kg-day	1.0E-05	mg/kg-day	0.2
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	5.0E-03	mg/kg-day	0.02
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	1.8E-03	mg/kg-day	3.0E-01	mg/kg-day	0.006
			Ingestion Total								1.6E-06					1
			Dermal	Benzo(a)anthracene	8.10E-02	mg/kg	1.3E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	9.8E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	1.5E-09	mg/kg-day	7.3E+00	mg/kg-day^{-1}	1.1E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.2E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	1.5E-09	mg/kg-day	7.3E-02	mg/kg-day^{-1}	1.1E-10	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E-03	mg/kg-day^{-1}	1.2E-11	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	1.1E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	8.3E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-13	mg/kg-day	1.3E+05	mg/kg-day^{-1}	1.4E-08	7.3E-12	mg/kg-day	7.0E-10	mg/kg-day	0.01
				PCB-1232	5.40E-01	mg/kg	9.0E-09	mg/kg-day	2.0E+00	mg/kg-day^{-1}	1.9E-08	NA	NA	NA	NA	NA
				Aluminum	3.20E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.72E+01	mg/kg	6.6E-08	mg/kg-day	1.5E+00	mg/kg-day^{-1}	9.8E-08	4.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	3.70E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.5E-07					0.03
	Total On Site Total Soil										1.7E-06					1

Table E-13R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Exposure Concentration		CF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	On Site	Inhalation	Benzo(a)anthracene	8.10E-02	mg/kg	4.7E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	5.2E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	5.3E-11	µg/m^3	1.1E-03	(µg/m^3)^-1	5.8E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	6.4E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	5.3E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	5.8E-15	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-05	(µg/m^3)^-1	6.4E-16	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	4.0E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	4.4E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.7E-14	µg/m^3	3.3E+01	(µg/m^3)^-1	6.4E-13	1.2E-12	µg/m^3	4.0E-08	mg/m^3	0.000000003
				PCB-1232	5.40E-01	mg/kg	2.1E-05	µg/m^3	5.7E-04	(µg/m^3)^-1	1.2E-08	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	1.3E-03	µg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.72E+01	mg/kg	1.0E-03	µg/m^3	4.3E-03	(µg/m^3)^-1	4.3E-11	7.0E-07	µg/m^3	1.5E-05	mg/m^3	0.00005
				Chromium	3.70E+01	mg/kg	2.1E-03	µg/m^3	8.4E-02	(µg/m^3)^-1	1.8E-09	1.5E-06	µg/m^3	1.0E-04	mg/m^3	0.00002
				Cobalt	1.75E+01	mg/kg	1.0E-03	µg/m^3	9.0E-03	(µg/m^3)^-1	9.2E-11	7.1E-07	µg/m^3	6.0E-06	mg/m^3	0.00001
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	5.6E-05	µg/m^3	5.0E-05	mg/m^3	0.001
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.6E-09	mg/m^3	1.0E-04	mg/m^3	0.00002
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.4E-08					0.002
	Total On Site Air										1.4E-08					0.002
Total On Site Total Soil											1.8E-08					1
Flenniken Branch																
Soil	Total Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	2.1E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.5E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.9E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	4.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	3.2E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.9E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	3.9E-09	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.8E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	4.0E-13	mg/kg-day	1.3E+05	(mg/kg-day)^-1	5.2E-08	2.8E-11	mg/kg-day	7.0E-10	mg/kg-day	0.04
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	3.9E-02	mg/kg-day	1.0E+00	mg/kg-day	0.04
				Arsenic	1.02E+01	mg/kg	2.5E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	3.7E-07	1.7E-05	mg/kg-day	3.0E-04	mg/kg-day	0.06
				Chromium	2.31E+01	mg/kg	1.1E-06	mg/kg-day	5.0E-01	(mg/kg-day)^-1	5.7E-07	7.9E-05	mg/kg-day	3.0E-03	mg/kg-day	0.03
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	6.8E-06	mg/kg-day	6.0E-04	mg/kg-day	0.01
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	8.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.1
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	3.2E-03	mg/kg-day	1.4E-01	mg/kg-day	0.02
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	3.1E-06	mg/kg-day	1.0E-05	mg/kg-day	0.3
			Ingestion Total								1.0E-06					0.7

Table E-13R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC value	EPC Unit	Cancer Risk Calculations: Intake Exposure Concentration value	Intake Exposure Concentration Unit	CSF Unit Risk value	CSF Unit Risk Unit	Cancer Risk	Noncancer Hazard Calculations: Intake Exposure Concentration value	Intake Exposure Concentration Unit	RfD/RfC value	RfD/RfC Unit	Hazard Quotient
Soil	Total Soil	Fleetwood Estate	Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	8.4E-10	mg/kg-day	7.3E-01	mg/kg-day^-1	6.2E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E+00	mg/kg-day^-1	1.2E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.8E-09	mg/kg-day	7.3E-01	mg/kg-day^-1	1.3E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E-02	mg/kg-day^-1	1.2E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.6E-09	mg/kg-day	7.3E-03	mg/kg-day^-1	1.2E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD (TEQ)	9.90E-06	mg/kg	3.8E-14	mg/kg-day	1.3E+05	mg/kg-day^-1	4.9E-09	NA	mg/kg-day	7.0E-10	mg/kg-day	0.004
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	3.9E-08	mg/kg-day	1.5E+00	mg/kg-day^-1	5.8E-08	2.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								7.7E-08					0.01
	Total Fleetwood Estate Total Soil										1.1E-06					0.3
	Air	Fleetwood Estate	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	3.0E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	3.3E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-03	(µg/m^3)^-1	6.4E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	6.4E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	7.0E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	6.4E-15	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	5.6E-11	µg/m^3	1.1E-05	(µg/m^3)^-1	6.1E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD (TEQ)	9.90E-06	mg/kg	5.8E-15	µg/m^3	3.3E+01	(µg/m^3)^-1	2.2E-13	4.0E-13	µg/m^3	4.0E-08	mg/m^3	0.000000001
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	5.6E-04	µg/m^3	5.0E-03	mg/m^3	0.00001
				Arsenic	1.02E+01	mg/kg	5.9E-09	µg/m^3	4.3E-03	(µg/m^3)^-1	2.5E-11	4.1E-07	µg/m^3	1.5E-05	mg/m^3	0.000003
				Chromium	2.81E+01	mg/kg	1.6E-08	µg/m^3	8.4E-02	(µg/m^3)^-1	1.4E-09	1.1E-09	µg/m^3	1.0E-04	mg/m^3	0.000001
				Cobalt	1.22E+01	mg/kg	7.0E-09	µg/m^3	9.0E-03	(µg/m^3)^-1	6.3E-11	4.9E-10	mg/m^3	6.0E-06	mg/m^3	0.000083
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.2E-02	µg/m^3	8.0E-04	mg/m^3	0.01
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	4.6E-03	mg/m^3	5.0E-05	mg/m^3	0.00009
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.4E-09					0.02
	Total Fleetwood Estate Total Air										1.4E-09					0.02
Total Fleetwood Estate Total Soil											1.1E-06					0.3

Table E-14R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Construction Time (Years): Eighty
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
On Site																
Soil	Total Soil	On Site	Ingestion	Benzo(a)anthracene	8.10E-02	mg/kg	2.5E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.8E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	2.8E-10	mg/kg-day	7.3E+00	mg/kg-day^{-1}	2.0E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.2E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	2.8E-10	mg/kg-day	7.3E-02	mg/kg-day^{-1}	2.0E-11	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E-03	mg/kg-day^{-1}	2.2E-12	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	2.1E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.5E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	8.9E-14	mg/kg-day	1.3E+05	mg/kg-day^{-1}	1.2E-08	6.2E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0009
				PCB-1262	5.40E-01	mg/kg	1.7E-09	mg/kg-day	2.0E+00	mg/kg-day^{-1}	3.3E-09	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	7.0E-03	mg/kg-day	1.0E+00	mg/kg-day	0.007
				Arsenic	1.72E+01	mg/kg	5.1E-08	mg/kg-day	1.5E+00	mg/kg-day^{-1}	4.7E-08	2.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	3.70E+01	mg/kg	1.1E-07	mg/kg-day	5.0E-01	mg/kg-day^{-1}	5.7E-08	7.9E-06	mg/kg-day	3.0E-03	mg/kg-day	0.003
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.8E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	7.5E-05	mg/kg-day	4.0E-02	mg/kg-day	0.002
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	8.4E-03	mg/kg-day	7.0E-01	mg/kg-day	0.01
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	2.4E-02	mg/kg-day	0.01
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/kg-day	1.0E-05	mg/kg-day	0.01
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	8.4E-06	mg/kg-day	5.0E-03	mg/kg-day	0.002
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	1.4E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0005
			Ingestion Total								1.2E-07					0.06
			Dermal	Benzo(a)anthracene	8.10E-02	mg/kg	2.2E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.6E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	2.5E-10	mg/kg-day	7.3E+00	mg/kg-day^{-1}	1.8E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.0E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	2.5E-10	mg/kg-day	7.3E-02	mg/kg-day^{-1}	1.8E-11	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E-03	mg/kg-day^{-1}	2.0E-12	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	1.9E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.4E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.3E-14	mg/kg-day	1.3E+05	mg/kg-day^{-1}	2.4E-09	1.3E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				PCB-1262	5.40E-01	mg/kg	1.6E-09	mg/kg-day	2.0E+00	mg/kg-day^{-1}	3.2E-09	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.72E+01	mg/kg	1.1E-08	mg/kg-day	1.5E+00	mg/kg-day^{-1}	1.6E-08	7.6E-07	mg/kg-day	3.0E-04	mg/kg-day	0.003
				Chromium	3.70E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.4E-08					0.004
	Total On Site Total Soil										1.5E-07					0.06

Table E-14R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	On-Site	Inhalation	Benzo(a)anthracene	8.10E-02	mg/kg	1.2E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.3E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	1.3E-11	µg/m^3	1.1E-03	(µg/m^3)^-1	1.5E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.6E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	1.3E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.5E-15	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-05	(µg/m^3)^-1	1.6E-16	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	1.0E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.1E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.2E-15	µg/m^3	3.3E+01	(µg/m^3)^-1	1.6E-13	2.9E-15	µg/m^3	4.0E-08	mg/m^3	0.000000007
				PCB-1262	5.40E-01	mg/kg	5.2E-06	µg/m^3	5.7E-04	(µg/m^3)^-1	3.0E-09	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	3.3E-04	µg/m^3	5.0E-03	mg/m^3	0.00007
				Arsenic	1.72E+01	mg/kg	2.5E-09	µg/m^3	4.3E-03	(µg/m^3)^-1	1.1E-11	1.7E-07	µg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	3.70E+01	mg/kg	5.4E-09	µg/m^3	8.4E-02	(µg/m^3)^-1	4.5E-10	3.8E-07	µg/m^3	1.0E-04	mg/m^3	0.0000004
				Cobalt	1.75E+01	mg/kg	2.5E-09	µg/m^3	9.0E-03	(µg/m^3)^-1	2.3E-11	1.8E-07	µg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.29E+03	mg/kg	NA	NA	NA	NA	NA	1.4E-05	µg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.0E-10	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.5E-09					0.0004
	Total On-Site Air										3.5E-09					0.0004
Total On-Site Total Soil											1.5E-07					0.03
Flenniken Branch																
Soil	Total Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	1.6E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.1E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.2E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	3.4E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.5E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.2E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	2.9E-10	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.1E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.0E-14	mg/kg-day	1.3E+05	(mg/kg-day)^-1	3.9E-09	2.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	3.0E-03	mg/kg-day	1.0E+00	mg/kg-day	0.003
				Arsenic	1.02E+01	mg/kg	1.9E-03	mg/kg-day	1.5E+00	(mg/kg-day)^-1	2.8E-03	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.004
				Chromium	2.31E+01	mg/kg	6.6E-03	mg/kg-day	5.0E-01	(mg/kg-day)^-1	4.3E-03	6.0E-06	mg/kg-day	3.0E-03	mg/kg-day	0.002
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.1E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0009
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	6.5E-03	mg/kg-day	7.0E-01	mg/kg-day	0.009
				Magnesium	1.14E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-04	mg/kg-day	1.4E-01	mg/kg-day	0.002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.02
			Ingestion Total								7.7E-03					0.2

Table E-14R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					value	Unit	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							value	Unit	value	Unit		value	Unit	value	Unit	
Soil	Total Soil	Elizabeth Branch	Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	1.4E-10	mg/kg-day	7.3E-01	mg/kg-day^-1	1.0E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E+00	mg/kg-day^-1	2.0E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	3.0E-10	mg/kg-day	7.3E-01	mg/kg-day^-1	2.2E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E-02	mg/kg-day^-1	2.0E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	2.6E-10	mg/kg-day	7.3E-03	mg/kg-day^-1	1.9E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	6.3E-15	mg/kg-day	1.3E+05	mg/kg-day^-1	8.2E-10	4.4E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00006
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	6.5E-09	mg/kg-day	1.5E+00	mg/kg-day^-1	9.7E-09	4.5E-07	mg/kg-day	3.0E-04	mg/kg-day	0.002
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.3E-08					0.002
	Total Elizabeth Branch Total Soil										9.0E-08					0.2
	Air	Elizabeth Branch	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	7.4E-12	µg/m^3	1.1E-04	µg/m^3^-1	8.1E-16	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-03	µg/m^3^-1	1.6E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.6E-11	µg/m^3	1.1E-04	µg/m^3^-1	1.8E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-04	µg/m^3^-1	1.6E-15	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.4E-11	µg/m^3	1.1E-05	µg/m^3^-1	1.5E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.4E-15	µg/m^3	3.8E+01	µg/m^3^-1	5.5E-14	1.0E-13	µg/m^3	4.0E-06	mg/m^3	0.000000003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	1.4E-04	µg/m^3	5.0E-03	mg/m^3	0.000003
				Arsenic	1.02E+01	mg/kg	1.5E-09	µg/m^3	4.3E-03	µg/m^3^-1	6.4E-12	1.0E-07	µg/m^3	1.5E-05	mg/m^3	0.0000007
				Chromium	2.31E+01	mg/kg	4.0E-09	µg/m^3	8.4E-02	µg/m^3	3.4E-10	2.8E-10	mg/m^3	1.0E-04	mg/m^3	0.0000003
				Cobalt	1.22E+01	mg/kg	1.8E-09	µg/m^3	9.0E-03	µg/m^3	1.6E-11	1.2E-10	mg/m^3	6.0E-06	mg/m^3	0.000002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.0E-03	µg/m^3	8.0E-04	mg/m^3	0.004
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-03	mg/m^3	5.0E-05	mg/m^3	0.00002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.0E-10					0.004
	Total Elizabeth Branch Air										3.0E-10					0.004
Total Elizabeth Branch Total Soil											9.1E-08					0.2

Table E-15R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Exposure Concentration		CDF Total Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.2E-11	mg/kg-day	1.3E+05	(mg/kg-day)^-1	5.4E-06	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	2.5E-05	mg/kg-day	1.5E+00	(mg/kg-day)^-1	3.8E-05	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Multiple Modes of Action. See Table 41				1.2E-04	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								1.6E-04					NA
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	2.8E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	3.6E-07	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	1.7E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	2.5E-06	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Multiple Modes of Action. See Table 41				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.9E-06					NA
	Total On Site Surface Soil										1.6E-04					NA
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.8E-12	µg/m^3	3.8E+01	(µg/m^3)^-1	7.0E-11	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	1.1E-06	µg/m^3	4.3E-03	µg/m^3	4.7E-09	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Multiple Modes of Action. See Table 41				5.4E-07	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	1.1E-06	µg/m^3	9.0E-03	(µg/m^3)^-1	1.0E-08	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								5.6E-07					NA
	Total On Site Air										5.6E-07					NA
Total On Site Surface Soil											1.6E-04					NA
Flenniken Branch																

Table E-15R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Eight
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
					value	Unit	Intake Equation/Concentration		CF Total Risk		Cancer Risk	Intake Equation/Concentration		RfD/RfC		Hazard Quotient
							value	Unit	value	Unit		value	Unit	value	Unit	
Soil	Surface Soil	Residential Exposure	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 41				2.4E-07	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				4.8E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 41				5.2E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				4.8E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 41				4.6E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.4E-11	(mg/kg-day)-1	1.5E+05	(mg/kg-day)-1	1.9E-06	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	8.8E-06	(mg/kg-day)-1	1.5E+00	(mg/kg-day)-1	1.3E-05	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Modes of Action, See Table 41				1.2E-04	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								1.3E-04					NA
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 41				6.0E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				1.2E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 41				1.3E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				1.2E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 41				1.1E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	9.5E-13	(mg/kg-day)-1	1.5E+05	(mg/kg-day)-1	1.2E-07	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	9.8E-07	(mg/kg-day)-1	1.5E+00	(mg/kg-day)-1	1.5E-06	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Modes of Action, See Table 41				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.0E-06					NA
	Total Residential Exposure Surface Soil										1.4E-04					NA

Table E-15R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
	Air	Flenniken Branch	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	Mutagenic Mode of Action: See Table 41				9.8E-13	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 41				1.9E-11	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mutagenic Mode of Action: See Table 41				2.1E-12	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 41				1.9E-12	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mutagenic Mode of Action: See Table 41				1.8E-13	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	6.3E-13	µg/m^3	3.8E+01	(µg/m^3)^-1	2.4E-11	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	6.5E-07	µg/m^3	4.3E-03	(µg/m^3)^-1	2.8E-09	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Mutagenic Mode of Action: See Table 41				5.4E-07	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	7.7E-07	µg/m^3	9.0E-03	µg/m^3	6.9E-09	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								5.5E-07					NA
	Total Flenniken Branch Air										5.5E-07					NA
Total Flenniken Branch Total Soil											1.4E-04					NA

Table E-16R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime - Fulltime
Receptor Population - Residential
Receptor Age - Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Unit	Intake Exposure Concentration		CDF Mutl Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.7E-10	mg/kg-day	7.0E-10	mg/kg-day	0.5
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	5.5E-01	mg/kg-day	1.0E+00	mg/kg-day	0.6
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	3.0E-04	mg/kg-day	0.7
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.7E-04	mg/kg-day	3.0E-03	mg/kg-day	0.2
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	3.0E-04	mg/kg-day	0.7
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	4.8E-03	mg/kg-day	4.0E-02	mg/kg-day	0.1
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.7
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.8E-02	mg/kg-day	1.4E-01	mg/kg-day	0.1
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	8.1E-06	mg/kg-day	1.0E-05	mg/kg-day	0.8
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	5.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.1
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	8.6E-03	mg/kg-day	3.0E-01	mg/kg-day	0.03
			Ingestion Total								NA					5
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	1.8E-11	mg/kg-day	7.0E-10	mg/kg-day	0.03
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	1.8E-05	mg/kg-day	3.0E-04	mg/kg-day	0.06
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.09
	Total On Site Surface Soil										NA					5
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	5.0E-12	µg/m3	4.0E-06	mg/m3	0.00000001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	7.3E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.0E-09	mg/m3	1.5E-05	mg/m3	0.00002
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	6.2E-09	mg/m3	1.0E-04	mg/m3	0.000006
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.9E-09	mg/m3	6.0E-06	mg/m3	0.00005
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/m3	5.0E-05	mg/m3	0.005
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	6.6E-09	mg/m3	1.0E-04	mg/m3	0.000007
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.007
	Total On Site Air										NA					0.007
Total On Site Surface Soil											NA					5
Flenniken Branch																

Table E-16R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.3E-10	mg/kg-day	7.0E-10	mg/kg-day	0.2
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.2
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.3E-04	mg/kg-day	3.0E-04	mg/kg-day	0.4
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	3.6E-04	mg/kg-day	3.0E-03	mg/kg-day	0.1
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.6E-04	mg/kg-day	3.0E-04	mg/kg-day	0.5
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.1E-05	mg/kg-day	6.0E-04	mg/kg-day	0.05
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	3.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.6
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.5E-02	mg/kg-day	1.4E-01	mg/kg-day	0.1
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	1.4E-05	mg/kg-day	1.0E-05	mg/kg-day	1
			Ingestion Total								NA					4
			Dermal	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	6.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0088
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.035
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.04
	Total Flenniken Branch Surface Soil										NA					4

Table E-16R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.7E-12	µg/m^3	4.0E-08	mg/m^3	0.000000042
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-03	µg/m^3	5.0E-03	mg/m^3	0.0005
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-09	mg/m3	1.5E-05	mg/m3	0.0001
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	4.8E-09	mg/m3	1.0E-04	mg/m3	0.00005
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-09	mg/m3	6.0E-06	mg/m3	0.0003
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.0E-02	µg/m^3	8.0E-04	mg/m^3	0.06
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.9E-07	mg/m3	5.0E-05	mg/m3	0.004
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.07
	Total Flenniken Branch Air										NA					0.07
Total Flenniken Branch Surface Soil											NA					4

Table E-17R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Unit	Intake Equation/Concentration		CDF Multi Route		Cancer Risk	Intake Equation/Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.5E-11	mg/kg-day	7.0E-10	mg/kg-day	0.05
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	5.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.05
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.07
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.4E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.07
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	4.5E-04	mg/kg-day	4.0E-02	mg/kg-day	0.01
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	4.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.07
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.7E-03	mg/kg-day	1.4E-01	mg/kg-day	0.01
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	7.6E-07	mg/kg-day	1.0E-05	mg/kg-day	0.08
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.7E-05	mg/kg-day	5.0E-03	mg/kg-day	0.009
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	8.1E-04	mg/kg-day	3.0E-01	mg/kg-day	0.003
			Ingestion Total								NA					0.4
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	4.4E-12	mg/kg-day	7.0E-10	mg/kg-day	0.006
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.02
	Total On Site Surface Soil										NA					0.4
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	5.0E-12	µg/m3	4.0E-08	mg/m3	0.00000001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	7.3E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.0E-09	mg/m3	1.5E-05	mg/m3	0.00002
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	6.2E-09	mg/m3	1.0E-04	mg/m3	0.000006
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.9E-09	mg/m3	6.0E-06	mg/m3	0.0005
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/m3	5.0E-05	mg/m3	0.005
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	6.6E-09	mg/m3	1.0E-04	mg/m3	0.000007
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.007
	Total On Site Air										NA					0.007
Total On Site Surface Soil											NA					0.5

Table E-17R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Lifetime
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CSF Mutl Rsk		Cancer Rsk	Intake Exposure Concentration		RfD Rfc		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.2E-11	mg/kg-day	7.0E-10	mg/kg-day	0.02
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	1.7E-02	mg/kg-day	1.0E+00	mg/kg-day	0.02
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	0.04
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.05
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.9E-06	mg/kg-day	6.0E-04	mg/kg-day	0.005
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	3.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.05
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.4E-03	mg/kg-day	1.4E-01	mg/kg-day	0.01
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	1.3E-06	mg/kg-day	1.0E-05	mg/kg-day	0.1
			Ingestion Total								NA					0.3
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.5E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.005
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.007
	Total Flenniken Branch Surface Soil										NA					0.3

Table E-17R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.7E-12	µg/m^3	4.0E-08	mg/m^3	0.00000004
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-03	µg/m^3	5.0E-03	mg/m^3	0.0005
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-06	µg/m^3	1.5E-05	mg/m^3	0.0001
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	4.8E-09	mg/m3	1.0E-04	mg/m3	0.00005
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-09	mg/m3	6.0E-06	mg/m3	0.0003
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.0E-02	µg/m^3	8.0E-04	mg/m^3	0.06
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.9E-07	mg/m3	5.0E-05	mg/m3	0.004
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.07
	Total Flenniken Branch Air										NA					0.07
Total Flenniken Branch Total Soil											NA					0.4

Table E-18R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime Exposure
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Exposure Concentration		CF Dual Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					ppm	Unit	ppm	Unit	ppm	Unit		ppm	Unit	ppm	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.81E-11	mg/kg-day	1.3E+05	mg/kg-day-1	2.4E-06	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	6.44E-06	mg/kg-day	1.5E+00	mg/kg-day-1	9.7E-06	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action. See Table 4C				5.4E-05	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								6.6E-05					NA
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.94E-13	mg/kg-day	1.3E+05	mg/kg-day-1	7.7E-08	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	3.51E-07	mg/kg-day	1.5E+00	mg/kg-day-1	5.3E-07	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action. See Table 4C				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								8.0E-07					NA
	Total On Site Surface Soil										6.7E-05					NA
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	7.07E-13	µg/m3	3.3E+01	(µg/m3)-1	2.7E-11	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	4.19E-07	µg/m3	4.3E-03	(µg/m3)-1	1.8E-09	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action. See Table 4C				1.9E-07	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	4.27E-07	µg/m3	9.0E-03	(µg/m3)-1	3.8E-09	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.9E-07					NA
	Total On Site Air										1.9E-07					NA
Total On Site Surface Soil											6.7E-05					NA

Table E-18R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime Eight
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Constant		CF Total Risk		Cancer Risk	Intake Equation/Constant		RfD/RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Model or Action See Table 4S				1.1E-07	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				2.2E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Model or Action See Table 4S				2.4E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				2.2E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Model or Action See Table 4S				2.1E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	6.19E-12	mg/kg/day	1.3E+05	mg/kg/day-1	8.0E-07	NA	NA	NA	NA	NA
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	3.81E-06	mg/kg/day	1.5E+00	mg/kg/day-1	5.7E-06	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Model or Action See Table 4S				4.2E-05	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								5.1E-05					NA
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Model or Action See Table 4S				1.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				9.4E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Model or Action See Table 4S				1.1E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				9.4E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Model or Action See Table 4S				2.7E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	2.03E-13	mg/kg/day	1.3E+05	mg/kg/day-1	2.6E-08	NA	NA	NA	NA	NA
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	2.08E-07	mg/kg/day	1.5E+00	mg/kg/day-1	3.1E-07	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Model or Action See Table 4S				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.7E-07					NA
	Total Flenniken Branch Surface Soil										5.1E-05					NA

Table E-18R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * CSF
Noncancer Hazard Quotient = Intake / RfD
Noncancer Age Adjusted = Intake / RfD

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake Equation/Constant		CSF/Unit Risk		Cancer Risk	Intake Equation/Constant		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	Fleetwood Estate	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Mode of Action, See Table 4.3				3.4E-13	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Mode of Action, See Table 4.3				6.7E-12	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Mode of Action, See Table 4.3				7.4E-13	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Mode of Action, See Table 4.3				6.7E-13	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	mg/kg	Multiple Mode of Action, See Table 4.3				6.5E-14	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	2.42E-13	µg/m^3	3.8E+01	(µg/m^3)^-1	9.2E-12	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	2.48E-07	µg/m^3	4.3E-03	(µg/m^3)^-1	1.1E-09	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Mode of Action, See Table 4.3				1.4E-07	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	2.56E-07	µg/m^3	9.0E-03	µg/m^3	2.3E-09	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.5E-07					NA
	Total Fleetwood Estate Air										1.5E-07					NA
Total Fleetwood Estate Surface Soil											5.1E-05					NA

Table E-19R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDF Mutl Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	1.9E-10	mg/kg-day	7.0E-10	mg/kg-day	0.3
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.3
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	3.0E-04	mg/kg-day	0.4
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	2.3E-04	mg/kg-day	3.0E-03	mg/kg-day	0.08
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	3.0E-04	mg/kg-day	0.4
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	2.4E-03	mg/kg-day	4.0E-02	mg/kg-day	0.06
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-01	mg/kg-day	7.0E-01	mg/kg-day	0.3
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	8.9E-03	mg/kg-day	1.4E-01	mg/kg-day	0.06
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	4.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.4
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	2.5E-04	mg/kg-day	5.0E-03	mg/kg-day	0.05
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	4.3E-03	mg/kg-day	3.0E-01	mg/kg-day	0.01
			Ingestion Total								NA					2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	6.0E-12	mg/kg-day	7.0E-10	mg/kg-day	0.009
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.02
	Total On Site Surface Soil										NA					2
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.3E-12	µg/m3	4.0E-08	mg/m3	0.000000083
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	1.5E-05	mg/m3	0.00001
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.1E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	6.0E-06	mg/m3	0.0003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.6E-07	mg/m3	5.0E-05	mg/m3	0.003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.4E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.005
	Total On Site Air										NA					0.005
Total On Site Surface Soil											NA					2

Table E-19R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Lifetime
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDF Total Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	6.3E-11	mg/kg-day	7.0E-10	mg/kg-day	0.09
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	8.9E-02	mg/kg-day	1.0E+00	mg/kg-day	0.09
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	6.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.2
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	1.3E-04	mg/kg-day	3.0E-03	mg/kg-day	0.06
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	7.8E-05	mg/kg-day	3.0E-04	mg/kg-day	0.3
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.5E-05	mg/kg-day	6.0E-04	mg/kg-day	0.03
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	1.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.3
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	7.3E-03	mg/kg-day	1.4E-01	mg/kg-day	0.05
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	7.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.7
				Vanadium	2.25E+01	mg/kg	NA	NA	NA	NA	NA	1.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.03
			Ingestion Total								NA					2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	2.0E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.01
	Total Flenniken Branch Surface Soil										NA					2

Table E-19R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime Fylgte
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CSF Mutl Rsk		Cancer Risk	Intake Exposure Concentration		RfD Rfc		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	Fleetwood Estate	Inhalation	Benzo[a]anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo[a]pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo[b]fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo[k]fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.1E-12	µg/m^3	4.0E-08	mg/m^3	0.000000003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	1.6E-03	µg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.2E-06	µg/m^3	1.5E-05	mg/m^3	0.000003
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	3.2E-09	mg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.4E-09	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.3E-02	µg/m^3	8.0E-04	mg/m^3	0.04
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/m^3	5.0E-05	mg/m^3	0.003
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.04
	Total Fleetwood Estate Air										NA					0.04
Total Fleetwood Estate Surface Soil											NA					2

Table E-20R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDF Mutl Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	1.7E-11	mg/kg-day	7.0E-10	mg/kg-day	0.02
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.6E-02	mg/kg-day	1.0E+00	mg/kg-day	0.03
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-05	mg/kg-day	3.0E-03	mg/kg-day	0.007
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	4.0E-02	mg/kg-day	0.006
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	2.3E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	8.3E-04	mg/kg-day	1.4E-01	mg/kg-day	0.006
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	3.8E-07	mg/kg-day	1.0E-05	mg/kg-day	0.04
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	2.3E-05	mg/kg-day	5.0E-03	mg/kg-day	0.005
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	4.0E-04	mg/kg-day	3.0E-01	mg/kg-day	0.001
			Ingestion Total								NA					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	6.3E-13	mg/kg-day	7.0E-10	mg/kg-day	0.001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.8E-07	mg/kg-day	3.0E-04	mg/kg-day	0.001
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.002
	Total On Site Surface Soil										NA					0.2
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.3E-12	µg/m3	4.0E-06	mg/m3	0.000000003
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	1.5E-05	mg/m3	0.00001
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.1E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	6.0E-06	mg/m3	0.000003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.6E-07	mg/m3	5.0E-05	mg/m3	0.003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.4E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.005
	Total On Site Air										NA					0.005
Total On Site Surface Soil											NA					0.2

Table E-20R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Fulltime
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CSF Total Risk		Cancer Risk	Intake Exposure Concentration		RfD Ref		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	5.9E-12	mg/kg-day	7.0E-10	mg/kg-day	0.008
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	8.3E-03	mg/kg-day	1.0E+00	mg/kg-day	0.008
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	6.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	7.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.4E-06	mg/kg-day	6.0E-04	mg/kg-day	0.002
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	1.8E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	6.8E-04	mg/kg-day	1.4E-01	mg/kg-day	0.005
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	6.6E-07	mg/kg-day	1.0E-05	mg/kg-day	0.07
			Ingestion Total								NA					0.2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	2.1E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0007
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.001
	Total Flenniken Branch Surface Soil										NA					0.2

Table E-20R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryprene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.1E-12	µg/m^3	4.0E-08	mg/m^3	0.00000003
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.6E-03	µg/m^3	5.0E-03	mg/m^3	0.0003
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.2E-06	µg/m^3	1.5E-05	mg/m^3	0.00008
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	3.2E-09	mg/m3	1.0E-04	mg/m3	0.00003
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.4E-09	mg/m3	6.0E-06	mg/m3	0.0002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.3E-02	µg/m^3	8.0E-04	mg/m^3	0.04
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/m3	5.0E-05	mg/m3	0.003
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.04
	Total Flenniken Branch Air										NA					0.04
Total Flenniken Branch Surface Soil											NA					0.2

Table E-21
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Age-adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	2.2E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				2,4-Dinitrotoluene	5.0E+00	µg/L	6.5E-05	mg/kg-day	3.1E-01	(mg/kg-day)-1	2.0E-05	--	--	--	--	--
				4,4'-DDD	3.20E-02	µg/L	4.1E-07	mg/kg-day	2.4E-01	(mg/kg-day)-1	9.9E-08	--	--	--	--	--
				Benzene	1.12E+00	µg/L	1.4E-05	mg/kg-day	5.5E-02	(mg/kg-day)-1	7.9E-07	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	3.0E-04	mg/kg-day	1.4E-02	(mg/kg-day)-1	4.1E-06	--	--	--	--	--
				Bromodichloromethane	3.20E-01	µg/L	4.1E-06	mg/kg-day	6.2E-02	(mg/kg-day)-1	2.5E-07	--	--	--	--	--
				Bromomethane	1.45E+00	µg/L	1.9E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Chloroform	9.10E+00	µg/L	1.2E-04	mg/kg-day	3.1E-02	(mg/kg-day)-1	3.6E-06	--	--	--	--	--
				Dibromochloromethane	1.60E+00	µg/L	2.1E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Dieldrin	3.40E-02	µg/L	4.4E-07	mg/kg-day	1.6E+01	(mg/kg-day)-1	7.0E-06	--	--	--	--	--
				Ethylbenzene	1.90E+00	µg/L	2.5E-05	mg/kg-day	1.1E-02	(mg/kg-day)-1	2.7E-07	--	--	--	--	--
				Naphthalene	3.14E+00	µg/L	4.0E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	3.01E+00	µg/L	3.9E-05	mg/kg-day	4.0E-01	(mg/kg-day)-1	1.5E-05	--	--	--	--	--
				Phenol	1.57E+02	µg/L	2.0E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Tetrachloroethene	5.89E+00	µg/L	7.6E-05	mg/kg-day	2.1E-03	(mg/kg-day)-1	1.6E-07	--	--	--	--	--
				Trichloroethene	1.99E+00	µg/L	Mutagenic Mode of Action See Table 4-7				1.7E-06	--	--	--	--	--
				1,3-Dichloropropene	8.74E+00	µg/L	1.1E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Aluminum	5.62E+04	µg/L	7.2E-01	mg/kg-day	NA	--	NA	--	--	--	--	--
				Antimony	7.74E+00	µg/L	1.0E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Arsenic	1.40E+01	µg/L	1.8E-04	mg/kg-day	1.5E+00	(mg/kg-day)-1	2.7E-04	--	--	--	--	--
				Barium	1.03E+01	µg/L	1.3E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Cadmium	2.34E+00	µg/L	3.0E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Chromium	3.14E+01	µg/L	Mutagenic Mode of Action See Table 4-2				5.6E-04	--	--	--	--	--
				Cobalt	1.14E+03	µg/L	1.5E-02	mg/kg-day	NA	--	NA	--	--	--	--	--
				Copper	2.80E+02	µg/L	3.6E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Cyanide	1.07E+01	µg/L	1.4E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Iron	2.54E+03	µg/L	3.3E-02	mg/kg-day	NA	--	NA	--	--	--	--	--
				Lead	1.49E+01	µg/L	1.9E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Magnesium	6.91E+04	µg/L	8.9E-01	mg/kg-day	NA	--	NA	--	--	--	--	--
				Manganese	6.99E+00	µg/L	9.0E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Molybdenum	1.20E+02	µg/L	1.5E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Nickel	7.56E+02	µg/L	9.7E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Selenium	1.75E+01	µg/L	2.2E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Strontium	1.80E+03	µg/L	2.3E-02	mg/kg-day	NA	--	NA	--	--	--	--	--
				Thallium	2.27E+01	µg/L	2.9E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Vanadium	2.30E+01	µg/L	3.0E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Zinc	2.33E+04	µg/L	3.0E-01	mg/kg-day	NA	--	NA	--	--	--	--	--
			Ingestion Total								8.3E-04					--

Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	2.5E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				2,4-Dinitrotoluene	5.06E+00	µg/L	3.9E-06	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	1.2E-06	--	--	--	--	--
				4,4'-DDD	3.20E-02	µg/L	4.0E-06	(mg/kg-day)	2.4E-01	(mg/kg-day)^-1	9.5E-07	--	--	--	--	--
				Benzene	1.12E+00	µg/L	2.2E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	1.2E-07	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	2.0E-02	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	2.8E-04	--	--	--	--	--
				Bromodichloromethane	3.20E-01	µg/L	2.9E-07	(mg/kg-day)	6.2E-02	(mg/kg-day)^-1	1.8E-08	--	--	--	--	--
				Bromomethane	1.45E+00	µg/L	5.9E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chloroform	9.10E+00	µg/L	1.0E-05	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	3.3E-07	--	--	--	--	--
				Dibenzofuran	1.60E+00	µg/L	3.6E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Dieldrin	3.40E-02	µg/L	8.1E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	1.3E-05	--	--	--	--	--
				Ethylbenzene	1.93E+00	µg/L	1.5E-05	(mg/kg-day)	1.1E-02	(mg/kg-day)^-1	1.6E-07	--	--	--	--	--
				Naphthalene	3.14E+00	µg/L	2.6E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	3.01E+00	µg/L	1.5E-04	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	6.0E-05	--	--	--	--	--
				Phenol	1.57E+02	µg/L	9.3E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Tetrachloroethene	5.89E+00	µg/L	4.5E-05	(mg/kg-day)	2.1E-03	(mg/kg-day)^-1	9.4E-08	--	--	--	--	--
				Trichloroethene	1.99E+00	µg/L	Mutagenic Mode of Action See Table 47				2.8E-07	--	--	--	--	--
				vinyl chloride	8.94E+00	µg/L	7.4E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Aluminum	5.62E+04	µg/L	4.0E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Antimony	7.94E+00	µg/L	5.7E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Arsenic	1.40E+01	µg/L	1.0E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.5E-06	--	--	--	--	--
				Beryllium	1.03E+01	µg/L	7.4E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cadmium	2.34E+00	µg/L	1.7E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chromium	3.14E+01	µg/L	Mutagenic Mode of Action See Table 42				1.4E-04	--	--	--	--	--
				Cobalt	1.14E+03	µg/L	3.3E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Copper	2.30E+02	µg/L	2.0E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cyanide	1.07E+01	µg/L	7.6E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Iron	2.54E+03	µg/L	1.8E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Lead	1.49E+01	µg/L	1.1E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Manganese	6.91E+04	µg/L	4.9E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Mercury	6.99E+00	µg/L	5.0E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Molybdenum	1.20E+02	µg/L	8.6E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Nickel	7.56E+02	µg/L	1.1E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Selenium	1.75E+01	µg/L	1.2E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Strontium	1.30E+03	µg/L	1.3E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Thallium	2.27E+01	µg/L	1.6E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Vanadium	2.30E+01	µg/L	1.6E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Zinc	2.33E+04	µg/L	1.0E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
			Dermal Total								5.0E-04					...
	Total Shallow Groundwater										1.4E-03					...
	Indoor Air (while showering)	Shallow	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	µg/L	1.5E-03	(mg/m^3)	NA	--	NA	--	--	--	--	--
				Benzene	1.12E+00	µg/L	1.2E-03	(mg/m^3)	7.8E-06	(µg/m3)^-1	9.6E-11	--	--	--	--	--
				Bromodichloromethane	3.20E-01	µg/L	2.3E-09	(mg/m^3)	3.7E-05	(µg/m3)^-1	8.6E-11	--	--	--	--	--
				Bromomethane	1.45E+00	µg/L	1.5E-03	(mg/m^3)	NA	--	NA	--	--	--	--	--
				Chloroform	9.10E+00	µg/L	8.1E-03	(mg/m^3)	2.3E-05	(µg/m3)^-1	1.9E-09	--	--	--	--	--
				Dibenzofuran	1.60E+00	µg/L	6.1E-09	(mg/m^3)	NA	--	NA	--	--	--	--	--
				Ethylbenzene	1.93E+00	µg/L	1.9E-03	(mg/m^3)	2.5E-06	(µg/m3)^-1	4.7E-11	--	--	--	--	--
				Naphthalene	3.14E+00	µg/L	1.9E-03	(mg/m^3)	3.4E-05	(µg/m3)^-1	6.3E-10	--	--	--	--	--
				Tetrachloroethene	5.89E+00	µg/L	4.7E-03	(mg/m^3)	2.6E-07	(µg/m3)^-1	1.2E-11	--	--	--	--	--
				Trichloroethene	1.99E+00	µg/L	1.3E-03	(mg/m^3)	4.1E-06	(µg/m3)^-1	7.2E-11	--	--	--	--	--
				vinyl chloride	8.94E+00	µg/L	8.6E-03	(mg/m^3)	NA	--	NA	--	--	--	--	--
	Total Indoor Air										2.8E-09					...
Total Shallow Groundwater											1.4E-03					...

Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	1.5E-05	(mg/kg-day)	9.1E-02	(mg/kg-day)^-1	1.4E-06	--	--	--	--	--
				2,4-Dinitrotoluene	1.29E+01	µg/L	1.7E-04	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	5.1E-05	--	--	--	--	--
				2,6-Dinitrotoluene	4.66E+00	µg/L	6.0E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	9.0E-05	--	--	--	--	--
				Benzene	8.61E-01	µg/L	1.1E-05	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	6.1E-07	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	8.6E-04	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	1.2E-05	--	--	--	--	--
				Bromomethane	2.90E+00	µg/L	3.7E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chloroform	2.02E+00	µg/L	2.6E-05	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	8.0E-07	--	--	--	--	--
				Dieldrin	3.50E-02	µg/L	4.5E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	7.2E-06	--	--	--	--	--
				Heptachlor epoxide	5.40E-02	µg/L	6.9E-07	(mg/kg-day)	9.1E+00	(mg/kg-day)^-1	6.3E-06	--	--	--	--	--
				Naphthalene	1.00E+00	µg/L	2.1E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	2.50E+00	µg/L	3.2E-05	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	1.3E-05	--	--	--	--	--
				Trichloroethene	5.30E-01	µg/L	Mutagenic Mode of Action See Table 47				4.9E-07	--	--	--	--	--
				Aluminum	3.66E+03	µg/L	5.0E-02	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Arsenic	6.67E+00	µg/L	8.6E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.3E-04	--	--	--	--	--
				Barium	4.80E+00	µg/L	6.2E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cadmium	2.75E+00	µg/L	3.5E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chromium	2.11E+01	µg/L	Mutagenic Mode of Action See Table 42				3.8E-04	--	--	--	--	--
				Cobalt	1.52E+01	µg/L	1.9E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Copper	3.43E+01	µg/L	4.5E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cyanide	1.10E+01	µg/L	1.4E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Iron	1.25E+04	µg/L	1.6E-01	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Lead	4.66E+00	µg/L	6.0E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Magnesium	1.00E+05	µg/L	1.3E+00	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Manganese	1.54E+01	µg/L	2.0E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Molybdenum	2.00E+02	µg/L	2.6E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Nickel	4.83E+01	µg/L	6.2E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Selenium	3.44E+01	µg/L	4.4E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Strontium	8.60E+03	µg/L	1.1E-01	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Thallium	1.74E+01	µg/L	2.2E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Vanadium	2.80E+01	µg/L	3.6E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Zinc	1.24E+02	µg/L	1.6E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
			Ingestion Total								6.9E-04					--
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	7.5E-07	(mg/kg-day)	9.1E-02	(mg/kg-day)^-1	6.8E-08	--	--	--	--	--
				2,4-Dinitrotoluene	1.29E+01	µg/L	1.0E-05	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	3.1E-06	--	--	--	--	--
				2,6-Dinitrotoluene	4.66E+00	µg/L	4.4E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	6.6E-06	--	--	--	--	--
				Benzene	8.61E-01	µg/L	1.7E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	9.1E-08	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	5.9E-02	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	8.3E-04	--	--	--	--	--
				Bromomethane	2.90E+00	µg/L	1.2E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chloroform	2.02E+00	µg/L	2.3E-06	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	7.2E-08	--	--	--	--	--
				Dieldrin	3.50E-02	µg/L	8.4E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	1.3E-05	--	--	--	--	--
				Heptachlor epoxide	5.40E-02	µg/L	8.6E-07	(mg/kg-day)	9.1E+00	(mg/kg-day)^-1	7.8E-06	--	--	--	--	--
				Naphthalene	1.00E+00	µg/L	1.3E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	2.50E+00	µg/L	1.2E-04	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	5.0E-05	--	--	--	--	--
				Trichloroethene	5.30E-01	µg/L	Mutagenic Mode of Action See Table 47				8.1E-08	--	--	--	--	--
				Aluminum	3.66E+03	µg/L	2.3E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Arsenic	6.67E+00	µg/L	4.3E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	7.1E-07	--	--	--	--	--
				Barium	4.80E+00	µg/L	3.4E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cadmium	2.75E+00	µg/L	2.0E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chromium	2.11E+01	µg/L	Mutagenic Mode of Action See Table 42				9.3E-05	--	--	--	--	--
				Cobalt	1.52E+01	µg/L	4.3E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Copper	3.43E+01	µg/L	2.5E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cyanide	1.10E+01	µg/L	7.9E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Iron	1.25E+04	µg/L	9.0E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--

				Lead	4.60E+00	pg/L	3.3E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
Groundwater	Groundwater	Deep	Dermal	Manganese	1.00E+05	pg/L	7.2E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Mercury	1.54E-01	pg/L	1.1E-08	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Molybdenum	2.00E+02	pg/L	1.4E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Nickel	4.83E+01	pg/L	6.9E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Selenium	3.44E+01	pg/L	2.5E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Strontium	8.60E+03	pg/L	6.1E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Thallium	1.74E+01	pg/L	1.2E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Vanadium	2.80E+01	pg/L	2.0E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Zinc	1.24E+02	pg/L	5.3E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
			Dermal Total								1.0E-03					...
	Total Deep Groundwater										1.7E-03					...
	Indoor Air (while showering)	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	pg/L	1.0E-06	(mg/m^3)	2.6E-05	(µg/m3)^-1	2.7E-10	--	--	--	--	...
				Benzene	8.61E-01	pg/L	9.5E-09	(mg/m^3)	7.8E-06	(µg/m3)^-1	7.4E-11	--	--	--	--	...
				Bromomethane	2.90E+00	pg/L	2.9E-06	(mg/m^3)	NA	--	NA	--	--	--	--	...
				Chloroform	2.02E+00	pg/L	1.8E-06	(mg/m^3)	2.3E-05	(µg/m3)^-1	4.1E-10	--	--	--	--	...
				Naphthalene	1.60E+00	pg/L	9.5E-09	(mg/m^3)	3.4E-05	(µg/m3)^-1	3.2E-10	--	--	--	--	...
				Trichloroethene	5.30E-01	pg/L	5.1E-09	(mg/m^3)	4.1E-06	(µg/m3)^-1	2.1E-11	--	--	--	--	...
			Inhalation Total								1.1E-09					...
	Total Indoor Air										1.1E-09					...
Total Deep Groundwater											1.7E-03					...

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	8.5E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	2.5E-04	mg/kg-day	2.0E-03	mg/kg-day	0.13
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	5.6E-05	mg/kg-day	4.0E-03	mg/kg-day	0.014
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	2.0E-02	mg/kg-day	0.057
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	1.6E-05	mg/kg-day	2.0E-02	mg/kg-day	0.00080
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	7.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.052
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	4.5E-04	mg/kg-day	1.0E-02	mg/kg-day	0.045
				Dibromochloromethane	1.60E+00	µg/L	---	--	--	--	--	8.0E-05	mg/kg-day	1.0E-03	mg/kg-day	0.080
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	5.0E-05	mg/kg-day	0.034
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	9.6E-05	mg/kg-day	1.0E-01	mg/kg-day	0.0010
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	2.0E-02	mg/kg-day	0.008
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	1.5E-04	mg/kg-day	5.0E-03	mg/kg-day	0.030
				Phenol	1.57E+02	µg/L	---	--	--	--	--	7.8E-03	mg/kg-day	3.0E-01	mg/kg-day	0.026
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	2.9E-04	mg/kg-day	6.0E-03	mg/kg-day	0.049
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	9.9E-05	mg/kg-day	5.0E-04	mg/kg-day	0.20
				Vinyl chloride	8.94E+00	µg/L	---	--	--	--	--	4.5E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0022
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	2.8E+00	mg/kg-day	1.0E+00	mg/kg-day	2.8
				Antimony	7.94E+00	µg/L	---	--	--	--	--	4.0E-04	mg/kg-day	4.0E-04	mg/kg-day	1.0
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	7.0E-04	mg/kg-day	3.0E-04	mg/kg-day	2.3
				Barium	1.03E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	2.0E-03	mg/kg-day	0.26
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	5.0E-04	mg/kg-day	0.2
				Chromium	3.14E+01	µg/L	---	--	--	--	--	1.6E-03	mg/kg-day	3.0E-03	mg/kg-day	0.52
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	5.7E-02	mg/kg-day	3.0E-04	mg/kg-day	190
				Copper	2.80E+02	µg/L	---	--	--	--	--	1.4E-02	mg/kg-day	4.0E-02	mg/kg-day	0.35
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	5.3E-04	mg/kg-day	6.0E-04	mg/kg-day	0.89
				Iron	2.54E+03	µg/L	---	--	--	--	--	1.3E-01	mg/kg-day	7.0E-01	mg/kg-day	0.2
				Lead	1.49E+01	µg/L	---	--	--	--	--	7.4E-04	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	3.4E+00	mg/kg-day	2.4E-02	mg/kg-day	140
				Mercury	6.99E+00	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	3.0E-04	mg/kg-day	1.2
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	6.0E-03	mg/kg-day	5.0E-03	mg/kg-day	1.2
				Nickel	7.56E+02	µg/L	---	--	--	--	--	3.8E-02	mg/kg-day	2.0E-02	mg/kg-day	1.9
				Selenium	1.75E+01	µg/L	---	--	--	--	--	8.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.17
				Silver	1.80E+03	µg/L	---	--	--	--	--	9.0E-02	mg/kg-day	6.0E-01	mg/kg-day	0.15
				Thallium	2.27E+01	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	1.0E-05	mg/kg-day	110
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	5.0E-03	mg/kg-day	0.23
				Zinc	2.33E+04	µg/L	---	--	--	--	--	1.2E+00	mg/kg-day	3.0E-01	mg/kg-day	3.9
			Ingestion Total								--					465

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	1.9E-05	mg/kg-day	2.0E-03	mg/kg-day	0.0095
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	1.9E-05	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0028
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	9.6E-02	mg/kg-day	2.0E-02	mg/kg-day	4.8
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	1.4E-06	mg/kg-day	2.0E-02	mg/kg-day	0.00006.8
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	2.9E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0021
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	4.9E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0049
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	1.7E-04	mg/kg-day	1.0E-03	mg/kg-day	0.17
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.076
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	6.9E-05	mg/kg-day	1.0E-01	mg/kg-day	0.0006.9
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	2.0E-02	mg/kg-day	0.0062
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	7.1E-04	mg/kg-day	5.0E-03	mg/kg-day	0.14
				Phenol	1.57E+02	µg/L	---	--	--	--	--	4.8E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0016
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	2.1E-04	mg/kg-day	6.0E-03	mg/kg-day	0.035
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	2.0E-05	mg/kg-day	5.0E-04	mg/kg-day	0.040
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0017
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	1.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.012
				Antimony	7.94E+00	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	6.0E-05	mg/kg-day	0.029
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.010
				Barium	1.03E+01	µg/L	---	--	--	--	--	2.2E-06	mg/kg-day	1.4E-05	mg/kg-day	0.16
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	5.1E-07	mg/kg-day	2.5E-05	mg/kg-day	0.021
				Chromium	3.14E+01	µg/L	---	--	--	--	--	6.9E-06	mg/kg-day	7.5E-05	mg/kg-day	0.092
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.34
				Copper	2.80E+02	µg/L	---	--	--	--	--	6.2E-05	mg/kg-day	4.0E-02	mg/kg-day	0.0015
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	2.3E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0039
				Iron	2.54E+03	µg/L	---	--	--	--	--	5.6E-04	mg/kg-day	7.0E-01	mg/kg-day	0.000080
				Lead	1.49E+01	µg/L	---	--	--	--	--	3.3E-07	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	1.5E-02	mg/kg-day	9.6E-04	mg/kg-day	16
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.5E-06	mg/kg-day	2.1E-05	mg/kg-day	0.073
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	2.6E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0053
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.6E-05	mg/kg-day	3.0E-04	mg/kg-day	0.042
				Selenium	1.75E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	5.0E-03	mg/kg-day	0.00077
				Strontium	1.80E+03	µg/L	---	--	--	--	--	4.0E-04	mg/kg-day	6.0E-01	mg/kg-day	0.000066
				Thallium	2.27E+01	µg/L	---	--	--	--	--	5.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.50
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	1.0E-04	mg/kg-day	0.0509
				Zinc	2.33E+04	µg/L	---	--	--	--	--	5.1E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0103
			Dermal Total								--					22
	Total Shallow Groundwater										--					487

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Total Shallow Groundwater											--					487
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	--	--	--	--	--	6.0E-05	mg/kg-day	6.0E-03	mg/kg-day	0.010
				2,4-Dinitrotoluene	1.29E+01	µg/L	--	--	--	--	--	6.4E-04	mg/kg-day	2.0E-03	mg/kg-day	0.32
				2,6-Dinitrotoluene	4.66E+00	µg/L	--	--	--	--	--	2.3E-04	mg/kg-day	3.0E-04	mg/kg-day	0.76
				Benzene	8.61E-01	µg/L	--	--	--	--	--	4.3E-05	mg/kg-day	4.0E-03	mg/kg-day	0.011
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	--	--	--	--	--	3.3E-03	mg/kg-day	2.0E-02	mg/kg-day	0.17
				Bromomethane	2.90E+00	µg/L	--	--	--	--	--	1.4E-04	mg/kg-day	1.4E-03	mg/kg-day	0.10
				Chloroform	2.02E+00	µg/L	--	--	--	--	--	1.0E-04	mg/kg-day	1.0E-02	mg/kg-day	0.010
				Dieldrin	3.50E-02	µg/L	--	--	--	--	--	1.7E-06	mg/kg-day	5.0E-05	mg/kg-day	0.035
				Heptachlor epoxide	5.40E-02	µg/L	--	--	--	--	--	2.7E-06	mg/kg-day	1.3E-05	mg/kg-day	0.21
				Naphthalene	1.66E+00	µg/L	--	--	--	--	--	8.3E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0040
				Pentachlorophenol	2.50E+00	µg/L	--	--	--	--	--	1.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.025
				Tetrachloroethene	5.60E-01	µg/L	--	--	--	--	--	2.8E-05	mg/kg-day	5.0E-04	mg/kg-day	0.056
				Aluminum	3.56E+03	µg/L	--	--	--	--	--	1.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.18
				Arsenic	6.67E+00	µg/L	--	--	--	--	--	3.3E-04	mg/kg-day	3.0E-04	mg/kg-day	1.1
				Barium	4.80E+00	µg/L	--	--	--	--	--	2.4E-04	mg/kg-day	2.0E-03	mg/kg-day	0.12
				Cadmium	2.75E+00	µg/L	--	--	--	--	--	1.4E-04	mg/kg-day	5.0E-04	mg/kg-day	0.27
				Chromium	2.11E+01	µg/L	--	--	--	--	--	1.1E-03	mg/kg-day	3.0E-03	mg/kg-day	0.35
				Cobalt	1.52E+01	µg/L	--	--	--	--	--	7.6E-04	mg/kg-day	3.0E-04	mg/kg-day	2.52
				Copper	3.48E+01	µg/L	--	--	--	--	--	1.7E-03	mg/kg-day	4.0E-02	mg/kg-day	0.04
				Cyanide	1.10E+01	µg/L	--	--	--	--	--	5.5E-04	mg/kg-day	6.0E-04	mg/kg-day	0.91
				Iron	1.25E+04	µg/L	--	--	--	--	--	6.3E-01	mg/kg-day	7.0E-01	mg/kg-day	0.89
				Lead	4.66E+00	µg/L	--	--	--	--	--	2.3E-04	mg/kg-day	NA	--	NA
				Manganese	1.00E+05	µg/L	--	--	--	--	--	5.0E+00	mg/kg-day	2.4E-02	mg/kg-day	209
				Mercury	1.54E-01	µg/L	--	--	--	--	--	7.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.026
				Molybdenum	2.00E+02	µg/L	--	--	--	--	--	1.0E-02	mg/kg-day	5.0E-03	mg/kg-day	2.0
				Nickel	4.83E+01	µg/L	--	--	--	--	--	2.4E-03	mg/kg-day	2.0E-02	mg/kg-day	0.12
				Selenium	3.44E+01	µg/L	--	--	--	--	--	1.7E-03	mg/kg-day	5.0E-03	mg/kg-day	0.34
				Strontium	8.60E+03	µg/L	--	--	--	--	--	4.3E-01	mg/kg-day	6.0E-01	mg/kg-day	0.71
				Thallium	1.74E+01	µg/L	--	--	--	--	--	8.7E-04	mg/kg-day	1.0E-05	mg/kg-day	87
				Vanadium	2.80E+01	µg/L	--	--	--	--	--	1.4E-03	mg/kg-day	5.0E-03	mg/kg-day	0.28
				Zinc	1.24E+02	µg/L	--	--	--	--	--	6.2E-03	mg/kg-day	3.0E-01	mg/kg-day	0.021
			Ingestion Total								--					307
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	--	--	--	--	--	3.7E-06	mg/kg-day	6.0E-03	mg/kg-day	0.000611
				2,4-Dinitrotoluene	1.29E+01	µg/L	--	--	--	--	--	4.7E-05	mg/kg-day	2.0E-03	mg/kg-day	0.024
				2,6-Dinitrotoluene	4.66E+00	µg/L	--	--	--	--	--	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.069
				Benzene	8.61E-01	µg/L	--	--	--	--	--	3.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.0022
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	--	--	--	--	--	2.8E-01	mg/kg-day	2.0E-02	mg/kg-day	14
				Bromomethane	2.90E+00	µg/L	--	--	--	--	--	5.9E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0042

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Deep	Dermal	Chloroform	2.02E+00	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0011
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	3.9E-06	mg/kg-day	5.0E-05	mg/kg-day	0.079
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	4.1E-06	mg/kg-day	1.3E-05	mg/kg-day	0.31
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	6.3E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0031
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	5.9E-04	mg/kg-day	5.0E-03	mg/kg-day	0.117
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	5.8E-06	mg/kg-day	5.0E-04	mg/kg-day	0.012
				Aluminum	3.36E+03	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	1.0E+00	mg/kg-day	0.00035
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0049
				Barium	4.60E+00	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	1.4E-05	mg/kg-day	0.075
				Cobalt	2.75E+00	µg/L	---	--	--	--	--	6.1E-07	mg/kg-day	2.5E-05	mg/kg-day	0.024
				Chromium	2.11E+01	µg/L	---	--	--	--	--	4.6E-06	mg/kg-day	7.5E-05	mg/kg-day	0.062
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0045
				Copper	3.48E+01	µg/L	---	--	--	--	--	7.7E-06	mg/kg-day	4.0E-02	mg/kg-day	0.000019
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	2.4E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0040
				Iron	1.25E+04	µg/L	---	--	--	--	--	2.8E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0039
				Lead	4.66E+00	µg/L	---	--	--	--	--	1.0E-07	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	2.2E-02	mg/kg-day	9.6E-04	mg/kg-day	23
				Mercury	1.54E-01	µg/L	---	--	--	--	--	3.4E-08	mg/kg-day	2.1E-05	mg/kg-day	0.0016
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	4.4E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0088
				Nickel	4.83E+01	µg/L	---	--	--	--	--	2.1E-06	mg/kg-day	8.0E-04	mg/kg-day	0.0027
				Selenium	3.44E+01	µg/L	---	--	--	--	--	7.6E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0015
				Strontium	8.60E+03	µg/L	---	--	--	--	--	1.9E-03	mg/kg-day	6.0E-01	mg/kg-day	0.0032
				Thallium	1.74E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	1.0E-05	mg/kg-day	0.38
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	6.2E-06	mg/kg-day	1.3E-04	mg/kg-day	0.047
				Zinc	1.24E+02	µg/L	---	--	--	--	--	1.6E-05	mg/kg-day	3.0E-01	mg/kg-day	0.000055
			Dermal Total								--					35
	Total Deep Groundwater										--					345
Total Deep Groundwater											--					345

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	--	--	--	--	--	5.1E-05	(mg/kg-day)	NA	--	NA
				2,4-Dinitrotoluene	5.0E+00	µg/L	--	--	--	--	--	1.5E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.076
				4,4'-DDD	3.20E-02	µg/L	--	--	--	--	--	9.6E-07	(mg/kg-day)	NA	--	NA
				Benzene	1.12E+00	µg/L	--	--	--	--	--	3.4E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0084
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	--	--	--	--	--	6.9E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.034
				Bromodichloromethane	3.20E-01	µg/L	--	--	--	--	--	9.6E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00048
				Bromomethane	1.45E+00	µg/L	--	--	--	--	--	4.3E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.031
				Chloroform	9.10E+00	µg/L	--	--	--	--	--	2.7E-04	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.027
				Dibenzofuran	1.60E+00	µg/L	--	--	--	--	--	4.8E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.048
				Dieldrin	3.40E-02	µg/L	--	--	--	--	--	1.0E-06	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.020
				Ethylbenzene	1.90E+00	µg/L	--	--	--	--	--	5.8E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00058
				Naphthalene	3.14E+00	µg/L	--	--	--	--	--	9.4E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0047
				Pentachlorophenol	3.01E+00	µg/L	--	--	--	--	--	9.0E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.018
				Phenol	1.57E+02	µg/L	--	--	--	--	--	4.7E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.016
				Tetrachloroethene	5.84E+00	µg/L	--	--	--	--	--	1.8E-04	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.029
				Trichloroethene	1.99E+00	µg/L	--	--	--	--	--	6.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.12
				1,1,1-Trichloroethane	8.94E+00	µg/L	--	--	--	--	--	2.7E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.0013
				Aluminum	5.62E+04	µg/L	--	--	--	--	--	1.7E+00	(mg/kg-day)	1.0E+00	(mg/kg-day)	1.7
				Antimony	7.94E+00	µg/L	--	--	--	--	--	2.4E-04	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.59
				Arsenic	1.40E+01	µg/L	--	--	--	--	--	4.2E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.4
				Barium	1.03E+01	µg/L	--	--	--	--	--	3.1E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.15
				Cadmium	2.34E+00	µg/L	--	--	--	--	--	7.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.14
				Chromium	3.14E+01	µg/L	--	--	--	--	--	9.4E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.31
				Cobalt	1.14E+03	µg/L	--	--	--	--	--	3.4E-02	(mg/kg-day)	3.0E-04	(mg/kg-day)	114
				Copper	2.80E+02	µg/L	--	--	--	--	--	8.4E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.21
				Cyanide	1.07E+01	µg/L	--	--	--	--	--	3.2E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.53
				Iron	2.54E+03	µg/L	--	--	--	--	--	7.6E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.11
				Lead	1.49E+01	µg/L	--	--	--	--	--	4.5E-04	(mg/kg-day)	NA	--	NA
				Magnesium	6.91E+04	µg/L	--	--	--	--	--	2.1E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	86
				Manganese	6.99E+00	µg/L	--	--	--	--	--	2.1E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.70
				Molybdenum	1.20E+02	µg/L	--	--	--	--	--	3.6E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.72
				Nickel	7.56E+02	µg/L	--	--	--	--	--	2.3E-02	(mg/kg-day)	2.0E-02	(mg/kg-day)	1.1
				Selenium	1.75E+01	µg/L	--	--	--	--	--	5.2E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.105
				Strontium	1.80E+03	µg/L	--	--	--	--	--	5.4E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.090
				Thallium	2.27E+01	µg/L	--	--	--	--	--	6.8E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	68
				Vanadium	2.30E+01	µg/L	--	--	--	--	--	6.9E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.14
				Zinc	2.33E+04	µg/L	--	--	--	--	--	7.0E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	2.3
			Ingestion Total								--					279

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	Hazard Quotient
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	5.4E-05	mg/kg-day	NA	--	NA
				2,4-Dinitrotoluene	5.0E+00	µg/L	---	--	--	--	--	8.7E-06	mg/kg-day	2.0E-03	mg/kg-day	0.0043
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	8.7E-06	mg/kg-day	NA	--	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	4.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.0012
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	4.5E-02	mg/kg-day	2.0E-02	mg/kg-day	2.2
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	6.4E-07	mg/kg-day	2.0E-02	mg/kg-day	0.000032
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	1.4E-03	mg/kg-day	0.00094
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	2.3E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0023
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	7.9E-05	mg/kg-day	1.0E-03	mg/kg-day	0.079
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.036
				Ethylbenzene	1.90E+00	µg/L	---	--	--	--	--	3.2E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00032
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	5.8E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0029
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	3.3E-04	mg/kg-day	5.0E-03	mg/kg-day	0.066
				Phenol	1.57E+02	µg/L	---	--	--	--	--	2.2E-04	mg/kg-day	3.0E-01	mg/kg-day	0.00072
				Tetrachloroethene	5.84E+00	µg/L	---	--	--	--	--	9.9E-05	mg/kg-day	6.0E-03	mg/kg-day	0.016
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	9.3E-06	mg/kg-day	5.0E-04	mg/kg-day	0.019
				1,1,2-Trichloro-1,2,2-trifluoroethane	8.94E+00	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	2.0E-01	mg/kg-day	0.000081
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	1.0E-02	mg/kg-day	1.0E+00	mg/kg-day	0.010
				Antimony	7.94E+00	µg/L	---	--	--	--	--	1.4E-06	mg/kg-day	6.0E-05	mg/kg-day	0.024
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0083
				Barium	1.03E+01	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	1.4E-05	mg/kg-day	0.13
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	4.2E-07	mg/kg-day	2.5E-05	mg/kg-day	0.017
				Chromium	3.14E+01	µg/L	---	--	--	--	--	5.6E-06	mg/kg-day	7.5E-05	mg/kg-day	0.074
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	8.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.27
				Copper	2.80E+02	µg/L	---	--	--	--	--	5.0E-05	mg/kg-day	4.0E-02	mg/kg-day	0.00125
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0032
				Iron	2.54E+03	µg/L	---	--	--	--	--	4.5E-04	mg/kg-day	7.0E-01	mg/kg-day	0.00065
				Lead	1.49E+01	µg/L	---	--	--	--	--	2.7E-07	mg/kg-day	NA	--	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	1.2E-02	mg/kg-day	9.6E-04	mg/kg-day	13
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	2.1E-05	mg/kg-day	0.059
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0043
				Nickel	7.56E+02	µg/L	---	--	--	--	--	2.7E-05	mg/kg-day	8.0E-04	mg/kg-day	0.034
				Selenium	1.75E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	5.0E-03	mg/kg-day	0.00062
				Strontium	1.80E+03	µg/L	---	--	--	--	--	3.2E-04	mg/kg-day	6.0E-01	mg/kg-day	0.00053
				Thallium	2.27E+01	µg/L	---	--	--	--	--	4.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.404
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	4.1E-06	mg/kg-day	1.3E-04	mg/kg-day	0.031
				Zinc	2.33E+04	µg/L	---	--	--	--	--	2.5E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0083
			Dermal Total								--					16
	Total Shallow Groundwater										--					29

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	Hazard Quotient
Groundwater	Indoor Air (while showering)	Shallow	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	µg/L	--	--	--	--	--	4.5E-06	mg/m^3	7.0E-03	mg/m^3	0.000000064
				Benzene	1.12E+00	µg/L	--	--	--	--	--	3.0E-06	mg/m^3	3.0E-02	mg/m^3	0.00000012
				Bromodichloromethane	3.20E-01	µg/L	--	--	--	--	--	8.5E-07	mg/m^3	NA	--	NA
				Bromomethane	1.45E+00	µg/L	--	--	--	--	--	4.0E-06	mg/m^3	5.0E-03	mg/m^3	0.000000800
				Chloroform	9.10E+00	µg/L	--	--	--	--	--	2.0E-07	mg/m^3	9.8E-02	mg/m^3	0.000000204
				Dibenzofuran	1.60E+00	µg/L	--	--	--	--	--	1.8E-06	mg/m^3	NA	--	NA
				Ethylbenzene	1.90E+00	µg/L	--	--	--	--	--	5.4E-06	mg/m^3	1.0E+00	mg/m^3	0.000000054
				Naphthalene	3.14E+00	µg/L	--	--	--	--	--	5.4E-06	mg/m^3	3.0E-03	mg/m^3	0.0000018
				Tetrachloroethene	5.89E+00	µg/L	--	--	--	--	--	1.4E-07	mg/m^3	4.0E-02	mg/m^3	0.000000034
				Trichloroethene	1.99E+00	µg/L	--	--	--	--	--	5.1E-06	mg/m^3	2.0E-03	mg/m^3	0.000002600
				m-Xylene + p-Xylene	8.94E+00	µg/L	--	--	--	--	--	2.5E-07	mg/m^3	1.0E-01	mg/m^3	0.000000025
	Total Indoor Air										--					0.000006.8
Total Shallow Groundwater											--					2%.
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	--	--	--	--	--	3.6E-05	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.006.0
				2,4-Dinitrotoluene	1.29E+01	µg/L	--	--	--	--	--	3.9E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.19
				2,6-Dinitrotoluene	4.66E+00	µg/L	--	--	--	--	--	1.4E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.47
				Benzene	8.61E-01	µg/L	--	--	--	--	--	2.6E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.006.5
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	--	--	--	--	--	2.0E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.10
				Bromomethane	2.90E+00	µg/L	--	--	--	--	--	8.7E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.062
				Chloroform	2.02E+00	µg/L	--	--	--	--	--	6.0E-05	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.006.0
				Dieldrin	3.50E-02	µg/L	--	--	--	--	--	1.0E-06	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.021
				Heptachlor epoxide	5.40E-02	µg/L	--	--	--	--	--	1.6E-06	(mg/kg-day)	1.3E-05	(mg/kg-day)	0.12
				Naphthalene	1.60E+00	µg/L	--	--	--	--	--	4.8E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0024
				Pentachlorophenol	2.50E+00	µg/L	--	--	--	--	--	7.5E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.015
				Trichloroethene	5.80E-01	µg/L	--	--	--	--	--	1.7E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.035
				Aluminum	3.66E+03	µg/L	--	--	--	--	--	1.2E-01	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.12
				Arsenic	6.67E+00	µg/L	--	--	--	--	--	2.0E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.67
				Barium	4.80E+00	µg/L	--	--	--	--	--	1.4E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.072
				Cadmium	2.75E+00	µg/L	--	--	--	--	--	8.2E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.16
				Chromium	2.11E+01	µg/L	--	--	--	--	--	6.3E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.21
				Cobalt	1.52E+01	µg/L	--	--	--	--	--	4.5E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.5
				Copper	3.48E+01	µg/L	--	--	--	--	--	1.0E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.026
				Cyanide	1.10E+01	µg/L	--	--	--	--	--	3.3E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.55
				Iron	1.25E+04	µg/L	--	--	--	--	--	3.8E-01	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.54
				Lead	4.66E+00	µg/L	--	--	--	--	--	1.4E-04	(mg/kg-day)	NA	--	NA
				Magnesium	1.00E+05	µg/L	--	--	--	--	--	3.0E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	125
				Manganese	1.54E-01	µg/L	--	--	--	--	--	4.6E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.015
				Molybdenum	2.00E+02	µg/L	--	--	--	--	--	6.0E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	1.2
				Nickel	4.83E+01	µg/L	--	--	--	--	--	1.4E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.072

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	float	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	float	slope	float		slope	float	slope	float	
Groundwater	Groundwater	Deep	Ingestion	Selenium	3.44E+01	µg/L	---	--	--	--	--	1.0E-03	mg/kg-day	5.0E-03	mg/kg-day	0.21
				Strontium	8.60E+03	µg/L	---	--	--	--	--	2.6E-01	mg/kg-day	6.0E-01	mg/kg-day	0.43
				Thallium	1.74E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	1.0E-05	mg/kg-day	52
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	8.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.17
				Zinc	1.24E+02	µg/L	---	--	--	--	--	3.7E-03	mg/kg-day	3.0E-01	mg/kg-day	0.012
			Ingestion Total								--					185
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	6.0E-03	mg/kg-day	0.00027
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	2.0E-03	mg/kg-day	0.011
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	7.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.032
				Benzene	8.61E-01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.00041
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.1E-01	mg/kg-day	2.0E-02	mg/kg-day	5.5
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	2.6E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0019
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	1.0E-02	mg/kg-day	0.00051
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.037
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	1.3E-05	mg/kg-day	0.15
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.9E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0015
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	2.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.055
				Trichloroethene	5.80E-01	µg/L	---	--	--	--	--	2.7E-06	mg/kg-day	5.0E-04	mg/kg-day	0.0054
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	6.9E-04	mg/kg-day	1.0E+00	mg/kg-day	0.00069
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0040
				Beryllium	4.80E+00	µg/L	---	--	--	--	--	8.5E-07	mg/kg-day	1.4E-05	mg/kg-day	0.0610
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	4.9E-07	mg/kg-day	2.5E-05	mg/kg-day	0.020
				Chromium	2.11E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	7.5E-05	mg/kg-day	0.050
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0036
				Copper	3.48E+01	µg/L	---	--	--	--	--	6.2E-06	mg/kg-day	4.0E-02	mg/kg-day	0.00015
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	2.0E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0033
				Iron	1.25E+04	µg/L	---	--	--	--	--	2.2E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0032
				Lead	4.66E+00	µg/L	---	--	--	--	--	8.3E-06	mg/kg-day	NA	--	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	1.8E-02	mg/kg-day	9.6E-04	mg/kg-day	19
				Mercury	1.54E-01	µg/L	---	--	--	--	--	2.7E-08	mg/kg-day	2.1E-05	mg/kg-day	0.0013
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	3.6E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0071
				Nickel	4.83E+01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	8.0E-04	mg/kg-day	0.0021
				Selenium	3.44E+01	µg/L	---	--	--	--	--	6.1E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0012
				Strontium	8.60E+03	µg/L	---	--	--	--	--	1.5E-03	mg/kg-day	6.0E-01	mg/kg-day	0.0025
				Thallium	1.74E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	1.0E-05	mg/kg-day	0.31
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	5.0E-06	mg/kg-day	1.3E-04	mg/kg-day	0.038
				Zinc	1.24E+02	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	3.0E-01	mg/kg-day	0.0000044
			Dermal Total								--					26
	Total Deep Groundwater										--					211

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	Hazard Quotient
Groundwater	Indoor Air	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	ug/L	---	--	--	--	--	3.0E-06	mg/m^3	7.0E-03	mg/m^3	0.0000043
				Benzene	8.61E-01	ug/L	---	--	--	--	--	2.8E-06	mg/m^3	3.0E-02	mg/m^3	0.00000092
				Bromomethane	2.90E+00	ug/L	---	--	--	--	--	8.6E-06	mg/m^3	5.0E-03	mg/m^3	0.0000017
				Chloroform	2.02E+00	ug/L	---	--	--	--	--	5.2E-06	mg/m^3	9.8E-02	mg/m^3	0.00000053
				Naphthalene	1.60E+00	ug/L	---	--	--	--	--	2.8E-06	mg/m^3	3.0E-03	mg/m^3	0.00000092
				Tetrachloroethene	5.30E-01	ug/L	---	--	--	--	--	1.5E-06	mg/m^3	2.0E-03	mg/m^3	0.0000074
	Volatile Inhalation		Inhalation Total								--					0.0000040
	Total Indoor Air										--					0.0000040
Total Deep Groundwater											--					211

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Chemical Potential Cancer Risks																					
Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Contaminant	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CDI Equation Key		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tribbey	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	ppbL	6.8E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
2,4-Dinitrotoluene					5.00E+00	ppbL	2.1E-05	mg/kg-day	4.1E-01	mg/kg-day-1	8.4E-06	...	...	...	...	...
4,4'-DDD					4.20E-02	ppbL	1.4E-07	mg/kg-day	2.4E-01	mg/kg-day-1	4.1E-08	...	...	...	...	...
Benzene					1.12E+00	ppbL	4.5E-06	mg/kg-day	5.5E-02	mg/kg-day-1	2.5E-07	...	...	...	...	...
bis(2-Ethylhexyl)phthalate					2.40E+01	ppbL	9.6E-05	mg/kg-day	1.4E-02	mg/kg-day-1	1.4E-06	...	...	...	...	...
Bromodichloromethane					4.20E-01	ppbL	1.4E-06	mg/kg-day	6.2E-02	mg/kg-day-1	1E-07	...	...	...	...	...
Bromoform					1.45E+00	ppbL	5.8E-06	mg/kg-day	NA	...	NA	...	...	...	...	...
Chloroform					9.10E+00	ppbL	3.7E-05	mg/kg-day	3.1E-02	mg/kg-day-1	1.1E-06	...	...	...	...	...
Dibromochloromethane					1.00E+00	ppbL	4.5E-06	mg/kg-day	NA	...	NA	...	...	...	...	...
Dieldrin					4.40E-02	ppbL	1.4E-07	mg/kg-day	1.6E+01	mg/kg-day-1	2.2E-06	...	...	...	...	...
Ethylbenzene					1.04E+00	ppbL	7.4E-06	mg/kg-day	1.1E-02	mg/kg-day-1	8E-08	...	...	...	...	...
Hexachlorobenzene					4.14E+00	ppbL	1.4E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Pentachlorophenol					4.01E+00	ppbL	1.2E-05	mg/kg-day	4.0E-01	mg/kg-day-1	4.8E-06	...	...	...	...	...
Phenol					1.57E+02	ppbL	6.4E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Tetrachloroethene					5.00E+00	ppbL	2.4E-05	mg/kg-day	2.1E-02	mg/kg-day-1	5.0E-07	...	...	...	...	...
Trichloroethene					1.00E+00	ppbL	Multiple Mode of Action - See Table 4				5.5E-07	...	...	...	...	...
1,1,1-Trichloroethane					9.4E+00	ppbL	4.1E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Aluminum					5.62E+04	ppbL	2.4E-01	mg/kg-day	NA	...	NA	...	...	...	...	...
Antimony					7.94E+00	ppbL	4.2E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Arsenic					1.40E+01	ppbL	5.7E-05	mg/kg-day	1.5E+00	mg/kg-day-1	5E-05	...	...	...	...	...
Barium					1.04E+01	ppbL	4.2E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Calcium					2.94E+00	ppbL	9.5E-06	mg/kg-day	NA	...	NA	...	...	...	...	...
Chromium					4.14E+01	ppbL	Multiple Mode of Action - See Table 4				2.0E-04	...	...	...	...	...
Cobalt					1.14E+04	ppbL	4.6E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Copper					2.10E+02	ppbL	1.1E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Cyanide					1.07E+01	ppbL	4.4E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Iron					2.54E+04	ppbL	1.0E-02	mg/kg-day	NA	...	NA	...	...	...	...	...
Lead					1.40E+01	ppbL	9.1E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Magnesium					9.94E+04	ppbL	2.0E-01	mg/kg-day	NA	...	NA	...	...	...	...	...
Manganese					9.94E+00	ppbL	2.0E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Molybdenum					1.20E+02	ppbL	4.9E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Nickel					7.50E+02	ppbL	4.1E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Potassium					1.75E+01	ppbL	7.1E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Selenium					1.10E+02	ppbL	7.4E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Thallium					2.22E+01	ppbL	9.2E-05	mg/kg-day	NA	...	NA	...	...	...	...	...

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Time=Future
Exposure Frequency=Present
Exposure Age=Adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
					Dose	Units	Intake/Exposure Concentration		CDF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Dose	Units	Dose	Units		Dose	Units	Dose	Units	
Groundwater	Groundwater	Tap Water	Ingestion	Aluminum	2.70E+01	ug/L	9.4E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Zinc	2.24E+04	ug/L	9.5E-02	mg/kg-day	NA	---	NA	---	---	---	---	---
			Ingestion Total								4.0E-04					---
			Dermal	1,2,4-Trimethylbenzene	1.70E+00	ug/L	1.1E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				2,4-Dinitrotoluene	5.00E+00	ug/L	1.[illegible]E-04	mg/kg-day	4.1E-01	mg/kg-day^{-1}	5.0E-07	---	---	---	---	---
				4,4'-DDD	4.20E-02	ug/L	1.[illegible]E-07	mg/kg-day	2.4E-01	mg/kg-day^{-1}	4.4E-07	---	---	---	---	---
				Benzene	1.10E+00	ug/L	[illegible]E-07	mg/kg-day	5.5E-02	mg/kg-day^{-1}	5.4E-08	---	---	---	---	---
				bis(2-Ethylhexyl)phthalate	2.40E+01	ug/L	[illegible]E-04	mg/kg-day	1.4E-02	mg/kg-day^{-1}	1.4E-04	---	---	---	---	---
				Bromodichloromethane	4.20E-01	ug/L	1.4E-07	mg/kg-day	[illegible].2E-02	mg/kg-day^{-1}	2E-09	---	---	---	---	---
				Bromoform	1.45E+00	ug/L	2.7E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chloroform	[illegible].10E+00	ug/L	4.1E-07	mg/kg-day	4.1E-02	mg/kg-day^{-1}	1.5E-08	---	---	---	---	---
				Dibromochloromethane	1.00E+00	ug/L	1.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Dieldrin	4.40E-02	ug/L	4.7E-07	mg/kg-day	1.6E+01	mg/kg-day^{-1}	[illegible].0E-06	---	---	---	---	---
				Ethylbenzene	1.04E+00	ug/L	[illegible].1E-07	mg/kg-day	1.1E-02	mg/kg-day^{-1}	7.4E-09	---	---	---	---	---
				Naphthalene	4.14E+00	ug/L	1.2E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Pentachlorophenol	4.01E+00	ug/L	[illegible].0E-05	mg/kg-day	4.0E-01	mg/kg-day^{-1}	2.[illegible]E-05	---	---	---	---	---
				Phenol	1.57E+02	ug/L	4.5E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Tetrachloroethene	5.[illegible]E+00	ug/L	2.1E-05	mg/kg-day	2.1E-02	mg/kg-day^{-1}	4.4E-08	---	---	---	---	---
				Trichloroethene	1.[illegible]E+00	ug/L	Multiple Mode of Action - See Table 4				1.4E-07	---	---	---	---	---
				[illegible]	[illegible]E+00	ug/L	4.4E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Aluminum	5.[illegible]E+04	ug/L	1.2E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Antimony	7.[illegible]E+00	ug/L	1.[illegible]E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Arsenic	1.40E+01	ug/L	4.1E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	4.7E-07	---	---	---	---	---
				Barium	1.04E+01	ug/L	2.4E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Cadmium	2.4E+00	ug/L	5.2E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chromium	4.14E+01	ug/L	Multiple Mode of Action - See Table 4				NA	---	---	---	---	---
				Cobalt	1.14E+04	ug/L	1.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Copper	2.[illegible]E+02	ug/L	[illegible].2E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Cyanide	1.07E+01	ug/L	2.4E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Iron	2.54E+04	ug/L	5.[illegible]E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Lead	1.40E+01	ug/L	4.4E-08	mg/kg-day	NA	---	NA	---	---	---	---	---
				Manganese	[illegible].[illegible]E+04	ug/L	1.5E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Mercury	[illegible].[illegible]E+00	ug/L	1.5E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Molybdenum	1.20E+02	ug/L	2.7E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Nickel	7.50E+02	ug/L	4.4E-06	mg/kg-day	NA	---	NA	---	---	---	---	---

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knowville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Age-Adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Total Exposure Concentration		CDI Equation Risk		Cancer Risk	Total Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water	Dermal	Arsenic	1.75E+01	ug/L	4.0E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chromium	1.10E+04	ug/L	4.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Thallium	2.27E+01	ug/L	5.0E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Molybdenum	2.40E+01	ug/L	5.1E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Zinc	2.44E+04	ug/L	4.1E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
			Dermal Total								1.7E-04					---
	Total Tap Water Groundwater										4.7E-04					---
	Indoor Air	Tap Water	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	ug/L	5.[illegible]E-07	mg/m^3	NA	---	NA	---	---	---	---	---
	volatile chemicals			Benzene	1.12E+00	ug/L	4.0E-07	mg/m^3	7.[illegible]E-05	mg/m^3^-1	4.0E-11	---	---	---	---	---
				Ethylbenzene	4.20E-01	ug/L	1.[illegible]E-07	mg/m^3	4.7E-05	mg/m^3^-1	4.2E-11	---	---	---	---	---
				Ethylene dibromide	1.45E+00	ug/L	5.5E-07	mg/m^3	NA	---	NA	---	---	---	---	---
				Chloroform	9.10E+00	ug/L	4.0E-07	mg/m^3	2.4E-05	mg/m^3^-1	9.6E-10	---	---	---	---	---
				Methylene chloride	1.00E+00	ug/L	2.4E-07	mg/m^3	NA	---	NA	---	---	---	---	---
				Ethylene	1.04E+00	ug/L	7.0E-07	mg/m^3	2.5E-05	mg/m^3^-1	1.7E-11	---	---	---	---	---
				Naphthalene	4.14E+00	ug/L	7.0E-07	mg/m^3	4.4E-05	mg/m^3^-1	2.4E-10	---	---	---	---	---
				Tetrachloroethene	5.[illegible]E+00	ug/L	1.[illegible]E-06	mg/m^3	2.0E-07	mg/m^3^-1	4.0E-12	---	---	---	---	---
				Trichloroethene	1.04E+00	ug/L	9.0E-07	mg/m^3	4.1E-06	mg/m^3^-1	3.7E-11	---	---	---	---	---
				Vinyl chloride (carcinogen)	9.4E+00	ug/L	4.2E-07	mg/m^3	NA	---	NA	---	---	---	---	---
	Total Indoor Air										1.0E-09					---
Total Tap Water Groundwater											4.7E-04					---
Groundwater	Groundwater	Dermal	Inhalation	1,2-Dichlorobenzene	1.20E+00	ug/L	4.0E-07	mg/kg-day	9.1E-02	mg/kg-day^-1	4.4E-07	---	---	---	---	---
				2,4-Dinitrotoluene	1.20E+01	ug/L	5.2E-05	mg/kg-day	4.1E-01	mg/kg-day^-1	1.0E-05	---	---	---	---	---
				2,6-Dinitrotoluene	4.00E+00	ug/L	1.0E-05	mg/kg-day	1.5E+00	mg/kg-day^-1	2.[illegible]E-05	---	---	---	---	---
				Benzene	9.1E-01	ug/L	4.5E-07	mg/kg-day	5.5E-02	mg/kg-day^-1	1.0E-07	---	---	---	---	---
				bis(2-Ethylhexyl)phthalate	9.70E+01	ug/L	2.7E-04	mg/kg-day	1.4E-02	mg/kg-day^-1	4.[illegible]E-06	---	---	---	---	---
				Ethylene dibromide	2.90E+00	ug/L	1.2E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chloroform	2.00E+00	ug/L	2.[illegible]E-06	mg/kg-day	9.1E-02	mg/kg-day^-1	2.5E-07	---	---	---	---	---
				Dieldrin	4.50E-02	ug/L	1.4E-07	mg/kg-day	1.6E+01	mg/kg-day^-1	2.4E-06	---	---	---	---	---
				Heptachlor epoxide	5.40E-02	ug/L	2.2E-07	mg/kg-day	9.1E+00	mg/kg-day^-1	2.0E-06	---	---	---	---	---
				Naphthalene	1.00E+00	ug/L	6.5E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Pentachlorophenol	2.50E+00	ug/L	1.0E-05	mg/kg-day	4.0E-01	mg/kg-day^-1	4.1E-06	---	---	---	---	---
				Tetrachloroethene	5.[illegible]E-01	ug/L	Mutagenic Mode of Action Per Table 4				1.0E-07	---	---	---	---	---
				Aluminum	4.[illegible]E+04	ug/L	1.6E-02	mg/kg-day	NA	---	NA	---	---	---	---	---
				Arsenic	6.67E+00	ug/L	2.7E-05	mg/kg-day	1.5E+00	mg/kg-day^-1	4.1E-05	---	---	---	---	---
				Cadmium	4.[illegible]E+00	ug/L	2.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Time Period: Future
Exposure Frequency: Resident
Exposure Age: Age-Adjusted

				Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
Medium	Exposure Medium	Exposure Point	Exposure Route		Value	Units	Total Exposure Concentration		CF Without Fill		Cancer Risk	Total Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Deep	Ingestion	Cadmium	2.25E+00	pg/L	1.1E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Chromium	2.11E+01	pg/L	Multiple Modes of Action - See Table 4-4				1.4E-04	..	...	...	...	...
				Cobalt	1.52E+01	pg/L	7.2E-06	mg/kg-day	NA	...	NA	..	...	...	...	...
				Copper	4.41E+01	pg/L	1.4E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Cyanide	1.10E+01	pg/L	4.5E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Iron	1.25E+04	pg/L	5.1E-02	mg/kg-day	NA	...	NA	..	...	...	...	...
				Lead	4.00E+00	pg/L	1.6E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Manganese	1.00E+05	pg/L	4.1E-01	mg/kg-day	NA	...	NA	..	...	...	...	...
				Mercury	1.54E-01	pg/L	6.4E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Molybdenum	2.00E+02	pg/L	8.1E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Nickel	4.[illegible]E+01	pg/L	2.0E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Selenium	4.44E+01	pg/L	1.4E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Strontium	[illegible]E+04	pg/L	4.5E-02	mg/kg-day	NA	...	NA	..	...	...	...	...
				Thallium	1.74E+01	pg/L	7.1E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Vanadium	2.[illegible]E+01	pg/L	1.1E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Zinc	1.24E+02	pg/L	5.0E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
			Ingestion Total								2.4E-04					...
			Dermal	1,2-Dichloroethane	1.20E+01	pg/L	4.4E-07	mg/kg-day	4.1E-02	mg/kg-day^{-1}	4.1E-05	..	...	...	...	...
				2,4-Dinitrotoluene	1.20E+01	pg/L	4.6E-07	mg/kg-day	4.1E-01	mg/kg-day^{-1}	1.4E-06	..	...	...	...	...
				2,6-Dinitrotoluene	4.00E+00	pg/L	2.0E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	4.0E-07	..	...	...	...	...
				Benzene	6.1E-01	pg/L	2.7E-07	mg/kg-day	5.5E-02	mg/kg-day^{-1}	4.2E-09	..	...	...	...	...
				bis(2-Ethylhexyl)phthalate	6.70E+01	pg/L	2.7E-06	mg/kg-day	1.4E-02	mg/kg-day^{-1}	4.[illegible]E-05	..	...	...	...	...
				Ethylbenzene	2.00E+00	pg/L	5.5E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Chloroform	2.00E+00	pg/L	1.1E-07	mg/kg-day	4.1E-02	mg/kg-day^{-1}	4.4E-09	..	...	...	...	...
				Dieldrin	4.50E-02	pg/L	4.[illegible]E-07	mg/kg-day	1.6E+01	mg/kg-day^{-1}	6.1E-07	..	...	...	...	...
				Heptachlor epoxide	5.40E-02	pg/L	4.0E-07	mg/kg-day	9.1E+00	mg/kg-day^{-1}	4.6E-07	..	...	...	...	...
				Naphthalene	1.00E+00	pg/L	6.1E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Pentachlorophenol	2.50E+00	pg/L	5.7E-05	mg/kg-day	4.0E-01	mg/kg-day^{-1}	2.4E-05	..	...	...	...	...
				Tetrachloroethene	5.00E-01	pg/L	Multiple Modes of Action - See Table 4-4				4.[illegible]E-09	..	...	...	...	...
				Aluminum	4.[illegible]E+04	pg/L	1.6E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Arsenic	6.67E+00	pg/L	1.5E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	2.2E-07	..	...	...	...	...
				Barium	4.[illegible]E+00	pg/L	1.1E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Cadmium	2.25E+00	pg/L	6.1E-10	mg/kg-day	NA	...	NA	..	...	...	...	...
				Chromium	2.11E+01	pg/L	Multiple Modes of Action - See Table 4-4				NA	..	...	...	...	...
				Cobalt	1.52E+01	pg/L	1.4E-07	mg/kg-day	NA	...	NA	..	...	...	...	...

Table E-24
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Age-adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Deep	Dermal	Copper	3.40E+01	µg/L	7.7E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Cyanide	1.10E+01	µg/L	2.4E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Iron	1.25E+04	µg/L	2.[illegible]E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Lead	4.66E+00	µg/L	1.0E-0[illegible]	mg/kg-day	NA	---	NA	---	---	---	---	---
				Manganese	1.00E+05	µg/L	2.2E-0[illegible]	mg/kg-day	NA	---	NA	---	---	---	---	---
				Mercury	1.54E-01	µg/L	3.4E-09	mg/kg-day	NA	---	NA	---	---	---	---	---
				Molybdenum	2.00E+02	µg/L	4.4E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Nickel	4.[illegible]E+01	µg/L	2.1E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Selenium	3.44E+01	µg/L	7.6E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Strontium	[illegible]E+0[illegible]	µg/L	1.9E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Thallium	1.74E+01	µg/L	3.9E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Vanadium	2.[illegible]E+01	µg/L	6.2E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Zinc	1.24E+02	µg/L	1.6E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
			Dermal Total								4.2E-04					---
	Total Deep Groundwater										6.5E-04					---
	Indoor Air (while showering)	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	µg/L	3.9E-09	mg/m³	2.6E-05	(µg/m³)-1	1.0E-10	---	---	---	---	---
				Benzene	[illegible]1E-01	µg/L	3.6E-09	mg/m³	7.[illegible]E-06	(µg/m³)-1	2.[illegible]E-11	---	---	---	---	---
				Bromomethane	2.90E+00	µg/L	1.1E-0[illegible]	mg/m³	NA	---	NA	---	---	---	---	---
				Chloroform	2.02E+00	µg/L	6.7E-09	mg/m³	2.3E-05	(µg/m³)-1	1.5E-10	---	---	---	---	---
				Naphthalene	1.60E+00	µg/L	3.6E-09	mg/m³	3.4E-05	(µg/m³)-1	1.2E-10	---	---	---	---	---
				Trichloroethene	5.[illegible]E-01	µg/L	1.9E-09	mg/m³	4.1E-06	(µg/m³)-1	7.[illegible]E-12	---	---	---	---	---
			Inhalation Total								4.1E-10					---
	Total Indoor Air										4.1E-10					---
Total Deep Groundwater											6.5E-04					---

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	4.2E-05	(mg/kg-day)	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	1.3E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.063
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	8.0E-07	(mg/kg-day)	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	2.8E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0070
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	5.7E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.029
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	8.0E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00040
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	3.6E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.026
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	2.3E-04	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.023
				Dibromochloromethane	1.60E+00	µg/L	---	--	--	--	--	4.0E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.040
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	8.5E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.017
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	4.8E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00048
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	7.8E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0039
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	7.5E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.015
				Phenol	1.57E+02	µg/L	---	--	--	--	--	3.9E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.013
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	1.5E-04	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.024
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	5.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.099
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	2.2E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.0011
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	1.4E+00	(mg/kg-day)	1.0E+00	(mg/kg-day)	1.4
				Antimony	7.94E+00	µg/L	---	--	--	--	--	2.0E-04	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.50
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	3.5E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.2
				Barium	1.03E+01	µg/L	---	--	--	--	--	2.6E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.13
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	5.8E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.12
				Chromium	3.14E+01	µg/L	---	--	--	--	--	7.8E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.26
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	2.8E-02	(mg/kg-day)	3.0E-04	(mg/kg-day)	95
				Copper	2.80E+02	µg/L	---	--	--	--	--	7.0E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.17
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	2.7E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.44
				Iron	2.54E+03	µg/L	---	--	--	--	--	6.3E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.090
				Lead	1.49E+01	µg/L	---	--	--	--	--	3.7E-04	(mg/kg-day)	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	1.7E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	72
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.7E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.58
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	3.0E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.60
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.9E-02	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.94
				Selenium	1.75E+01	µg/L	---	--	--	--	--	4.4E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.087
				Silver	1.80E+03	µg/L	---	--	--	--	--	4.5E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.075
				Thallium	2.27E+01	µg/L	---	--	--	--	--	5.7E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	57
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	5.7E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.11
				Zinc	2.33E+04	µg/L	---	--	--	--	--	5.8E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.9
			Ingestion Total								---					232

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	8.2E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	2.0E-03	mg/kg-day	0.0
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	7.2E-06	mg/kg-day	4.0E-03	mg/kg-day	0.0018
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	6.8E-02	mg/kg-day	2.0E-02	mg/kg-day	3.4
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	9.6E-07	mg/kg-day	2.0E-02	mg/kg-day	0.0000483
				Bromomethane	1.48E+00	µg/L	---	--	--	--	--	2.0E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0014
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	3.5E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0035
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	1.0E-03	mg/kg-day	0.12
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	2.7E-06	mg/kg-day	5.0E-05	mg/kg-day	0.054
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	4.9E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00049
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	8.7E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0044
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	5.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.10
				Phenol	1.57E+02	µg/L	---	--	--	--	--	3.3E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0011
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	1.5E-04	mg/kg-day	6.0E-03	mg/kg-day	0.025
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	1.4E-05	mg/kg-day	5.0E-04	mg/kg-day	0.028
				1,2,4-Trichlorobenzene	8.94E+00	µg/L	---	--	--	--	--	2.5E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0012
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	6.2E-03	mg/kg-day	1.0E+00	mg/kg-day	0.0062
				Antimony	7.94E+00	µg/L	---	--	--	--	--	8.7E-07	mg/kg-day	6.0E-05	mg/kg-day	0.015
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0051
				Barium	1.03E+01	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	1.4E-05	mg/kg-day	0.081
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	2.6E-07	mg/kg-day	2.5E-05	mg/kg-day	0.0103
				Chromium	3.14E+01	µg/L	---	--	--	--	--	3.5E-06	mg/kg-day	7.5E-05	mg/kg-day	0.046
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	5.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.17
				Copper	2.80E+02	µg/L	---	--	--	--	--	3.1E-05	mg/kg-day	4.0E-02	mg/kg-day	0.000777
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0020
				Iron	2.54E+03	µg/L	---	--	--	--	--	2.8E-04	mg/kg-day	7.0E-01	mg/kg-day	0.000040
				Lead	1.49E+01	µg/L	---	--	--	--	--	1.6E-07	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	7.6E-03	mg/kg-day	9.6E-04	mg/kg-day	7.9
				Mercury	6.99E+00	µg/L	---	--	--	--	--	7.7E-07	mg/kg-day	2.1E-05	mg/kg-day	0.037
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0026
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.7E-05	mg/kg-day	8.0E-04	mg/kg-day	0.0206
				Selenium	1.75E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	5.0E-03	mg/kg-day	0.000038
				Strontium	1.80E+03	µg/L	---	--	--	--	--	2.0E-04	mg/kg-day	6.0E-01	mg/kg-day	0.000333
				Thallium	2.27E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	1.0E-05	mg/kg-day	0.25
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	1.3E-04	mg/kg-day	0.019
				Zinc	2.33E+04	µg/L	---	--	--	--	--	1.5E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0051
			Dermal Total								--					12
	Total Shallow Groundwater										--					245

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Total Shallow Groundwater											--					245
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	3.0E-05	mg/kg-day	6.0E-03	mg/kg-day	0.0050
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	3.2E-04	mg/kg-day	2.0E-03	mg/kg-day	0.16
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	3.0E-04	mg/kg-day	0.39
				Benzene	8.61E-01	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0054
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.7E-03	mg/kg-day	2.0E-02	mg/kg-day	0.084
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	7.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.052
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.0E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0050
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	8.7E-07	mg/kg-day	5.0E-05	mg/kg-day	0.017
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	1.3E-05	mg/kg-day	0.104
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	4.0E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0020
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	6.2E-05	mg/kg-day	5.0E-03	mg/kg-day	0.012
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	1.4E-05	mg/kg-day	5.0E-04	mg/kg-day	0.029
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	9.1E-02	mg/kg-day	1.0E+00	mg/kg-day	0.091
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.7E-04	mg/kg-day	3.0E-04	mg/kg-day	0.55
				Barium	4.80E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	2.0E-03	mg/kg-day	0.060
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	6.9E-05	mg/kg-day	5.0E-04	mg/kg-day	0.14
				Chromium	2.11E+01	µg/L	---	--	--	--	--	5.3E-04	mg/kg-day	3.0E-03	mg/kg-day	0.18
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	3.8E-04	mg/kg-day	3.0E-04	mg/kg-day	1.26
				Copper	3.48E+01	µg/L	---	--	--	--	--	8.7E-04	mg/kg-day	4.0E-02	mg/kg-day	0.022
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	2.7E-04	mg/kg-day	6.0E-04	mg/kg-day	0.46
				Iron	1.25E+04	µg/L	---	--	--	--	--	3.1E-01	mg/kg-day	7.0E-01	mg/kg-day	0.45
				Lead	4.66E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	2.5E+00	mg/kg-day	2.4E-02	mg/kg-day	104
				Mercury	1.54E-01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	3.0E-04	mg/kg-day	0.013
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	5.0E-03	mg/kg-day	5.0E-03	mg/kg-day	1.0
				Nickel	4.83E+01	µg/L	---	--	--	--	--	1.2E-03	mg/kg-day	2.0E-02	mg/kg-day	0.06
				Selenium	3.44E+01	µg/L	---	--	--	--	--	8.6E-04	mg/kg-day	5.0E-03	mg/kg-day	0.17
				Strontium	8.60E+03	µg/L	---	--	--	--	--	2.1E-01	mg/kg-day	6.0E-01	mg/kg-day	0.36
				Thallium	1.74E+01	µg/L	---	--	--	--	--	4.3E-04	mg/kg-day	1.0E-05	mg/kg-day	43
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	7.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.14
				Zinc	1.24E+02	µg/L	---	--	--	--	--	3.1E-03	mg/kg-day	3.0E-01	mg/kg-day	0.010
			Ingestion Total								--					154
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	3.7E-06	mg/kg-day	6.0E-03	mg/kg-day	0.000611
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	4.7E-05	mg/kg-day	2.0E-03	mg/kg-day	0.024
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.069
				Benzene	8.61E-01	µg/L	---	--	--	--	--	3.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.002
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	2.8E-01	mg/kg-day	2.0E-02	mg/kg-day	14
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	5.9E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0042

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Deep	Dermal	Chloroform	2.02E+00	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0011
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	3.9E-06	mg/kg-day	5.0E-05	mg/kg-day	0.079
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	4.1E-06	mg/kg-day	1.3E-05	mg/kg-day	0.31
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	6.3E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0031
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	5.9E-04	mg/kg-day	5.0E-03	mg/kg-day	0.12
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	5.8E-06	mg/kg-day	5.0E-04	mg/kg-day	0.012
				Aluminum	3.36E+03	µg/L	---	--	--	--	--	4.2E-04	mg/kg-day	1.0E+00	mg/kg-day	0.000413
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	7.2E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0024
				Beryllium	4.60E+00	µg/L	---	--	--	--	--	5.2E-07	mg/kg-day	1.4E-05	mg/kg-day	0.036
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	3.0E-07	mg/kg-day	2.5E-05	mg/kg-day	0.012
				Chromium	2.11E+01	µg/L	---	--	--	--	--	2.3E-06	mg/kg-day	7.5E-05	mg/kg-day	0.031
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	6.7E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0022
				Copper	3.48E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	4.0E-02	mg/kg-day	0.000010
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0020
				Iron	1.25E+04	µg/L	---	--	--	--	--	1.4E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0020
				Lead	4.66E+00	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	1.1E-02	mg/kg-day	9.6E-04	mg/kg-day	12
				Mercury	1.54E-01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	2.1E-05	mg/kg-day	0.000081
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	5.0E-03	mg/kg-day	0.00044
				Nickel	4.83E+01	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	8.0E-04	mg/kg-day	0.0013
				Selenium	3.44E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0006
				Strontium	8.60E+03	µg/L	---	--	--	--	--	9.5E-04	mg/kg-day	6.0E-01	mg/kg-day	0.00016
				Thallium	1.74E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	1.0E-05	mg/kg-day	0.19
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	1.3E-04	mg/kg-day	0.024
				Zinc	1.24E+02	µg/L	---	--	--	--	--	8.2E-06	mg/kg-day	3.0E-01	mg/kg-day	0.000027
			Dermal Total								--					26
	Total Deep Groundwater										--					130
Total Deep Groundwater											--					130

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	2.5E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.0E+00	µg/L	---	--	--	--	--	7.6E-05	mg/kg-day	2.0E-03	mg/kg-day	0.038
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	4.8E-07	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	1.7E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0042
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	3.4E-04	mg/kg-day	2.0E-02	mg/kg-day	0.01725
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	4.8E-06	mg/kg-day	2.0E-02	mg/kg-day	0.0002
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.016
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	1.4E-04	mg/kg-day	1.0E-02	mg/kg-day	0.014
				Dibromochloromethane	1.60E+00	µg/L	---	--	--	--	--	2.4E-05	mg/kg-day	1.0E-03	mg/kg-day	0.024
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	5.1E-07	mg/kg-day	5.0E-05	mg/kg-day	0.0102
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	2.9E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00029
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	4.7E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0024
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	4.5E-05	mg/kg-day	5.0E-03	mg/kg-day	0.00901
				Phenol	1.57E+02	µg/L	---	--	--	--	--	2.4E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0078
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	8.8E-05	mg/kg-day	6.0E-03	mg/kg-day	0.015
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	3.0E-05	mg/kg-day	5.0E-04	mg/kg-day	0.060
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	1.3E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0007
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	8.4E-01	mg/kg-day	1.0E+00	mg/kg-day	0.84
				Antimony	7.94E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	4.0E-04	mg/kg-day	0.30
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	2.1E-04	mg/kg-day	3.0E-04	mg/kg-day	0.70
				Barium	1.03E+01	µg/L	---	--	--	--	--	1.5E-04	mg/kg-day	2.0E-03	mg/kg-day	0.077
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	3.5E-05	mg/kg-day	5.0E-04	mg/kg-day	0.070
				Chromium	3.14E+01	µg/L	---	--	--	--	--	4.7E-04	mg/kg-day	3.0E-03	mg/kg-day	0.16
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	1.7E-02	mg/kg-day	3.0E-04	mg/kg-day	57
				Copper	2.80E+02	µg/L	---	--	--	--	--	4.2E-03	mg/kg-day	4.0E-02	mg/kg-day	0.105
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	6.0E-04	mg/kg-day	0.27
				Iron	2.54E+03	µg/L	---	--	--	--	--	3.8E-02	mg/kg-day	7.0E-01	mg/kg-day	0.054
				Lead	1.49E+01	µg/L	---	--	--	--	--	2.2E-04	mg/kg-day	NA	---	NA
				Magnesium	6.91E+04	µg/L	---	--	--	--	--	1.0E+00	mg/kg-day	2.4E-02	mg/kg-day	43
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.35
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	1.8E-03	mg/kg-day	5.0E-03	mg/kg-day	0.36
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.1E-02	mg/kg-day	2.0E-02	mg/kg-day	0.57
				Selenium	1.75E+01	µg/L	---	--	--	--	--	2.6E-04	mg/kg-day	5.0E-03	mg/kg-day	0.052
				Strontium	1.80E+03	µg/L	---	--	--	--	--	2.7E-02	mg/kg-day	6.0E-01	mg/kg-day	0.045
				Thallium	2.27E+01	µg/L	---	--	--	--	--	3.4E-04	mg/kg-day	1.0E-05	mg/kg-day	34
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	3.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.069
				Zinc	2.33E+04	µg/L	---	--	--	--	--	3.5E-01	mg/kg-day	3.0E-01	mg/kg-day	1.2
			Ingestion Total								--					140

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	3.5E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	5.7E-06	mg/kg-day	2.0E-03	mg/kg-day	0.0029
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	5.7E-06	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	4.0E-03	mg/kg-day	0.00078
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	2.9E-02	mg/kg-day	2.0E-02	mg/kg-day	1.5
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	4.2E-07	mg/kg-day	2.0E-02	mg/kg-day	0.000021
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	8.6E-07	mg/kg-day	1.4E-03	mg/kg-day	0.00061
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	1.5E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0015
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	5.2E-05	mg/kg-day	1.0E-03	mg/kg-day	0.052
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	5.0E-05	mg/kg-day	0.023
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00021
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	3.8E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0019
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	2.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.043
				Phenol	1.57E+02	µg/L	---	--	--	--	--	1.4E-04	mg/kg-day	3.0E-01	mg/kg-day	0.00047
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	6.5E-05	mg/kg-day	6.0E-03	mg/kg-day	0.011
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	6.1E-06	mg/kg-day	5.0E-04	mg/kg-day	0.012
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	1.1E-04	mg/kg-day	2.0E-01	mg/kg-day	0.000550
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	5.1E-03	mg/kg-day	1.0E+00	mg/kg-day	0.0051
				Antimony	7.94E+00	µg/L	---	--	--	--	--	7.2E-07	mg/kg-day	6.0E-05	mg/kg-day	0.012
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0042
				Barium	1.03E+01	µg/L	---	--	--	--	--	9.3E-07	mg/kg-day	1.4E-05	mg/kg-day	0.067
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	2.1E-07	mg/kg-day	2.5E-05	mg/kg-day	0.0084
				Chromium	3.14E+01	µg/L	---	--	--	--	--	2.8E-06	mg/kg-day	7.5E-05	mg/kg-day	0.038
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	4.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.14
				Copper	2.80E+02	µg/L	---	--	--	--	--	2.5E-05	mg/kg-day	4.0E-02	mg/kg-day	0.000625
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	9.6E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0016
				Iron	2.54E+03	µg/L	---	--	--	--	--	2.3E-04	mg/kg-day	7.0E-01	mg/kg-day	0.000330
				Lead	1.49E+01	µg/L	---	--	--	--	--	1.3E-07	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	6.2E-03	mg/kg-day	9.6E-04	mg/kg-day	6.5
				Mercury	6.99E+00	µg/L	---	--	--	--	--	6.3E-07	mg/kg-day	2.1E-05	mg/kg-day	0.030
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0022
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.4E-05	mg/kg-day	8.0E-04	mg/kg-day	0.017
				Selenium	1.75E+01	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	5.0E-03	mg/kg-day	0.000321
				Strontium	1.80E+03	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	6.0E-01	mg/kg-day	0.00027
				Thallium	2.27E+01	µg/L	---	--	--	--	--	2.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.205
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	2.1E-06	mg/kg-day	1.0E-04	mg/kg-day	0.016
				Zinc	2.33E+04	µg/L	---	--	--	--	--	1.2E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0042
			Dermal Total								--					9
	Total Shallow Groundwater										--					148

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	Hazard Quotient
Groundwater	Indoor Air (while showering)	Shallow	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	4.5E-06	mg/m^3	7.0E-03	mg/m^3	0.0000064
				Benzene	1.12E+00	µg/L	---	--	--	--	--	3.0E-06	mg/m^3	3.0E-02	mg/m^3	0.0000012
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	8.5E-07	mg/m^3	NA	---	NA
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	4.0E-06	mg/m^3	5.0E-03	mg/m^3	0.0000006
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	2.3E-07	mg/m^3	9.8E-02	mg/m^3	0.0000024
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	1.8E-06	mg/m^3	NA	---	NA
				Ethylbenzene	1.92E+00	µg/L	---	--	--	--	--	5.4E-06	mg/m^3	1.0E+00	mg/m^3	0.000000054
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	5.4E-06	mg/m^3	3.0E-03	mg/m^3	0.0000018
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	1.4E-07	mg/m^3	4.0E-02	mg/m^3	0.0000004
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	5.1E-06	mg/m^3	2.0E-03	mg/m^3	0.0000026
				Trichlorofluoromethane	8.94E+00	µg/L	---	--	--	--	--	2.5E-07	mg/m^3	1.0E-01	mg/m^3	0.0000025
	Total Indoor Air										--					0.0000063
Total Shallow Groundwater											--					143
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	1.8E-05	mg/kg-day	6.0E-03	mg/kg-day	0.0030
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	1.9E-04	mg/kg-day	2.0E-03	mg/kg-day	0.10
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	7.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.23
				Benzene	8.61E-01	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0032
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.0E-03	mg/kg-day	2.0E-02	mg/kg-day	0.050
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	4.3E-05	mg/kg-day	1.4E-03	mg/kg-day	0.031
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	3.0E-05	mg/kg-day	1.0E-02	mg/kg-day	0.00302
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	5.2E-07	mg/kg-day	5.0E-05	mg/kg-day	0.010
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	8.1E-07	mg/kg-day	1.3E-05	mg/kg-day	0.062
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.4E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0012
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	3.7E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0075
				Trichloroethene	5.60E-01	µg/L	---	--	--	--	--	8.7E-06	mg/kg-day	5.0E-04	mg/kg-day	0.017
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	5.6E-02	mg/kg-day	1.0E+00	mg/kg-day	0.056
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.33
				Beryllium	4.60E+00	µg/L	---	--	--	--	--	7.2E-05	mg/kg-day	2.0E-03	mg/kg-day	0.036
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	4.1E-05	mg/kg-day	5.0E-04	mg/kg-day	0.082
				Chromium	2.11E+01	µg/L	---	--	--	--	--	3.2E-04	mg/kg-day	3.0E-03	mg/kg-day	0.11
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	2.3E-04	mg/kg-day	3.0E-04	mg/kg-day	0.76
				Copper	3.48E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	4.0E-02	mg/kg-day	0.013
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	6.0E-04	mg/kg-day	0.27
				Iron	1.25E+04	µg/L	---	--	--	--	--	1.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.27
				Lead	4.66E+00	µg/L	---	--	--	--	--	7.0E-05	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	1.5E+00	mg/kg-day	2.4E-02	mg/kg-day	62.9
				Mercury	1.54E-01	µg/L	---	--	--	--	--	2.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0077
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	3.0E-03	mg/kg-day	5.0E-03	mg/kg-day	0.60
				Nickel	4.83E+01	µg/L	---	--	--	--	--	7.2E-04	mg/kg-day	2.0E-02	mg/kg-day	0.036

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Deep	Ingestion	Selenium	1.44E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.10
				Strontium	8.60E+03	µg/L	---	--	--	--	--	1.3E-01	mg/kg-day	6.0E-01	mg/kg-day	0.21
				Thallium	1.74E+01	µg/L	---	--	--	--	--	2.6E-04	mg/kg-day	1.0E-05	mg/kg-day	26
				Iodide	2.80E+01	µg/L	---	--	--	--	--	4.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.084
				Zinc	1.24E+02	µg/L	---	--	--	--	--	1.9E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0062
			Ingestion Total								--					92
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	6.0E-03	mg/kg-day	0.00027
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	2.0E-03	mg/kg-day	0.011
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	9.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.032
				Benzene	8.61E-01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.00091
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.3E-01	mg/kg-day	2.0E-02	mg/kg-day	6.5
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	2.6E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0019
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	1.0E-02	mg/kg-day	0.00051
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.037
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	1.3E-05	mg/kg-day	0.15
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.9E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0015
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	2.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.055
				Trichloroethene	5.60E-01	µg/L	---	--	--	--	--	2.7E-06	mg/kg-day	5.0E-04	mg/kg-day	0.0054
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	1.0E+00	mg/kg-day	0.00035
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	6.0E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0020
				Beryllium	4.80E+00	µg/L	---	--	--	--	--	4.3E-07	mg/kg-day	1.4E-05	mg/kg-day	0.031
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	2.5E-07	mg/kg-day	2.5E-05	mg/kg-day	0.0099
				Chromium	2.11E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	7.5E-05	mg/kg-day	0.025
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	5.5E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0018
				Copper	3.48E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	4.0E-02	mg/kg-day	0.0000773
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	9.9E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0017
				Iron	1.25E+04	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0016
				Lead	4.66E+00	µg/L	---	--	--	--	--	4.2E-06	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	9.1E-03	mg/kg-day	9.6E-04	mg/kg-day	9.4
				Mercury	1.54E-01	µg/L	---	--	--	--	--	1.4E-06	mg/kg-day	2.1E-05	mg/kg-day	0.00066
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	1.8E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0036
				Nickel	4.83E+01	µg/L	---	--	--	--	--	8.7E-07	mg/kg-day	8.0E-04	mg/kg-day	0.0011
				Selenium	3.44E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	5.0E-03	mg/kg-day	0.00062
				Strontium	8.60E+03	µg/L	---	--	--	--	--	7.8E-04	mg/kg-day	6.0E-01	mg/kg-day	0.0013
				Thallium	1.74E+01	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	1.0E-05	mg/kg-day	0.16
				Iodide	2.80E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	1.3E-04	mg/kg-day	0.019
				Zinc	1.24E+02	µg/L	---	--	--	--	--	6.7E-06	mg/kg-day	3.0E-01	mg/kg-day	0.000022
			Dermal Total								--					16
	Total Deep Groundwater										--					109

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Indoor Air	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	3.0E-03	mg/m^3	7.0E-03	mg/m^3	0.0000043
				Benzene	3.1E-01	µg/L	---	--	--	--	--	2.8E-03	mg/m^3	3.0E-02	mg/m^3	0.00000092
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	3.6E-03	mg/m^3	5.0E-03	mg/m^3	0.0000172
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.2E-03	mg/m^3	9.3E-02	mg/m^3	0.00000053
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.8E-03	mg/m^3	3.0E-03	mg/m^3	0.00000092
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	1.5E-03	mg/m^3	2.0E-03	mg/m^3	0.0000074
	Inhale Showering		Inhalation Total								--					0.0000096
	Total Indoor Air										--					0.0000096
Total Deep Groundwater											--					100

Table E-27
Calculation of COPC Cancer Risks and Noncancer Hazards - Resident- Soil Gas Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child-Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake-Exposure Concentration		CSF-Unit Risk		Cancer Risk	Intake-Exposure Concentration		RfD-RfC		
					alue	Units	alue	Units	alue	Units		alue	Units	alue	Units	Hazard Quotient
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	pg/m	See 1 Calculations Table C-3				1.0E-04	See 1 Calculations Table C-3				---
				1,2,4-Trimethylbenzene	2.19E+00	pg/m					---					0.30
				1,2-Dichloroethane	3.80E+02	pg/m					3.5E-03					52.1
				Benzene	2.10E+00	pg/m					5.8E-06					0.067
				Chloroform	1.20E+00	pg/m					9.8E-06					0.012
				Chloromethane	1.00E+03	pg/m					---					11
				Ethylbenzene	3.18E+00	pg/m					2.8E-06					0.0030
			Inhalation Total								3.6E-03					63
Total Site Indoor Air											3.6E-03					63

Table E-28
Calculation of COPC Cancer Risks and Noncancer Hazards - Resident- Soil Gas Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child-Adult

Medium	Exposure Medium	Exposure Point	Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					slope	Units	Exposure Concentration		CSF/Unit Risk		Cancer Risk	Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Units	slope	Units		slope	Units	slope	Units	
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	µg/m	See Calculations: Table C-4				3.9E-05	See Calculations: Table C-4				...
				1,2,4-Trimethylbenzene	2.19E+00	µg/m					...					0.12
				1,2-Dichloroethane	3.80E+02	µg/m					1.4E-03					20
				Benzene	2.10E+00	µg/m					2.2E-06					0.026
				Chloroform	1.20E+00	µg/m					3.8E-06					0.0045
				Chloromethane	1.00E+03	µg/m					...					4.1
				Ethylbenzene	3.18E+00	µg/m					1.1E-06					0.0012
			Inhalation Total								1.4E-03					24
Total Site Indoor Air											1.4E-03					24

Table E-29
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Angler - Fish Tissue Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	3.1E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	4.0E-05	3.6E-09	mg/kg-day	7.0E-10	mg/kg-day	5.2
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	6.8E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	8.8E-04	7.9E-08	mg/kg-day	7.0E-10	mg/kg-day	113
				PCB-1260	1.80E+00	mg/kg	2.7E-04	mg/kg-day	2.0E+00	(mg/kg-day)-1	5.3E-04	3.1E-03	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	8.1E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	1.2E-05	9.5E-05	mg/kg-day	3.0E-04	(mg/kg-day)-1	0.32
				Chromium	9.50E-01	mg/kg	Mutagenic Mode of Action - See Table 4-5				3.7E-04	1.6E-03	mg/kg-day	3.0E-03	(mg/kg-day)-1	0.55
				Lead	6.30E-02	mg/kg	9.3E-06	mg/kg-day	NA	---	NA	1.1E-04	mg/kg-day	NA	---	NA
			Ingestion Total								1.3E-03					119
Total Knox Creek Carp											1.3E-03					119
Largemouth Bass																
Fish	Fish Tissue	Knox Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	mg/kg	8.7E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.1E-05	1.0E-09	mg/kg-day	7.0E-10	mg/kg-day	1.5
				PCB Dioxin-like Congener TEQ	3.50E-06	mg/kg	5.2E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	6.7E-05	6.0E-09	mg/kg-day	7.0E-10	mg/kg-day	8.6
				PCB-1260	1.20E-01	mg/kg	1.8E-05	mg/kg-day	2.0E+00	(mg/kg-day)-1	3.6E-05	2.1E-04	mg/kg-day	NA	---	NA
				Chromium	6.70E-01	mg/kg	Mutagenic Mode of Action - See Table 4-5				2.6E-04	1.2E-03	mg/kg-day	3.0E-03	(mg/kg-day)-1	0.39
				Mercury	2.90E-01	mg/kg	4.3E-05	mg/kg-day	NA	---	NA	5.0E-04	mg/kg-day	1.0E-04	(mg/kg-day)-1	5.0
			Ingestion Total								3.8E-04					15
Total Knox Creek Largemouth Bass											3.8E-04					15
All Species																
Fish	Fish Tissue	Knox Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	3.1E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	4.0E-05	3.6E-09	mg/kg-day	7.0E-10	mg/kg-day	5.2
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	6.8E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	8.8E-04	7.9E-08	mg/kg-day	7.0E-10	mg/kg-day	113
				PCB-1260	1.80E+00	mg/kg	2.7E-04	mg/kg-day	2.0E+00	(mg/kg-day)-1	5.3E-04	3.1E-03	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	8.1E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	1.2E-05	9.5E-05	mg/kg-day	3.0E-04	(mg/kg-day)-1	0.32
				Chromium	4.80E-01	mg/kg	Mutagenic Mode of Action - See Table 4-5				1.9E-04	8.4E-04	mg/kg-day	3.0E-03	(mg/kg-day)-1	0.28
				Lead	6.30E-02	mg/kg	9.3E-06	mg/kg-day	NA	---	NA	1.1E-04	mg/kg-day	NA	---	NA
				Mercury	1.65E-01	mg/kg	2.4E-05	mg/kg-day	NA	---	NA	2.8E-04	mg/kg-day	1.0E-04	(mg/kg-day)-1	2.8
			Ingestion Total								1.7E-03					119
Total Knox Creek All Species											1.7E-03					119

Table E-30
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Angler - Fish Tissue Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					size	Unit	size	Unit	size	Unit		size	Unit	size	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	7.8E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.0E-05	9.1E-10	mg/kg-day	7.0E-10	mg/kg-day	1.3
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	1.7E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	2.2E-04	2.0E-08	mg/kg-day	7.0E-10	mg/kg-day	28
				PCB-1260	1.30E+00	mg/kg	6.7E-05	mg/kg-day	2.0E+00	(mg/kg-day)-1	1.3E-04	7.8E-04	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	2.0E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	3.1E-06	2.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.079
				Chromium	9.50E-01	mg/kg	Mutagenic Mode of Action - See Table 4b				9.4E-05	4.1E-04	mg/kg-day	3.0E-03	mg/kg-day	0.14
				Lead	6.30E-02	mg/kg	2.3E-06	mg/kg-day	NA	---	NA	2.7E-05	mg/kg-day	NA	---	NA
			Ingestion Total								4.6E-04					30
Total Knoxville Creek Carp											4.6E-04					30
Largemouth Bass																
Fish	Fish Tissue	Knoxville Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	mg/kg	2.2E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	2.8E-06	2.5E-10	mg/kg-day	7.0E-10	mg/kg-day	0.36
				PCB Dioxin-like Congener TEQ	3.50E-06	mg/kg	1.3E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.7E-05	1.5E-09	mg/kg-day	7.0E-10	mg/kg-day	2.2
				PCB-1260	1.20E-01	mg/kg	4.4E-06	mg/kg-day	2.0E+00	(mg/kg-day)-1	8.9E-06	5.2E-05	mg/kg-day	NA	---	NA
				Chromium	6.70E-01	mg/kg	Mutagenic Mode of Action - See Table 4b				6.6E-05	2.9E-04	mg/kg-day	3.0E-03	mg/kg-day	0.096
				Mercury	2.90E-01	mg/kg	1.1E-05	mg/kg-day	NA	---	NA	1.3E-04	mg/kg-day	1.0E-04	mg/kg-day	1.3
			Ingestion Total								9.5E-05					3.9
Total Knoxville Creek Largemouth Bass											9.5E-05					3.9
All Species																
Fish	Fish Tissue	Knoxville Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	7.8E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.0E-05	9.1E-10	mg/kg-day	7.0E-10	mg/kg-day	1.3
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	1.7E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	2.2E-04	2.0E-08	mg/kg-day	7.0E-10	mg/kg-day	28
				PCB-1260	1.30E+00	mg/kg	6.7E-05	mg/kg-day	2.0E+00	(mg/kg-day)-1	1.3E-04	7.8E-04	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	2.0E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	3.1E-06	2.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.079
				Chromium	4.8E-01	mg/kg	Mutagenic Mode of Action - See Table 4b				4.8E-05	2.1E-04	mg/kg-day	3.0E-03	mg/kg-day	0.070
				Lead	6.30E-02	mg/kg	2.3E-06	mg/kg-day	NA	---	NA	2.7E-05	mg/kg-day	NA	---	NA
				Mercury	1.65E-01	mg/kg	6.1E-06	mg/kg-day	NA	---	NA	7.1E-05	mg/kg-day	1.0E-04	mg/kg-day	0.71
			Ingestion Total								4.2E-04					30
Total Knoxville Creek All Species											4.2E-04					30

Table E-31
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Angler - Fish Tissue Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	5.0E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	6.6E-05	1.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	1.9
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	1.1E-08	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.4E-03	3.0E-08	(mg/kg-day)	7.0E-10	(mg/kg-day)	43
				PCB-1260	1.30E+00	(mg/kg)	4.3E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	8.7E-04	1.2E-03	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	1.3E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	2.0E-05	3.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Chromium	9.50E-01	(mg/kg)	2.3E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.1E-04	6.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.205
				Lead	6.30E-02	(mg/kg)	1.5E-05	(mg/kg-day)	NA	---	NA	4.1E-05	(mg/kg-day)	NA	---	NA
			Ingestion Total								2.5E-03					45
Total Knoxville Creek Carp											2.5E-03					45
Largemouth Bass																
Fish	Fish Tissue	Knoxville Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	(mg/kg)	1.4E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.8E-05	3.8E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.55
				PCB Dioxin-like Congener TEQ	3.50E-06	(mg/kg)	8.4E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.1E-04	2.3E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	3.2
				PCB-1260	1.20E-01	(mg/kg)	2.9E-05	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	5.8E-05	7.8E-05	(mg/kg-day)	NA	---	NA
				Chromium	6.70E-01	(mg/kg)	1.6E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	8.1E-05	4.3E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.14
				Mercury	2.90E-01	(mg/kg)	7.0E-05	(mg/kg-day)	NA	---	NA	1.9E-04	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.9
			Ingestion Total								2.7E-04					6
Total Knoxville Creek Largemouth Bass											2.7E-04					6
All Species																
Fish	Fish Tissue	Knoxville Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	5.0E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	6.6E-05	1.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	1.9
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	1.1E-08	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.4E-03	3.0E-08	(mg/kg-day)	7.0E-10	(mg/kg-day)	43
				PCB-1260	1.30E+00	(mg/kg)	4.3E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	8.7E-04	1.2E-03	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	1.3E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	2.0E-05	3.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Chromium	4.86E-01	(mg/kg)	1.2E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	5.8E-05	3.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.10
				Lead	6.30E-02	(mg/kg)	1.5E-05	(mg/kg-day)	NA	---	NA	4.1E-05	(mg/kg-day)	NA	---	NA
				Mercury	1.65E-01	(mg/kg)	4.0E-05	(mg/kg-day)	NA	---	NA	1.1E-04	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.1
			Ingestion Total								2.4E-03					45
Total Knoxville Creek All Species											2.4E-03					45

Table E-32
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Angler - Fish Tissue Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	1.3E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.6E-05	3.4E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.49
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	2.8E-09	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	3.6E-04	7.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	11
				PCB-1260	1.30E+00	(mg/kg)	1.1E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	2.2E-04	2.9E-04	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	3.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	5.0E-06	8.9E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.030
				Chromium	9.50E-01	(mg/kg)	5.7E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	2.9E-05	1.5E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.051
				Lead	6.30E-02	(mg/kg)	3.8E-06	(mg/kg-day)	NA	---	NA	1.0E-05	(mg/kg-day)	NA	---	NA
			Ingestion Total								6.3E-04					11
Total Knoxville Creek Carp											6.3E-04					11
Largemouth Bass																
Fish	Fish Tissue	Knoxville Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	(mg/kg)	3.5E-11	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	4.6E-06	9.5E-11	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.14
				PCB Dioxin-like Congener TEQ	3.50E-06	(mg/kg)	2.1E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	2.7E-05	5.7E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.81
				PCB-1260	1.20E-01	(mg/kg)	7.2E-06	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	1.4E-05	1.9E-05	(mg/kg-day)	NA	---	NA
				Chromium	6.70E-01	(mg/kg)	4.0E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	2.0E-05	1.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.036
				Mercury	2.90E-01	(mg/kg)	1.7E-05	(mg/kg-day)	NA	---	NA	4.7E-05	(mg/kg-day)	1.0E-04	(mg/kg-day)	0.47
			Ingestion Total								6.7E-05					1.5
Total Knoxville Creek Largemouth Bass											6.7E-05					1.5
All Species																
Fish	Fish Tissue	Knoxville Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	1.3E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.6E-05	3.4E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.49
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	2.8E-09	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	3.6E-04	7.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	11
				PCB-1260	1.30E+00	(mg/kg)	1.1E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	2.2E-04	2.9E-04	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	3.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	5.0E-06	8.9E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.030
				Chromium	4.80E-01	(mg/kg)	2.9E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.5E-05	7.9E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.026
				Lead	6.30E-02	(mg/kg)	3.8E-06	(mg/kg-day)	NA	---	NA	1.0E-05	(mg/kg-day)	NA	---	NA
				Mercury	1.65E-01	(mg/kg)	9.9E-06	(mg/kg-day)	NA	---	NA	2.7E-05	(mg/kg-day)	1.0E-04	(mg/kg-day)	0.27
			Ingestion Total								6.1E-04					11
Total Knoxville Creek All Species											6.1E-04					11

Table E-33R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2 x 7 -TCDD TEQ	1.2E-06	NA	1.4E-07	1.3E-06	Developmental	0.04	NA	0.004	0.04
			Aluminum	NA	NA	NA	NA	Nervous system	0.04	NA	NA	0.04
			Arsenic	4.[illegible]E-06	NA	1.0E-06	5.[illegible]E-06	Skin	0.0[illegible]	NA	0.006	0.04
			Chromium	5.6E-06	NA	NA	5.6E-06	None observed	0.01	NA	NA	0.01
			Cobalt	NA	NA	NA	NA	Thyroid	0.05	NA	NA	0.05
			Copper	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
			Iron	NA	NA	NA	NA	Gastrointestinal	0.05	NA	NA	0.05
			Manganese	NA	NA	NA	NA	Nervous system	0.05	NA	NA	0.05
			Thallium	NA	NA	NA	NA	Hair	0.05	NA	NA	0.05
			Vanadium	NA	NA	NA	NA	Kidney	0.007	NA	NA	0.007
			Zinc	NA	NA	NA	NA	Blood	0.002	NA	NA	0.002
			Chemical Total	1.2E-05	NA	1.1E-06	1.3E-05		0.[illegible]	NA	0.01	0.[illegible]
		On-Site Total					1.3E-05					0.[illegible]
	Surface Soil Total						1.3E-05					0.[illegible]
	Air	On-Site	2 x 7 -TCDD TEQ	NA	1.6E-11	NA	1.6E-11	Liver, Reproductive system, Developmental, Endocrine system	NA	0.000000003	NA	0.000000003
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.0004	NA	0.0004
			Arsenic	NA	1.1E-09	NA	1.1E-09	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000005	NA	0.000005
			Chromium	NA	4.5E-0[illegible]	NA	4.5E-0[illegible]	Respiratory system	NA	0.000001	NA	0.000001
			Cobalt	NA	2.[illegible]E-09	NA	2.[illegible]E-09	Respiratory system	NA	0.0001	NA	0.0001
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.001	NA	0.001
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.000002	NA	0.000002
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.[illegible]E-0[illegible]	NA	4.[illegible]E-0[illegible]		NA	0.002	NA	0.002
		On-Site Total					4.[illegible]E-0[illegible]					0.002
	Air Total						4.[illegible]E-0[illegible]					0.002
Total On-Site Soil							1.3E-05					0.[illegible]

Table E-33R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Floodplain Erosion	Benzo(a)anthracene	1.1E-10	NA	6.3E-09	1.1E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.2E-07	NA	1.2E-07	3.4E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.5E-11	NA	1.3E-11	3.8E-11	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.2E-09	NA	1.2E-09	3.4E-09	NA	NA	NA	NA	NA
			Chrysene	2.1E-10	NA	1.2E-10	3.3E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	3.9E-07	NA	4.9E-11	4.4E-07	Developmental	0.001	NA	0.0002	0.001
			Aluminum	NA	NA	NA	NA	Neurological	0.001	NA	NA	0.001
			Arsenic	4.7E-06	NA	5.3E-07	5.2E-06	Skin	0.03	NA	0.004	0.03
			Chromium	4.3E-06	NA	NA	4.3E-06	Non-specified	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.03	NA	NA	0.03
			Copper	NA	NA	NA	NA	Reproductive System	0.0003	NA	NA	0.0003
			Iron	NA	NA	NA	NA	Gastrointestinal	0.04	NA	NA	0.04
			Manganese	NA	NA	NA	NA	Neurological	0.0007	NA	NA	0.0007
			Thallium	NA	NA	NA	NA	Hair	0.09	NA	NA	0.09
			Chemical Total	9.0E-06	NA	7.7E-07	1.0E-05		0.2	NA	0.0005	0.2
		Floodplain Erosion Total					1.0E-05					0.2
	Surface Soil Total						1.0E-05					0.2

Table E-33R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emissions	Benzo(a)anthracene	NA	1E-14	NA	1E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.6E-12	NA	1.6E-12	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.[illegible]E-1[illegible]	NA	1.[illegible]E-1[illegible]	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.6E-1[illegible]	NA	1.6E-1[illegible]	NA	NA	NA	NA	NA
			Chrysene	NA	1.5E-14	NA	1.5E-14	NA Liver, Reproductive System	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	5.5E-12	NA	5.5E-12	Developmental, Endocrine System	NA	[illegible]	NA	[illegible]
			Aluminum	NA	NA	NA	NA	Neurological System Liver, Reproductive, Immune, Skin, Urinary System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	6.4E-10	NA	6.4E-10	Neurological System, Lung, Skin	NA	[illegible]	NA	[illegible]
			Chromium	NA	[illegible]4E-[illegible]	NA	[illegible]4E-[illegible]	Reproductive System	NA	[illegible]	NA	[illegible]
			Cobalt	NA	1.6E-[illegible]	NA	1.6E-[illegible]	Reproductive System	NA	[illegible]	NA	[illegible]
			Cyanide	NA	NA	NA	NA	Thyroid	NA	[illegible]	NA	[illegible]
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	[illegible]	NA	[illegible]
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	[illegible]E-[illegible]	NA	[illegible]E-[illegible]		NA	[illegible]	NA	[illegible]
		Fugitive Emissions Total					1.6E-05					[illegible]
	Air Total						[illegible]E-[illegible]					[illegible]
Total Fugitive Emissions Total							1.6E-05					[illegible]
Total Risk across all Media - On-Site							1.6E-05	Total Hazard across all Media - On-Site				[illegible]
Total Risk across all Media - Fugitive Emissions							1.6E-05	Total Hazard across all Media - Fugitive Emissions				[illegible]

Table E-34R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Receptor Time Period: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.4E-07	NA	5.6E-11	1.4E-07	Developmental	0.0001	NA	0.00004	0.0001
			Aluminum	NA	NA	NA	NA	Neurological Effects	0.0001	NA	NA	0.0001
			Arsenic	5.6E-07	NA	4.0E-11	5.6E-07	Skin	0.0007	NA	0.00005	0.0008
			Chromium	6.7E-07	NA	NA	6.7E-07	Hematological	0.0004	NA	NA	0.0004
			Cobalt	NA	NA	NA	NA	Thyroid	0.001	NA	NA	0.001
			Copper	NA	NA	NA	NA	NA	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.001	NA	NA	0.001
			Magnesium	NA	NA	NA	NA	Neurological Effects	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	High	0.001	NA	NA	0.001
			Vanadium	NA	NA	NA	NA	Kidney	0.0002	NA	NA	0.0002
			Zinc	NA	NA	NA	NA	Blood	0.00005	NA	NA	0.00005
			Chemical Total	1.4E-06	NA	4.6E-11	1.4E-06		0.00	NA	0.00004	0.00
		On-Site Total					1.4E-06					0.00
	Surface Soil Total						1.4E-06					0.00
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	1.9E-12	NA	1.9E-12	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.0000000007	NA	0.0000000007
			Aluminum	NA	NA	NA	NA	Neurological Effects	NA	0.00004	NA	0.00004
			Arsenic	NA	1.4E-10	NA	1.4E-10	Developmental Cardiovascular System Neurological Effects Lung Skin	NA	0.00001	NA	0.00001
			Chromium	NA	5.4E-07	NA	5.4E-07	Respiratory Effects	NA	0.0004	NA	0.0004
			Cobalt	NA	2.7E-10	NA	2.7E-10	Respiratory Effects	NA	0.0001	NA	0.0001
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Neurological Effects	NA	0.0001	NA	0.0001
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory Effects	NA	0.0004	NA	0.0004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	5.6E-07	NA	5.6E-07		NA	0.0004	NA	0.0004
		On-Site Total					5.6E-07					0.0004
	Air Total						5.6E-07					0.0004
Total On-Site Soil							1.4E-06					0.00

Table E-34R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=10 yrs Cancer Risk
Exposure Frequency=20 Days/Year
Exposure Age=Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Plantation Ecotech	Benzo(a)anthracene	1.4E-11	NA	2.5E-10	1.6E-11	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.7E-10	NA	4.8E-11	3.2E-10	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.0E-11	NA	5.4E-10	5.6E-11	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.7E-10	NA	4.8E-11	3.2E-10	NA	NA	NA	NA	NA
			Chrysene	2.0E-11	NA	4.0E-12	2.4E-11	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	4.7E-10	NA	2.0E-11	4.9E-10	Developmental	0.0004	NA	0.00001	0.0004
			Aluminum	NA	NA	NA	NA	Neurotoxicity	0.0004	NA	NA	0.0004
			Arsenic	5.0E-07	NA	2.4E-10	5.0E-07	Skin	0.0007	NA	0.00001	0.0007
			Chromium	5.1E-07	NA	NA	5.1E-07	Hematopoietic	0.0002	NA	NA	0.0002
			Cobalt	NA	NA	NA	NA	Thyroid	0.0004	NA	NA	0.0004
			Copper	NA	NA	NA	NA	Reproductive System	0.00004	NA	NA	0.00004
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0004	NA	NA	0.0004
			Magnesium	NA	NA	NA	NA	Neurotoxicity	0.0002	NA	NA	0.0002
			Thallium	NA	NA	NA	NA	Hair	0.002	NA	NA	0.002
			Chemical Total	1.2E-06	NA	4.1E-10	1.2E-06		0.006	NA	0.00004	0.006
		Plantation Ecotech Total					1.2E-06					0.006
	Surface Soil Total						1.2E-06					0.006

Table E-34R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Air	Flenniken Branch	Benzo(a)anthracene	NA	9.1E-15	NA	9.1E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.9E-13	NA	1.9E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	2.1E-14	NA	2.1E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.9E-14	NA	1.9E-14	NA	NA	NA	NA	NA
			Chrysene	NA	1.1E-15	NA	1.1E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	6.6E-13	NA	6.6E-13	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	0.000000000002	NA	0.000000000002
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.000003	NA	0.000003
			Arsenic	NA	7.6E-11	NA	7.6E-11	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.000000007	NA	0.000000007
			Chromium	NA	4.1E-09	NA	4.1E-09	Respiratory System	NA	0.000000003	NA	0.000000003
			Cobalt	NA	1.9E-10	NA	1.9E-10	Respiratory System	NA	0.000002	NA	0.000002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.000000003	NA	0.000000003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.000002	NA	0.000002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.3E-09	NA	4.3E-09		NA	0.000003	NA	0.000003
		Flenniken Branch Total					1.2E-06					0.006
	Air Total						4.3E-09					0.000003
Total Flenniken Branch Soil							1.2E-06					0.006
						Total Risk Across All Media - On-Site	1.4E-06				Total Hazard Across All Media - On-Site	0.006
						Total Risk Across All Media - Flenniken Branch	1.2E-06				Total Hazard Across All Media - Flenniken Branch	0.006

Table E-35
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	1.2E-05	--	--	1.2E-05	Nervous System, Blood, Liver	0.054	--	--	0.054
			4,4'-DDD	5.9E-06	--	--	5.9E-06	--	--	--	--	--
			Benzene	4.7E-07	--	--	4.7E-07	Blood	0.0000	--	--	0.0000
			bis(2-Ethylhexyl)phthalate	2.5E-06	--	--	2.5E-06	Liver	0.025	--	--	0.025
			Bromodichloromethane	1.5E-07	--	--	1.5E-07	Kidney	0.00004	--	--	0.00004
			Bromomethane	--	--	--	--	Gastrointestinal	0.022	--	--	0.022
			Chloroform	2.2E-06	--	--	2.2E-06	Liver, Blood	0.019	--	--	0.019
			Dibenzofuran	--	--	--	--	Whole Body	0.004	--	--	0.004
			Dieldrin	4.2E-06	--	--	4.2E-06	Liver	0.015	--	--	0.015
			Ethylbenzene	1.6E-07	--	--	1.6E-07	Liver, Kidney	0.00041	--	--	0.00041
			Naphthalene	--	--	--	--	Body Weight	0.0034	--	--	0.0034
			Pentachlorophenol	9.2E-06	--	--	9.2E-06	Liver	0.013	--	--	0.013
			Phenol	--	--	--	--	Body Weight	0.011	--	--	0.011
			Tetrachloroethene	9.5E-06	--	--	9.5E-06	Nervous System	0.021	--	--	0.021
			Trichloroethene	7.0E-07	--	--	7.0E-07	Cardiovascular System	0.085	--	--	0.085
			1,1-Dichloropropene	--	--	--	--	Body Weight	0.00006	--	--	0.00006
			Aluminum	--	--	--	--	Nervous System	1.2	--	--	1.2
			Antimony	--	--	--	--	Blood	0.42	--	--	0.42
			Arsenic	1.6E-04	--	--	1.6E-04	Skin	1.0	--	--	1.0
			Beryllium	--	--	--	--	Gastrointestinal	0.11	--	--	0.11
			Cadmium	--	--	--	--	Kidney	0.10	--	--	0.10
			Chromium	1.2E-04	--	--	1.2E-04	None observed	0.22	--	--	0.22
			Cobalt	--	--	--	--	Thyroid	82	--	--	82
			Copper	--	--	--	--	--	0.15	--	--	0.15
			Cyanide	--	--	--	--	Reproductive System	0.38	--	--	0.38
			Iron	--	--	--	--	Gastrointestinal	0.073	--	--	0.073
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	62	--	--	62
			Mercury	--	--	--	--	Kidney	0.50	--	--	0.50
			Molybdenum	--	--	--	--	Blood	0.51	--	--	0.51
			Nickel	--	--	--	--	Body Weight	0.31	--	--	0.31
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.075	--	--	0.075
			Strontium	--	--	--	--	Bone	0.004	--	--	0.004
			Thallium	--	--	--	--	Hair	49	--	--	49
			Vanadium	--	--	--	--	Kidney	0.093	--	--	0.093
			Zinc	--	--	--	--	Blood	1.7	--	--	1.7
			Chemical Total	3.1E-04	--	--	3.1E-04		199	--	--	199
Total Shallow Groundwater							3.1E-04					199

Table E-35
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	1,2-Dichloroethane	8.3E-07	--	--	8.3E-07	Kidney	0.0043	--	--	0.0043
			2,4-Dinitrotoluene	3.0E-05	--	--	3.0E-05	Nervous System, Blood, Liver	0.14	--	--	0.14
			2,6-Dinitrotoluene	5.3E-05	--	--	5.3E-05	Spleen	0.33	--	--	0.33
			Benzene	3.6E-07	--	--	3.6E-07	Blood	0.0046	--	--	0.0046
			bis(2-Ethylhexyl)phthalate	7.2E-06	--	--	7.2E-06	Liver	0.072	--	--	0.072
			Bromomethane	--	--	--	--	Gastrointestinal	0.044	--	--	0.044
			Chloroform	4.8E-07	--	--	4.8E-07	Liver, Blood	0.0043	--	--	0.0043
			Dieldrin	4.3E-06	--	--	4.3E-06	Liver	0.015	--	--	0.015
			Heptachlorepoxide	3.8E-06	--	--	3.8E-06	Liver	0.039	--	--	0.039
			Naphthalene	--	--	--	--	Body Weight	0.0017	--	--	0.0017
			Pentachlorophenol	7.6E-06	--	--	7.6E-06	Liver	0.011	--	--	0.011
			Trichloroethene	2.0E-07	--	--	2.0E-07	Cardiovascular System	0.025	--	--	0.025
			Aluminum	--	--	--	--	Nervous System	0.083	--	--	0.083
			Arsenic	7.7E-05	--	--	7.7E-05	Skin	0.48	--	--	0.48
			Beryllium	--	--	--	--	Gastrointestinal	0.051	--	--	0.051
			Cadmium	--	--	--	--	Kidney	0.12	--	--	0.12
			Chromium	8.1E-05	--	--	8.1E-05	None Delivered	0.15	--	--	0.15
			Cobalt	--	--	--	--	Thyroid	1.1	--	--	1.1
			Copper	--	--	--	--	--	0.019	--	--	0.019
			Cyanide	--	--	--	--	Reproductive System	0.29	--	--	0.29
			Iron	--	--	--	--	Gastrointestinal	0.38	--	--	0.38
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	90	--	--	90
			Mercury	--	--	--	--	Kidney	0.011	--	--	0.011
			Molybdenum	--	--	--	--	Blood	0.36	--	--	0.36
			Nickel	--	--	--	--	Body Weight	0.052	--	--	0.052
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.15	--	--	0.15
			Strontium	--	--	--	--	Bone	0.31	--	--	0.31
			Thallium	--	--	--	--	Hair	37	--	--	37
			Vanadium	--	--	--	--	Kidney	0.12	--	--	0.12
			Zinc	--	--	--	--	Blood	0.0066	--	--	0.0066
			Chemical Total	2.7E-04	--	--	2.7E-04		132	--	--	132
Total Deep Groundwater							2.7E-04					132
			Total Risk Across All Media - Shallow Groundwater				3.1E-04	Total Hazard Across All Media - Shallow Groundwater				199
											Total Blood HI	2.7
											Total Liver HI	0.201
											Total Kidney HI	0.70
											Total Body Weight HI	0.62

Table E-35
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Nervous System HI	0.2
											Total Cardiovascular System HI	0.065
											Total Skin HI	1.1
											Total Gastrointestinal HI	0.21
											Total Thyroid HI	0.2
											Total Bone HI	0.004
											Total Whole Body HI	0.034
											Total Reproductive System HI	0.38
											Total Hair HI	49
			Total Risk Acro All Media - Deep Groundwater				2.7E-04	Total Hazard Acro All Media - Deep Groundwater				1.02
											Total Kidney HI	0.25
											Total Nervous System HI	90
											Total Skin HI	0.48
											Total Blood HI	1.2
											Total Liver HI	0.48
											Total Spleen HI	0.33
											Total Thyroid HI	1.1
											Total Reproductive System HI	0.39
											Total Gastrointestinal HI	0.48
											Total Cardiovascular HI	0.025
											Total Bone HI	0.31
											Total Hair HI	37
											Total Body Weight HI	0.053

Table E-36
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	1.4E-06	--	--	1.4E-06	Nervous System, Blood, Liver	0.014	--	--	0.014
			4,4'-DDD	7.0E-09	--	--	7.0E-09	--	--	--	--	--
			Benzene	5.6E-06	--	--	5.6E-06	Blood	0.0015	--	--	0.0015
			bis(2-Ethylhexyl)phthalate	3.0E-07	--	--	3.0E-07	Liver	0.00062	--	--	0.00062
			Bromodichloromethane	1.3E-06	--	--	1.3E-06	Kidney	0.0000066	--	--	0.0000066
			Bromomethane	--	--	--	--	Gastrointestinal	0.0055	--	--	0.0055
			Chloroform	2.6E-07	--	--	2.6E-07	Liver, Blood	0.0049	--	--	0.0049
			Dibenzofuran	--	--	--	--	Whole Body	0.0066	--	--	0.0066
			Dieldrin	5.0E-07	--	--	5.0E-07	Liver	0.0066	--	--	0.0066
			Ethylbenzene	1.9E-06	--	--	1.9E-06	Liver, Kidney	0.0000100	--	--	0.0000100
			Naphthalene	--	--	--	--	Body Weight	0.000064	--	--	0.000064
			Pentachlorophenol	1.1E-06	--	--	1.1E-06	Liver	0.0002	--	--	0.0002
			Phenol	--	--	--	--	Body Weight	0.0028	--	--	0.0028
			Tetrachloroethene	1.1E-06	--	--	1.1E-06	Nervous System	0.0050	--	--	0.0050
			Trichloroethene	8.4E-06	--	--	8.4E-06	Cardiovascular System	0.021	--	--	0.021
			1,1,1-Trichloroethane	--	--	--	--	Body Weight	0.000024	--	--	0.000024
			Aluminum	--	--	--	--	Nervous System	0.001	--	--	0.001
			Antimony	--	--	--	--	Blood	0.11	--	--	0.11
			Arsenic	1.9E-05	--	--	1.9E-05	Skin	0.25	--	--	0.25
			Beryllium	--	--	--	--	Gastrointestinal	0.028	--	--	0.028
			Cadmium	--	--	--	--	Kidney	0.025	--	--	0.025
			Chromium	1.4E-05	--	--	1.4E-05	None observed	0.056	--	--	0.056
			Cobalt	--	--	--	--	Thyroid	20	--	--	20
			Copper	--	--	--	--	--	0.007	--	--	0.007
			Cyanide	--	--	--	--	Reproductive System	0.095	--	--	0.095
			Iron	--	--	--	--	Gastrointestinal	0.019	--	--	0.019
			Lead	--	--	--	--	--	--	--	--	--
			Magnesium	--	--	--	--	Nervous System	15	--	--	15
			Mercury	--	--	--	--	Kidney	0.12	--	--	0.12
			Molybdenum	--	--	--	--	Blood	0.13	--	--	0.13
			Nickel	--	--	--	--	Body Weight	0.202	--	--	0.202
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.019	--	--	0.019
			Strontium	--	--	--	--	Bone	0.016	--	--	0.016
			Thallium	--	--	--	--	Hair	12	--	--	12
			Vanadium	--	--	--	--	Kidney	0.025	--	--	0.025
			Zinc	--	--	--	--	Blood	0.42	--	--	0.42
			Chemical Total	2.7E-05	--	--	2.7E-05		50	--	--	50
Total Shallow Groundwater							2.7E-05					50

Table E-36
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	1,2-Dichloroethane	1.0E-07	--	--	1.0E-07	Kidney	0.00107	--	--	0.00107
			2,4-Dinitrotoluene	3.7E-06	--	--	3.7E-06	Nervous System, Blood, Liver	0.034	--	--	0.034
			2,6-Dinitrotoluene	6.4E-06	--	--	6.4E-06	Spleen	0.063	--	--	0.063
			Benzene	4.3E-06	--	--	4.3E-06	Blood	0.0012	--	--	0.0012
			bis(2-Ethylhexyl)phthalate	8.6E-07	--	--	8.6E-07	Liver	0.016	--	--	0.016
			Bromomethane	--	--	--	--	Gastrointestinal	0.011	--	--	0.011
			Chloroform	5.7E-08	--	--	5.7E-08	Liver, Blood	0.0011	--	--	0.0011
			Dieldrin	5.1E-07	--	--	5.1E-07	Liver	0.0007	--	--	0.0007
			Heptachlorepoxide	4.5E-07	--	--	4.5E-07	Liver	0.022	--	--	0.022
			Naphthalene	--	--	--	--	Body Weight	0.00043	--	--	0.00043
			Pentachlorophenol	9.2E-07	--	--	9.2E-07	Liver	0.0027	--	--	0.0027
			Trichloroethene	2.4E-08	--	--	2.4E-08	Cardiovascular System	0.0002	--	--	0.0002
			Aluminum	--	--	--	--	Nervous System	0.021	--	--	0.021
			Arsenic	9.2E-06	--	--	9.2E-06	Skin	0.12	--	--	0.12
			Beryllium	--	--	--	--	Gastrointestinal	0.013	--	--	0.013
			Cadmium	--	--	--	--	Kidney	0.029	--	--	0.029
			Chromium	9.7E-06	--	--	9.7E-06	Not quantified	0.036	--	--	0.036
			Cobalt	--	--	--	--	Thyroid	0.27	--	--	0.27
			Copper	--	--	--	--	--	0.0047	--	--	0.0047
			Cyanide	--	--	--	--	Reproductive System	0.096	--	--	0.096
			Iron	--	--	--	--	Gastrointestinal	0.096	--	--	0.096
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	22	--	--	22
			Mercury	--	--	--	--	Kidney	0.0027	--	--	0.0027
			Molybdenum	--	--	--	--	Blood	0.21	--	--	0.21
			Nickel	--	--	--	--	Body Weight	0.013	--	--	0.013
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.007	--	--	0.007
			Strontium	--	--	--	--	Bone	0.077	--	--	0.077
			Thallium	--	--	--	--	Hair	9.3	--	--	9.3
			Vanadium	--	--	--	--	Kidney	0.020	--	--	0.020
			Zinc	--	--	--	--	Blood	0.0022	--	--	0.0022
			Chemical Total	3.2E-05	--	--	3.2E-05		33	--	--	33
Total Deep Groundwater							3.2E-05					33
			Total Risk Across All Media - Shallow Groundwater				3.7E-05	Total Hazard Across All Media - Shallow Groundwater				50
								Total Blood HI				0.09
								Total Liver HI				0.050
								Total Kidney HI				0.17
								Total Body Weight HI				0.21

Table E-36
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Nervous System HI	16
											Total Cardiovascular System HI	0.021
											Total Skin HI	0.27
											Total Gastrointestinal HI	0.053
											Total Thyroid HI	20
											Total Reproductive System HI	0.095
											Total Whole Body HI	0.0066
											Total Blood HI	0.67
											Total Bone HI	0.016
											Total Hair HI	12
			Total Risk Acro All Media - Deep Groundwater				3.2E-05	Total Hazard Acro All Media - Deep Groundwater				33
											Total Endocr. HI	0.063
											Total Nervous System HI	22
											Total Blood HI	0.29
											Total Liver HI	0.12
											Total Spleen HI	0.083
											Total Skin HI	0.12
											Total Thyroid HI	0.27
											Total Reproductive System HI	0.10
											Total Gastrointestinal HI	0.12
											Total Bone HI	0.077
											Total Cardiovascular HI	0.0062
											Total Hair HI	9.3
											Total Body Weight HI	0.013

Table E-37
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.3E-05	---	2.3E-05	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.071	---	0.071
			1,2-Dichloroethane	---	8.1E-04	---	8.1E-04	Nervous System	---	12	--	12
			Benzene	---	1.3E-06	---	1.3E-06	Blood	---	0.016	---	0.016
			Chloroform	---	2.3E-06	---	2.3E-06	Liver	---	0.0028	--	0.0028
			Chloromethane	---	---	---	--	Nervous System	---	2.5	---	2.5
			Ethylbenzene	---	6.5E-07	---	6.5E-07	Developmental	---	0.00073	--	0.00073
			Chemical Total	---	8.3E-04	---	8.3E-04		---	15	---	15
Total Indoor Air							8.3E-04					15
						Total Risk	8.3E-04				Total Hazard	15
											Total Developmental HI	0.00073
											Total Liver HI	0.0028
											Total Blood HI	0.087
											Total Nervous System HI	15

Table E-38
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.8E-06	---	2.8E-06	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.0006	--	0.0006
			1,2-Dichloroethane	---	9.7E-05	---	9.7E-05	Nervous System	---	1.5	--	1.5
			Benzene	---	1.6E-07	---	1.6E-07	Blood	---	0.0019	--	0.0019
			Chloroform	---	2.7E-07	---	2.7E-07	Liver	---	0.00004	--	0.00004
			Chloromethane	---	---	---	--	Nervous System	---	0.30	---	0.30
			Ethylbenzene	---	7.8E-06	---	7.8E-06	Developmental	---	0.000007	--	0.000007
			Chemical Total	---	1.0E-04	---	1.0E-04		---	1.8	---	1.8
Total Indoor Air							1.0E-04					1.8
						Total Risk	1.0E-04				Total Hazard	1.8
											Total Developmental HI	0.000007
											Total Liver HI	0.00004
											Total Blood HI	0.010
											Total Nervous System HI	1.8

Table E-39R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	3.4E-07	NA	4.2E-08	3.8E-07	Developmental	0.03	NA	0.003	0.03
			Aluminum	NA	NA	NA	NA	Nervous system	0.03	NA	NA	0.03
			Arsenic	1.4E-06	NA	2.9E-07	1.7E-06	Skin	0.02	NA	0.005	0.03
			Chromium	5.0E-06	NA	NA	5.0E-06	None considered	0.003	NA	NA	0.003
			Cobalt	NA	NA	NA	NA	Thyroid	0.04	NA	NA	0.04
			Copper	NA	NA	NA	NA	NA	0.006	NA	NA	0.006
			Iron	NA	NA	NA	NA	GI tract (oral)	0.03	NA	NA	0.03
			Manganese	NA	NA	NA	NA	Nervous system	0.04	NA	NA	0.04
			Thallium	NA	NA	NA	NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA	NA	Kidney	0.005	NA	NA	0.005
			Zinc	NA	NA	NA	NA	Blood	0.001	NA	NA	0.001
			Chemical Total	6.7E-06	NA	3.4E-07	7.1E-06		0.2	NA	0.01	0.3
		On-Site Total					7.1E-06					0.3
	Surface Soil Total						7.1E-06					0.3
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	1.3E-12	NA	1.3E-12	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000006	NA	0.000000006
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00007	NA	0.00007
			Arsenic	NA	9.1E-11	NA	9.1E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	1.1E-03	NA	1.1E-03	Respiratory system	NA	0.000003	NA	0.000003
			Cobalt	NA	1.9E-10	NA	1.9E-10	Respiratory system	NA	0.00002	NA	0.00002
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0002	NA	0.0002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.000003	NA	0.000003
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.1E-03	NA	1.1E-03		NA	0.0003	NA	0.0003
		On-Site Total					1.1E-03					0.0003
	Air Total						1.1E-03					0.0003
Total On-Site Soil							7.1E-06					0.3

Table E-39R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Flemmken Branch	Benzo(a)anthracene	1.0E-06	NA	5.4E-09	1.0E-06	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.0E-07	NA	1.1E-07	3.0E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.2E-06	NA	1.2E-06	3.3E-06	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.0E-09	NA	1.1E-09	3.0E-09	NA	NA	NA	NA	NA
			Chrysene	1.9E-10	NA	1.0E-10	2.9E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	1.2E-07	NA	1.4E-08	1.3E-07	Developmental	0.009	NA	0.001	0.01
			Aluminum	NA	NA	NA	NA	Nervous System	0.009	NA	NA	0.009
			Arsenic	1.4E-06	NA	1.7E-07	1.6E-06	Skin	0.02	NA	0.003	0.02
			Chromium	3.8E-06	NA	NA	3.8E-06	None Observed	0.006	NA	NA	0.006
			Cobalt	NA	NA	1.3E-10	1.3E-10	Thyroid	0.03	NA	0.00000	0.03
			Cyanide	NA	NA	NA	NA	Reproductive System	0.003	NA	NA	0.003
			Iron	NA	NA	NA	NA	GI tract (ulcer)	0.03	NA	NA	0.03
			Manganese	NA	NA	NA	NA	Nervous System	0.005	NA	NA	0.005
			Thallium	NA	NA	NA	NA	Hair	0.07	NA	NA	0.07
			Chemical Total	5.5E-06	NA	3.1E-07	5.8E-06		0.2	NA	0.004	0.2
		Flemmken Branch Total					5.8E-06					0.2
	Surface Soil Total						5.8E-06					0.2
	Air	Flemmken Branch	Benzo(a)anthracene	NA	2.0E-14	NA	2.0E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	4.0E-13	NA	4.0E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	4.4E-14	NA	4.4E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	4.0E-14	NA	4.0E-14	NA	NA	NA	NA	NA
			Chrysene	NA	3.8E-15	NA	3.8E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	4.5E-13	NA	4.5E-13	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	0.0000000002	NA	0.0000000002
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00002	NA	0.00002
			Arsenic	NA	5.3E-11	NA	5.3E-11	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	8.5E-09		8.5E-09	Respiratory System	NA	0.000002	NA	0.000002
			Cobalt	NA	1.3E-10	NA	1.3E-10	Respiratory System	NA	0.00002	NA	0.00002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.00000003	NA	0.00000003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0002	NA	0.0002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	8.7E-09	NA	8.7E-09		NA	0.0002	NA	0.0002
		Flemmken Branch Total					5.8E-06					0.2
	Air Total						8.7E-09					0.0002
Total Flemmken Branch Soil							5.9E-06					0.2
			Total Risk Across All Media - On-Site				7.1E-06		Total Hazard Across All Media - On-Site			0.3
			Total Risk Across All Media - Flemmken Branch				5.9E-06		Total Hazard Across All Media - Flemmken Branch			0.2

Table E-40R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route: Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route: Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	8.5E-08	NA	3.0E-09	8.8E-08	Developmental	0.007	NA	0.0002	0.007
			Aluminum	NA	NA	NA	NA	Nervous system	0.007	NA	NA	0.007
			Arsenic	3.6E-07	NA	2.1E-08	3.8E-07	Skin	0.006	NA	0.0003	0.006
			Chromium	1.2E-06	NA	NA	1.2E-06	None observed	0.002	NA	NA	0.002
			Cobalt	NA	NA	NA	NA	Thyroid	0.009	NA	NA	0.009
			Copper	NA	NA	NA	NA	NA	0.001	NA	NA	0.001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.009	NA	NA	0.009
			Manganese	NA	NA	NA	NA	Nervous system	0.009	NA	NA	0.009
			Thallium	NA	NA	NA	NA	Hair	0.01	NA	NA	0.01
			Vanadium	NA	NA	NA	NA	Kidney	0.001	NA	NA	0.001
			Zinc	NA	NA	NA	NA	Blood	0.0004	NA	NA	0.0004
		On-Site Total	Chemical Total	1.7E-06	NA	2.4E-08	1.7E-06		0.06	NA	0.0006	0.06
		On-Site Total					1.7E-06					0.06
	Surface Soil Total						1.7E-06					0.06
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	3.3E-13	NA	3.3E-13	Liver Reproductive system Developmental Endocrine system Respiratory system Blood	NA	0.000000002	NA	0.000000002
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00002	NA	0.00002
			Arsenic	NA	2.3E-11	NA	2.3E-11	Developmental Cardiovascular system Nervous system Lung Skin	NA	0.0000002	NA	0.0000002
			Chromium	NA	2.8E-09	NA	2.8E-09	Respiratory system	NA	0.00000008	NA	0.00000008
			Cobalt	NA	4.7E-11	NA	4.7E-11	Respiratory system	NA	0.0000006	NA	0.0000006
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00006	NA	0.00006
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.00000008	NA	0.00000008
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
		On-Site Total	Chemical Total	NA	2.8E-09	NA	2.8E-09		NA	0.00009	NA	0.00009
		On-Site Total					2.8E-09					0.00009
	Air Total						2.8E-09					0.00009
Total On-Site Soil							1.7E-06					0.06

Table E-40R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route: Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route: Total
Soil	Surface Soil	Flemmken Branch	Benzo(a)anthracene	2.5E-09	NA	3.9E-10	2.9E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	5.0E-08	NA	7.6E-09	5.7E-08	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	5.4E-09	NA	8.4E-10	6.3E-09	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	5.0E-10	NA	7.6E-11	5.7E-10	NA	NA	NA	NA	NA
			Chrysene	4.8E-11	NA	7.3E-12	5.5E-11	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	2.9E-08	NA	1.0E-09	3.0E-08	Developmental	0.002	NA	0.00008	0.002
			Aluminum	NA	NA	NA	NA	Nervous system	0.002	NA	NA	0.002
			Arsenic	3.4E-07	NA	1.2E-08	3.6E-07	Skin	0.005	NA	0.00002	0.006
			Chromium	9.5E-07	NA	NA	9.5E-07	None observed	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.006	NA	NA	0.006
			Cyanide	NA	NA	NA	NA	Reproductive system	0.00006	NA	NA	0.00006
			Iron	NA	NA	NA	NA	Gastrointestinal	0.007	NA	NA	0.007
			Manganese	NA	NA	NA	NA	Nervous system	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.02	NA	NA	0.02
			Chemical Total	1.4E-06	NA	2.2E-08	1.4E-06		0.04	NA	0.00003	0.04
		Flemmken Branch Total					1.4E-06					0.04
	Surface Soil Total						1.4E-06					0.04
	Air	Flemmken Branch	Benzo(a)anthracene	NA	5.0E-15	NA	5.0E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	9.9E-14	NA	9.9E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.1E-14	NA	1.1E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	9.9E-15	NA	9.9E-15	NA	NA	NA	NA	NA
			Chrysene	NA	9.5E-16	NA	9.5E-16	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	1.1E-13	NA	1.1E-13	Liver Reproductive system Developmental Endocrine system Respiratory system Blood	NA	0.0000000005	NA	0.0000000005
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000006	NA	0.000006
			Arsenic	NA	1.3E-11	NA	1.3E-11	System Lung Skin	NA	0.000001	NA	0.000001
			Chromium	NA	2.1E-09	NA	2.1E-09	Respiratory system	NA	0.0000006	NA	0.0000006
			Cobalt	NA	3.3E-11	NA	3.3E-11	Respiratory system	NA	0.000004	NA	0.000004
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.0000000006	NA	0.0000000006
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00005	NA	0.00005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	2.2E-09	NA	2.2E-09		NA	0.00006	NA	0.00006
		Flemmken Branch Total					1.4E-06					0.04
	Air Total						2.2E-09					0.00006
Total Flemmken Branch Soil							1.4E-06					0.04
						Total Risk Across All Media - On-Site	1.7E-06				Total Hazard Across All Media - On-Site	0.06
						Total Risk Across All Media - Flemmken Branch	1.4E-06				Total Hazard Across All Media - Flemmken Branch	0.04

Table E-41R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.4E-06	NA	6.7E-08	1.4E-06	Developmental	0.2	NA	0.009	0.2
			Aluminum	NA	NA	NA	NA	Nervous system	0.2	NA	NA	0.2
			Arsenic	5.8E-06	NA	4.6E-07	6.2E-06	Skin	0.1	NA	0.01	0.2
			Chromium	3.6E-05	NA	NA	3.6E-05	None observed	0.05	NA	NA	0.05
			Cobalt	NA	NA	NA	NA	Thyroid	0.2	NA	NA	0.2
			Copper	NA	NA	NA	NA	NA	0.04	NA	NA	0.04
			Iron	NA	NA	NA	NA	Gastrointestinal	0.2	NA	NA	0.2
			Magnesium	NA	NA	NA	NA	Nervous system	0.2	NA	NA	0.2
			Thallium	NA	NA	NA	NA	Hair	0.3	NA	NA	0.3
			Vanadium	NA	NA	NA	NA	Kidney	0.03	NA	NA	0.03
			Zinc	NA	NA	NA	NA	Blood	0.01	NA	NA	0.01
			Chemical Total	4.3E-05	NA	5.3E-07	4.3E-05		2	NA	0.02	2
		On-Site Total					4.3E-05					2
	Surface Soil Total						4.3E-05					2
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	9.0E-13	NA	9.0E-13	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000007	NA	0.000000007
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00008	NA	0.00008
			Arsenic	NA	6.1E-11	NA	6.1E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	1.3E-08	NA	1.3E-08	Respiratory system	NA	0.0000003	NA	0.0000003
			Cobalt	NA	1.3E-10	NA	1.3E-10	Respiratory system	NA	0.00003	NA	0.00003
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Nervous system	NA	0.0003	NA	0.0003
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.0000004	NA	0.0000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.3E-08	NA	1.3E-08		NA	0.0004	NA	0.0004
		On-Site Total					1.3E-08					0.0004
	Air Total						1.3E-08					0.0004
Total On-Site Soil							4.3E-05					2

Table E-41R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Flennken Branch	Benzo(a)anthracene	7.3E-08	NA	2.6E-08	9.9E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	1.4E-06	NA	5.2E-07	1.9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1.6E-07	NA	5.7E-08	2.1E-07	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	1.4E-08	NA	5.2E-09	1.9E-08	NA	NA	NA	NA	NA
			Chrysene	1.4E-09	NA	5.0E-10	1.9E-09	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	4.7E-07	NA	2.3E-08	4.9E-07	Developmental	0.06	NA	0.003	0.06
			Aluminum	NA	NA	NA	NA	Nervous system	0.06	NA	NA	0.06
			Arsenic	3.4E-06	NA	2.7E-07	3.6E-06	Skin	0.09	NA	0.007	0.09
			Chromium	2.7E-05	NA	NA	2.7E-05	None observed	0.04	NA	NA	0.04
			Cobalt	NA	NA	NA	NA	Thyroid	0.2	NA	NA	0.2
			Cyanide	NA	NA	NA	NA	Reproductive system	0.02	NA	NA	0.02
			Iron	NA	NA	NA	NA	Gastrointestinal	0.2	NA	NA	0.2
			Manganese	NA	NA	NA	NA	Nervous system	0.03	NA	NA	0.03
			Thallium	NA	NA	NA	NA	Hair	0.5	NA	NA	0.5
			Chemical Total	3.3E-05	NA	9.0E-07	3.4E-05		1	NA	0.01	1
		Flennken Branch Total					3.4E-05					1
	Surface Soil Total						3.4E-05					1
	Air	Flennken Branch	Benzo(a)anthracene	NA	2.4E-14	NA	2.4E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	4.7E-13	NA	4.7E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	5.2E-14	NA	5.2E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	4.7E-14	NA	4.7E-14	NA	NA	NA	NA	NA
			Chrysene	NA	4.6E-15	NA	4.6E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	3.1E-13	NA	3.1E-13	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000002	NA	0.000000002
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00003	NA	0.00003
			Arsenic	NA	3.6E-11	NA	3.6E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.0000006	NA	0.0000006
			Chromium	NA	1.0E-08	NA	1.0E-08	Respiratory system	NA	0.0000003	NA	0.0000003
			Cobalt	NA	8.9E-11	NA	8.9E-11	Respiratory system	NA	0.00002	NA	0.00002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.003	NA	0.003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0002	NA	0.0002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-08	NA	1.0E-08		NA	0.004	NA	0.004
		Flennken Branch Total					3.4E-05					1
	Air Total						1.0E-08					0.004
Total Flennken Branch Soil							3.4E-05					1
				Total Risk Across All Media - On-Site			4.3E-05	Total Hazard Across All Media - On-Site				2

Table E-41R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe Current/Future
Receptor Population Recreational User
Receptor Age Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Developmental HI	0.2
											Total Nervous System HI	0.4
											Total Skin HI	0.2
											Total Thyroid HI	0.2
											Total Gastrointestinal HI	0.2
											Total Heart HI	0.3
											Total Blood HI	0.01
											Total Liver HI	0.000000007
											Total Reproductive System HI	0.000000007
											Total Endocrine System HI	0.000000007
											Total Lung/Respiratory Tract HI	0.00004
											Total Cardiovascular System HI	0.00001
			Total Risk Across All Media - Flemmken Branch				3.4E-05	Total Hazard Across All Media - Flemmken Branch				1

Table E-42R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=0.5hr Cancer Risk
Exposure Frequency Recreational Use
Exposure Age Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.7E-07	NA	1.1E-07	1.[illegible]E-07	Developmental	0.0[illegible]	NA	0.0001	0.0[illegible]
			Aluminum	NA	NA	NA	NA	Neurological System	0.0[illegible]	NA	NA	0.0[illegible]
			Arsenic	7.1E-07	NA	7.7E-07	7.[illegible]E-07	Skin	0.0[illegible]	NA	0.0001	0.0[illegible]
			Chromium	4.4E-06	NA	NA	4.4E-06	Non-observed	0.000[illegible]	NA	NA	0.000[illegible]
			Cobalt	NA	NA	NA	NA	Thyroid	0.001	NA	NA	0.001
			Copper	NA	NA	NA	NA	NA	0.0005	NA	NA	0.0005
			Iron	NA	NA	NA	NA	Gastrointestinal	0.001	NA	NA	0.001
			Magnesium	NA	NA	NA	NA	Neurological System	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.001	NA	NA	0.001
			Vanadium	NA	NA	NA	NA	Fetus	0.0004	NA	NA	0.0004
			Zinc	NA	NA	NA	NA	Blood	0.0001	NA	NA	0.0001
			Chemical Total	5.4E-06	NA	E-06	5.4E-06		0.[illegible]	NA	0.0001	0.[illegible]
		On-Site Total					5.4E-06					0.[illegible]
	Surface Soil Total						5.4E-06					0.[illegible]
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	2.2E-14	NA	2.2E-14	Liver Reproductive System Developmental Endocrine System Reproductive System Blood	NA	0.000000000[illegible]	NA	0.000000000[illegible]
			Aluminum	NA	NA	NA	NA	Neurological System	NA	0.000001[illegible]	NA	0.000001[illegible]
			Arsenic	NA	1.5E-11	NA	1.5E-11	Developmental Cardiovascular System Neurological System Lung Skin	NA	0.000000004	NA	0.000000004
			Chromium	NA	4.4E-06	NA	4.4E-06	Respiratory System	NA	0.000000004[illegible]	NA	0.000000004[illegible]
			Cobalt	NA	4.2E-11	NA	4.2E-11	Respiratory System	NA	0.000000007	NA	0.000000007
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Neurological System	NA	0.000000007	NA	0.000000007
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.000000004[illegible]	NA	0.000000004[illegible]
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.4E-06	NA	4.4E-06		NA	0.0001	NA	0.0001
		On-Site Total					4.4E-06					0.0001
	Air Total						4.4E-06					0.0001
Total On-Site Soil							5.4E-06					0.[illegible]

Table E-42R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	9.0E-09	NA	2.6E-09	1.2E-0	NA	NA	NA	NA	NA
			Benzo(a)pyrene	1.[illegible]E-07	NA	5.1E-0	2.3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1.9E-0	NA	5.7E-09	2.5E-0	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	1.[illegible]E-09	NA	5.1E-10	2.3E-09	NA	NA	NA	NA	NA
			Chrysene	1.7E-10	NA	4.9E-11	2.2E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	5.[illegible]E-0	NA	3.[illegible]E-09	6.2E-0	Developmental	0.0007	NA	0.00005	0.000
			Aluminum	NA	NA	NA	NA	Nervous system	0.0007	NA	NA	0.0007
			Arsenic	4.2E-07	NA	4.5E-0	4.6E-07	Skin	0.001	NA	0.0001	0.001
			Chromium	3.4E-06	NA	NA	3.4E-06	None observed	0.0005	NA	NA	0.0005
			Cobalt	NA	NA	NA	NA	Thyroid	0.002	NA	NA	0.002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.002	NA	NA	0.002
			Manganese	NA	NA	NA	NA	Nervous system	0.0004	NA	NA	0.0004
			Thallium	NA	NA	NA	NA	Hair	0.006	NA	NA	0.006
			Chemical Total	4.1E-06	NA	1.1E-07	4.2E-06		0.1	NA	0.0002	0.1
		Flenniken Branch Total					4.2E-06					0.1
	Surface Soil Total						4.2E-06					0.1
	Air	Flenniken Branch	Benzo(a)anthracene	NA	6.0E-15	NA	6.0E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.2E-13	NA	1.2E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.3E-14	NA	1.3E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.2E-14	NA	1.2E-14	NA	NA	NA	NA	NA
			Chrysene	NA	1.1E-15	NA	1.1E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	7.6E-14	NA	7.6E-14	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000006	NA	0.000000000006
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.0000007	NA	0.0000007
			Arsenic	NA	E-12	NA	E-12	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.0000002	NA	0.0000002
			Chromium	NA	2.5E-09	NA	2.5E-09	Respiratory system	NA	0.0000007	NA	0.0000007
			Cobalt	NA	2.2E-11	NA	2.2E-11	Respiratory system	NA	0.0000005	NA	0.0000005
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.00009	NA	0.00009
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00005	NA	0.00005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	2.6E-09	NA	2.6E-09		NA	0.00009	NA	0.00009
		Flenniken Branch Total					4.2E-06					0.1
	Air Total						2.6E-09					0.00009
Total Flenniken Branch Soil							4.2E-06					0.1

Table E-42R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
						Total Risk Across All Media - On-Site	5.4E-06				Total Hazard Across All Media - On-Site	0.2
						Total Risk Across All Media - Flenniken Branch	4.2E-06				Total Hazard Across All Media - Flenniken Branch	0.1

Table E-43R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	4.3E-07	NA	5.5E-0[illegible]	4.9E-07	Developmental	0.02	NA	0.002	0.02
			Aluminum	NA	NA	NA	NA	Nervous system	0.02	NA	NA	0.02
			Arsenic	1.[illegible]E-06	NA	3.[illegible]E-07	2.2E-06	Skin	0.01	NA	0.003	0.02
			Chromium	2.1E-06	NA	NA	2.1E-06	None observed	0.005	NA	NA	0.005
			Cobalt	NA	NA	NA	NA	Thyroid	0.02	NA	NA	0.02
			Copper	NA	NA	NA	NA	NA	0.004	NA	NA	0.004
			Iron	NA	NA	NA	NA	Gastrointestinal	0.02	NA	NA	0.02
			Manganese	NA	NA	NA	NA	Nervous system	0.02	NA	NA	0.02
			Thallium	NA	NA	NA	NA	Hair	0.03	NA	NA	0.03
			Vanadium	NA	NA	NA	NA	Kidney	0.003	NA	NA	0.003
			Zinc	NA	NA	NA	NA	Blood	0.0009	NA	NA	0.0009
			Chemical Total	4.3E-06	NA	4.3E-07	4.[illegible]E-06		0.2	NA	0.005	0.2
		On-Site Total					4.[illegible]E-06					0.2
	Surface Soil Total						4.[illegible]E-06					0.2
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	3.0E-12	NA	3.0E-12	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000007	NA	0.000000000007
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000000	NA	0.000000
			Arsenic	NA	2.0E-10	NA	2.0E-10	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000001	NA	0.000001
			Chromium	NA	4E-09	NA	4E-09	Respiratory system	NA	0.000003	NA	0.000003
			Cobalt	NA	4.2E-10	NA	4.2E-10	Respiratory system	NA	0.000003	NA	0.000003
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0003	NA	0.0003
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.000004	NA	0.000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	5.0E-09	NA	5.0E-09		NA	0.0004	NA	0.0004
		On-Site Total					5.0E-09					0.0004
	Air Total						5.0E-09					0.0004
Total On-Site Soil							4.[illegible]E-06					0.2

Table E-43R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	4.3E-09	NA	2.3E-09	6.6E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4E-0	NA	4.6E-0	1.3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	9.2E-09	NA	5.0E-09	1.4E-0	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	4E-10	NA	4.6E-10	1.3E-09	NA	NA	NA	NA	NA
			Chrysene	0E-11	NA	4.4E-11	1.2E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	1.5E-07	NA	1.9E-0	1.7E-07	Developmental	0.0006	NA	0.00007	0.0006
			Aluminum	NA	NA	NA	NA	Nervous system	0.0006	NA	NA	0.0006
			Arsenic	1.0E-06	NA	2.2E-07	1.3E-06	Skin	0.000	NA	0.0002	0.001
			Chromium	1.6E-06	NA	NA	1.6E-06	None observed	0.0004	NA	NA	0.0004
			Cobalt	NA	NA	NA	NA	Thyroid	0.002	NA	NA	0.002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.002	NA	NA	0.002
			Manganese	NA	NA	NA	NA	Nervous system	0.0003	NA	NA	0.0003
			Thallium	NA	NA	NA	NA	Hair	0.004	NA	NA	0.004
			Chemical Total	2.9E-06	NA	2.9E-07	3.2E-06		0.1	NA	0.0002	0.1
		Flenniken Branch Total					3.2E-06					0.1
	Surface Soil Total						3.2E-06					0.1
	Air	Flenniken Branch	Benzo(a)anthracene	NA	1.5E-14	NA	1.5E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	3.0E-13	NA	3.0E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	3.3E-14	NA	3.3E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	3.0E-14	NA	3.0E-14	NA	NA	NA	NA	NA
			Chrysene	NA	2.9E-15	NA	2.9E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	1.0E-12	NA	1.0E-12	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000002	NA	0.000000000002
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000003	NA	0.000003
			Arsenic	NA	1.2E-10	NA	1.2E-10	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000000006	NA	0.000000006
			Chromium		6.4E-09	NA	6.4E-09	Respiratory system	NA	0.000000003		0.000000003
			Cobalt	NA	3.0E-10	NA	3.0E-10	Respiratory system	NA	0.000002	NA	0.000002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.0003	NA	0.0003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00002	NA	0.00002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	6.0E-09	NA	6.0E-09		NA	0.0004	NA	0.0004
		Flenniken Branch Total					3.2E-06					0.1
	Air Total						6.0E-09					0.0004
Total Flenniken Branch Soil							3.2E-06					0.1

Table E-43R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
						Total Risk Across All Media - On-Site	4 E-06				Total Hazard Across All Media - On-Site	0.2
						Total Risk Across All Media - Flenniken Branch	3.2E-06				Total Hazard Across All Media - Flenniken Branch	0.1

Table E-44R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=0.5hr Cancer=Future
Exposure Population Recreational User
Exposure Age Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	2.4E-10	NA	1.7E-09	2.0E-09	Developmental	0.00E+00	NA	0.00E+00	0.00E+00
			Aluminum	NA	NA	NA	NA	Nervous System	0.00E+00	NA	NA	0.00E+00
			Arsenic	1.0E-07	NA	1.2E-09	1.1E-07	Skin	0.00E+00	NA	0.00E+00	0.00E+00
			Chromium	1.2E-07	NA	NA	1.2E-07	Non-observed	0.00E+00	NA	NA	0.00E+00
			Cobalt	NA	NA	NA	NA	Thyroid	0.00E+00	NA	NA	0.00E+00
			Copper	NA	NA	NA	NA	NA	0.00E+00	NA	NA	0.00E+00
			Iron	NA	NA	NA	NA	Gastrointestinal	0.00E+00	NA	NA	0.00E+00
			Manganese	NA	NA	NA	NA	Nervous System	0.00E+00	NA	NA	0.00E+00
			Thallium	NA	NA	NA	NA	Hair	0.00E+00	NA	NA	0.00E+00
			Vanadium	NA	NA	NA	NA	Fetus	0.00E+00	NA	NA	0.00E+00
			Zinc	NA	NA	NA	NA	Blood	0.00E+00	NA	NA	0.00E+00
			Chemical Total	2.4E-07	NA	1.4E-09	2.5E-07		0.00E+00	NA	0.00E+00	0.00E+00
		On-Site Total					2.5E-07					0.00E+00
	Surface Soil Total						2.5E-07					0.00E+00
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	4.4E-14	NA	4.4E-14	Liver Reproductive System Developmental Endocrine System Reproductive System Blood	NA	0.00E+00	NA	0.00E+00
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00E+00	NA	0.00E+00
			Arsenic	NA	2.4E-11	NA	2.4E-11	Developmental Cardiovascular System Nervous System Lung Skin	NA	0.00E+00	NA	0.00E+00
			Chromium	NA	9.4E-10	NA	9.4E-10	Reproductive System	NA	0.00E+00	NA	0.00E+00
			Cobalt	NA	4.7E-11	NA	4.7E-11	Reproductive System	NA	0.00E+00	NA	0.00E+00
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.00E+00	NA	0.00E+00
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Reproductive System	NA	0.00E+00	NA	0.00E+00
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-09	NA	1.0E-09		NA	0.00E+00	NA	0.00E+00
		On-Site Total					1.0E-09					0.00E+00
	Air Total						1.0E-09					0.00E+00
Total On-Site Soil							2.5E-07					0.00E+00

Table E-44R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	2.4E-10	NA	7.5E-11	3.1E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4.7E-09	NA	1.5E-09	6.1E-09	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	5.1E-10	NA	1.6E-10	6.7E-10	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	4.7E-11	NA	1.5E-11	6.1E-11	NA	NA	NA	NA	NA
			Chrysene	4.5E-12	NA	1.4E-12	5.9E-12	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	2E-09	NA	5.9E-10	E-09	Developmental	0.00007	NA	0.000005	0.0000
			Aluminum	NA	NA	NA	NA	Nervous system	0.00007	NA	NA	0.00007
			Arsenic	5.0E-0	NA	7.0E-09	6.5E-0	Skin	0.0001	NA	0.00001	0.0001
			Chromium	9.0E-0	NA	NA	9.0E-0	None observed	0.00005	NA	NA	0.00005
			Cobalt	NA	NA	NA	NA	Thyroid	0.0002	NA	NA	0.0002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.00002	NA	NA	0.00002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0002	NA	NA	0.0002
			Manganese	NA	NA	NA	NA	Nervous system	0.00004	NA	NA	0.00004
			Thallium	NA	NA	NA	NA	Hair	0.0005	NA	NA	0.0005
			Chemical Total	1.6E-07	NA	9.4E-09	1.7E-07		0.001	NA	0.00002	0.001
		Flenniken Branch Total					1.7E-07					0.001
	Surface Soil Total						1.7E-07					0.001
	Air	Flenniken Branch	Benzo(a)anthracene	NA	1.7E-15	NA	1.7E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	3.3E-14	NA	3.3E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	3.7E-15	NA	3.7E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	3.3E-15	NA	3.3E-15	NA	NA	NA	NA	NA
			Chrysene	NA	3.2E-16	NA	3.2E-16	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	1.1E-13	NA	1.1E-13	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000006	NA	0.000000000006
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000007	NA	0.000007
			Arsenic	NA	1.3E-11	NA	1.3E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000002	NA	0.000002
			Chromium	NA	7.1E-10	NA	7.1E-10	Respiratory system	NA	0.000007	NA	0.000007
			Cobalt	NA	3.3E-11	NA	3.3E-11	Respiratory system	NA	0.000005	NA	0.000005
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.00009	NA	0.00009
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.000005	NA	0.000005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	7.6E-10	NA	7.6E-10		NA	0.00009	NA	0.00009
		Flenniken Branch Total					1.7E-07					0.001
	Air Total						7.6E-10					0.00009
Total Flenniken Branch Soil							1.7E-07					0.001

Table E-44R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
						Total Risk Across All Media - On-Site	2.6E-07				Total Hazard Across All Media - On-Site	0.02
						Total Risk Across All Media - Flenniken Branch	1.7E-07				Total Hazard Across All Media - Flenniken Branch	0.01

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Total Soil	On-Site	Benzo(a)anthracene	2.4E-09	NA	9.1E-10	3.4E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.7E-08	NA	1.1E-08	3.8E-08	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.0E-09	NA	1.2E-09	4.2E-09	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.7E-10	NA	1.1E-10	3.8E-10	NA	NA	NA	NA	NA
			Chrysene	2.0E-11	NA	1.2E-11	4.2E-11	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.0E-09	NA	8.3E-10	2.8E-09	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	1.5E-07	NA	1.4E-08	1.7E-07	Developmental	0.1	NA	0.001	0.1
			PCB-1242	4.4E-08	NA	1.9E-08	6.3E-08	Immune System	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	0.004	NA	NA	0.004
			Arsenic	6.2E-07	NA	9.1E-08	7.1E-07	Skin	0.1	NA	0.002	0.1
			Chromium	7.5E-07	NA	NA	7.5E-07	Non-specified	0.004	NA	NA	0.004
			Cobalt	NA	NA	NA	NA	Thyroid	0.2	NA	NA	0.2
			Copper	NA	NA	NA	NA	NA	0.002	NA	NA	0.002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.2	NA	NA	0.2
			Magnesium	NA	NA	NA	NA	Nervous System	0.2	NA	NA	0.2
			Thallium	NA	NA	NA	NA	Hair	0.2	NA	NA	0.2
			Vanadium	NA	NA	NA	NA	Kidney	0.002	NA	NA	0.002
			Zinc	NA	NA	NA	NA	Blood	0.000	NA	NA	0.000
			Chemical Total	1.0E-06	NA	1.8E-07	1.2E-06		0.4	NA	0.002	1
		On-Site Total					1.2E-06					1
	Total Soil Total						1.2E-06					1

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	On-Site	Benzo(a)anthracene	NA	5.2E-15	NA	5.2E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	5.[illegible]E-14	NA	5.[illegible]E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	[illegible].4E-15	NA	[illegible].4E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	5.[illegible]E-15	NA	5.[illegible]E-15	NA	NA	NA	NA	NA
			Chrysene	NA	[illegible].4E-1[illegible]	NA	[illegible].4E-1[illegible]	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	NA	4.4E-15	NA	4.4E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	[illegible].4E-1[illegible]	NA	[illegible].4E-1[illegible]	Liver, Reproductive System, Developmental, Endocrine System, Reproductive System, Blood	NA	[illegible]	NA	[illegible]
			PCB-1254	NA	1.2E-[illegible]	NA	1.2E-[illegible]	NA	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	4.[illegible]E-11	NA	4.[illegible]E-11	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	[illegible]5	NA	[illegible]5
			Chromium	NA	1.[illegible]E-[illegible]	NA	1.[illegible]E-[illegible]	Respiratory System	NA	[illegible]2	NA	[illegible]2
			Cobalt	NA	[illegible].2E-11	NA	[illegible].2E-11	Respiratory System	NA	[illegible]1	NA	[illegible]1
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	[illegible]1	NA	[illegible]1
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	[illegible]2	NA	[illegible]2
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.4E-[illegible]	NA	1.4E-[illegible]		NA	[illegible]2	NA	[illegible]2
		On-Site Total					1.4E-[illegible]					[illegible]2
	Air Total						1.4E-[illegible]					[illegible]2
Total On-Site Soil							1.[illegible]E-[illegible]					1

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Total Soil	Floodplain Erosion	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.5E-09	NA	6.2E-10	2.1E-09	NA	NA	NA	NA	NA
			1,2,3,7,8-Pentachlorodibenzo-p-dioxin	2.0E-10	NA	1.2E-10	4.2E-10	NA	NA	NA	NA	NA
			1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	4.2E-09	NA	1.4E-09	4.6E-09	NA	NA	NA	NA	NA
			1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	2.0E-10	NA	1.2E-10	4.2E-10	NA	NA	NA	NA	NA
			Chrysene	2.1E-11	NA	1.2E-11	4.0E-11	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	5.2E-09	NA	4.0E-09	5.7E-09	Developmental	0.004	NA	0.0004	0.004
			Aluminum	NA	NA	NA	NA	Nervous System	0.004	NA	NA	0.004
			Arsenic	4.7E-07	NA	5.1E-08	4.4E-07	Skin	0.006	NA	0.0001	0.007
			Chromium	5.7E-07	NA	NA	5.7E-07	Non-specified	0.004	NA	NA	0.004
			Cobalt	NA	NA	NA	NA	Thyroid	0.1	NA	NA	0.1
			Copper	NA	NA	NA	NA	Reproductive System	0.001	NA	NA	0.001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.1	NA	NA	0.1
			Magnesium	NA	NA	NA	NA	Nervous System	0.002	NA	NA	0.002
			Thallium	NA	NA	NA	NA	Hair	0.4	NA	NA	0.4
			Chemical Total	1.0E-06	NA	7.7E-08	1.1E-06		0.7	NA	0.001	0
		Floodplain Erosion Total					1.1E-06					0
	Total Soil Total						1.1E-06					0

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Exposure Future
Exposure Frequency Construction Worker
Exposure Age Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	4.4E-15	NA	4.4E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	6.4E-14	NA	6.4E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	7.0E-15	NA	7.0E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	6.4E-15	NA	6.4E-15	NA	NA	NA	NA	NA
			Chrysene	NA	6.1E-16	NA	6.1E-16	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	2.2E-14	NA	2.2E-14	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	[illegible]	NA	[illegible]
			Aluminum	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	2.5E-11	NA	2.5E-11	Developmental, Cardiovascular, Nervous System, Lung, Skin	NA	[illegible]	NA	[illegible]
			Chromium		1.4E-04		1.4E-04	Respiratory System	NA	[illegible]	NA	[illegible]
			Cobalt	NA	6.4E-11	NA	6.4E-11	Respiratory System	NA	[illegible]	NA	[illegible]
			Copper	NA	NA	NA	NA	Thyroid	NA	[illegible]	NA	[illegible]
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.4E-04	NA	1.4E-04		NA	[illegible]	NA	[illegible]
		Fugitive Emission Total					1.4E-04					[illegible]
	Air Total						1.4E-04					[illegible]
Total Fugitive Emission Soil							1.1E-06					0
Total Risk Across All Media - One Site							1.1E-06	Total Hazard Across All Media - One Site				1
Total Developmental HI												0.1
Total Nervous System HI												0.1
Total Skin HI												0.1
Total Thyroid HI												0.2
Total Gastrointestinal HI												0.2
Total Hair HI												0.2
Total Blood HI												[illegible]
Total Liver HI												[illegible]
Total Reproductive System HI												[illegible]
Total Endocrine System HI												[illegible]
Total Lung/Respiratory Tract HI												[illegible]
Total Cardiovascular System HI												[illegible]
Total Risk Across All Media - Fugitive Emission							1.1E-06	Total Hazard Across All Media - Fugitive Emission				0

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Total Soil	On-Site	Benzo(a)anthracene	1.[illegible]E-10	NA	1.0E-10	4.4E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.0E-11	NA	1.[illegible]E-11	4.0E-11	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.2E-10	NA	2.0E-10	4.2E-10	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.0E-11	NA	1.[illegible]E-11	4.0E-11	NA	NA	NA	NA	NA
			Chrysene	2.2E-12	NA	2.0E-12	4.2E-12	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.5E-10	NA	1.4E-10	2.9E-10	NA	NA	NA	NA	NA
			2,4,7,8-TCDD (TEQ)	1.2E-11	NA	2.4E-11	1.4E-11	Developmental	[illegible]	NA	[illegible]	[illegible]
			PCB-1242	4.4E-11	NA	4.2E-11	8.5E-11	Ex: Immune System	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	[illegible]	NA	NA	[illegible]
			Arsenic	4.7E-11	NA	1.0E-11	5.4E-11	Skin	[illegible]	NA	[illegible]	[illegible]
			Chromium	5.7E-11	NA	NA	5.7E-11	Nervous System	[illegible]	NA	NA	[illegible]
			Cobalt	NA	NA	NA	NA	Thyroid	[illegible]	NA	NA	[illegible]
			Copper	NA	NA	NA	NA	NA	[illegible]	NA	NA	[illegible]
			Iron	NA	NA	NA	NA	Gastrointestinal	[illegible]	NA	NA	[illegible]
			Manganese	NA	NA	NA	NA	Nervous System	[illegible]	NA	NA	[illegible]
			Thallium	NA	NA	NA	NA	Hair	[illegible]	NA	NA	[illegible]
			Vanadium	NA	NA	NA	NA	Kidney	[illegible]	NA	NA	[illegible]
			Zinc	NA	NA	NA	NA	Blood	[illegible]	NA	NA	[illegible]
			Chemical Total	1.2E-07	NA	2.4E-07	1.5E-07		[illegible]	NA	[illegible]	[illegible]
		On-Site Total					1.5E-07					[illegible]
	Total Soil Total						1.5E-07					[illegible]

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	On-Site	Benzo(a)anthracene	NA	1.4E-15	NA	1.4E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.5E-14	NA	1.5E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.6E-15	NA	1.6E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.5E-15	NA	1.5E-15	NA	NA	NA	NA	NA
			Chrysene	NA	1.6E-16	NA	1.6E-16	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	NA	1.1E-15	NA	1.1E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	1.6E-14	NA	1.6E-14	Liver, Reproductive System, Developmental Endocrine System, Respiratory System, Blood	NA	**********	NA	**********
			PCB-1242	NA	4.0E-11	NA	4.0E-11	NA	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Arsenic	NA	1.1E-11	NA	1.1E-11	Developmental, Cardiovascular System Nervous System, Lung, Skin	NA	*******	NA	*******
			Chromium	NA	4.5E-10	NA	4.5E-10	Respiratory System	NA	********	NA	********
			Cobalt	NA	2.4E-11	NA	2.4E-11	Respiratory System	NA	*******	NA	*******
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	********	NA	********
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.5E-10	NA	4.5E-10		NA	*******	NA	*******
		On-Site Total					4.5E-10					*******
	Air Total						4.5E-10					*******
Total On-Site Soil							1.5E-07					*****

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Total Soil	Flenniken Branch	Benzo(a)anthracene	1.1E-10	NA	1.0E-10	2.2E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.2E-09	NA	2.0E-09	4.2E-09	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.5E-10	NA	2.2E-10	4.7E-10	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.2E-11	NA	2.0E-11	4.2E-11	NA	NA	NA	NA	NA
			Chrysene	2.1E-12	NA	1.9E-12	4.1E-12	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	3.9E-09	NA	2E-10	4.1E-09	Developmental	0.0003	NA	0.00006	0.0004
			Aluminum	NA	NA	NA	NA	Nervous system	0.0003	NA	NA	0.0003
			Arsenic	2.1E-0	NA	9.7E-09	3.1E-0	Skin	0.0004	NA	0.0002	0.0006
			Chromium	4.3E-0		NA	4.3E-0	None observed	0.0002	NA	NA	0.0002
			Cobalt	NA	NA	NA	NA	Thyroid	0.1	NA	NA	0.1
			Cyanide	NA	NA	NA	NA	Reproductive system	0.00009	NA	NA	0.0001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0009	NA	NA	0.0009
			Manganese	NA	NA	NA	NA	Nervous system	0.0002	NA	NA	0.0002
			Thallium	NA	NA	NA	NA	Hair	0.02	NA	NA	0.02
			Chemical Total	7.7E-0	NA	1.3E-0	9.0E-0		0.2	NA	0.0002	0.2
		Flenniken Branch Total					9.0E-0					0.2
	Total Soil Total						9.0E-0					0.2

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Dust	Benzo(a)anthracene	NA	1E-10	NA	1E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.6E-14	NA	1.6E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1 E-15	NA	1 E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.6E-15	NA	1.6E-15	NA	NA	NA	NA	NA
			Chrysene	NA	1.5E-10	NA	1.5E-10	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	NA	5.5E-14	NA	5.5E-14	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	**********	NA	**********
			Aluminum	NA	NA	NA	NA	Nervous System, Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	*******	NA	*******
			Arsenic	NA	6.4E-12	NA	6.4E-12		NA	*********	NA	*********
			Chromium	NA	4.4E-10	NA	4.4E-10	Respiratory System	NA	*********	NA	*********
			Cobalt	NA	1.6E-11	NA	1.6E-11	Respiratory System	NA	*******	NA	*******
			Cyanide	NA	NA	NA	NA	Thyroid	NA	****	NA	****
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.6E-10	NA	4.6E-10		NA	****	NA	****
		Fugitive Dust Total					4.6E-10					****
	Air Total						4.6E-10					****
Total Fugitive Dust Soil							4.6E-10					**
Total PAH Across All Media - One Chemical							1.5E-09	Total Hazard Across All Media - One Chemical				****
Total PAH Across All Media - Fugitive Dust							4.6E-10	Total Hazard Across All Media - Fugitive Dust				**

Table E-47R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	5.4E-06	NA	4.6E-07	5.8E-06	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Arsenic	2.2E-05	NA	2.5E-06	2.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	Non-specified	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	Thyroid	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	Gastrointestinal	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Kidney	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	Blood	NA	NA	NA	NA
			Chemical Total	1.6E-04	NA	4.7E-06	1.6E-04		NA	NA	NA	NA
		On-Site Total					1.6E-04					NA
	Total Soil Total						1.6E-04					NA
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	7.0E-11	NA	7.0E-11	Liver; Reproductive System; Developmental; Endocrine System; Reproductive System; Blood	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System; Developmental; Cardiovascular System; Nervous System; Lung; Skin	NA	NA	NA	NA
			Arsenic	NA	4.7E-04	NA	4.7E-04		NA	NA	NA	NA
			Chromium	NA	5.4E-07	NA	5.4E-07	Respiratory System	NA	NA	NA	NA
			Cobalt	NA	1.0E-10	NA	1.0E-10	Respiratory System	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-04	NA	5.1E-07		NA	NA	NA	NA
		On-Site Total					5.1E-07					NA
	Air Total						5.1E-07					NA
Total On-Site Soil							1.6E-04					NA

Table E-47R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	2.4E-07	NA	6.0E-0[illegible]	3.0E-07	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4.[illegible]E-06	NA	1.2E-06	5.9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	5.2E-07	NA	1.3E-07	6.5E-07	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	4.[illegible]E-0[illegible]	NA	1.2E-0[illegible]	5.9E-0[illegible]	NA	NA	NA	NA	NA
			Chrysene	4.6E-09	NA	1.1E-09	5.7E-09	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	1.9E-06	NA	1.2E-07	2.0E-06	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous system	NA	NA	NA	NA
			Arsenic	1.3E-05	NA	1.5E-06	1.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	NA	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Cyanide	NA	NA	NA	NA	Reproductive system	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Chemical Total	1.4E-04	NA	3.0E-06	1.4E-04		NA	NA	NA	NA
		Flenniken Branch Total					1.4E-04					NA
	Surface Soil Total						1.4E-04					NA

Table E-47R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Air	Flenniken Branch	Benzo(a)anthracene	NA	9.1E-13	NA	9.1E-13	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.9E-11	NA	1.9E-11	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	2.1E-12	NA	2.1E-12	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.9E-12	NA	1.9E-12	NA	NA	NA	NA	NA
			Chrysene	NA	1.1E-13	NA	1.1E-13	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	2.4E-11	NA	2.4E-11	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Arsenic	NA	2.1E-09	NA	2.1E-09	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	NA	NA	NA
			Chromium	NA	5.4E-07	NA	5.4E-07	NA	NA	NA	NA	NA
			Cobalt	NA	6.9E-09	NA	6.9E-09	NA	NA	NA	NA	NA
			Cyanide	NA	NA	NA	NA	Thyroid	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	5.5E-07	NA	5.5E-07		NA	NA	NA	NA
		Flenniken Branch Total					5.5E-07					NA
	Air Total						5.5E-07					NA
Total Flenniken Branch Soil							1.4E-04					NA
						Total Risk Across All Media - On-Site	1.5E-04				Total Hazard Across All Media - On-Site	NA
						Total Risk Across All Media - Flenniken Branch	1.4E-04				Total Hazard Across All Media - Flenniken Branch	NA

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.5	NA	0.004	0.5
			Aluminum	NA	NA	NA	NA	Nervous System	0.0	NA	NA	0.0
			Arsenic	NA	NA	NA	NA	Skin	0.7	NA	0.00	0
			Chromium	NA	NA	NA	NA	Hematopoietic	0.2	NA	NA	0.2
			Cobalt	NA	NA	NA	NA	Thyroid	0.7	NA	NA	0.7
			Copper	NA	NA	NA	NA	NA	0.1	NA	NA	0.1
			Iron	NA	NA	NA	NA	Gastrointestinal	0.7	NA	NA	0.7
			Manganese	NA	NA	NA	NA	Nervous System	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	0	NA	NA	0
			Vanadium	NA	NA	NA	NA	Kidney	0.1	NA	NA	0.1
			Zinc	NA	NA	NA	NA	Blood	0.004	NA	NA	0.004
			Chemical Total	NA	NA	NA	NA		5.	NA	0.004	5.
		On-Site Total					NA					5.
	Surface Soil Total						NA					5.
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.00000001	NA	0.00000001
			Aluminum	NA	NA	NA	NA	Nervous System Developmental Cardiovascular System Nervous System Lung Skin	NA	0.0001	NA	0.0001
			Arsenic	NA	NA	NA	NA		NA	0.00002	NA	0.00002
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.00000.	NA	0.00000.
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.00005	NA	0.00005
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0005	NA	0.0005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.00007	NA	0.00007
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0007	NA	0.0007
		On-Site Total					NA					0.0007
	Air Total						NA					0.0007
Total On-Site Soil							NA					5.

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Floodplain Erosion	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.2	NA	0.0004	0.2
			Aluminum	NA	NA	NA	NA	Nervous System	0.2	NA	NA	0.2
			Arsenic	NA	NA	NA	NA	Skin	0.4	NA	0.004	0.5
			Chromium	NA	NA	NA	NA	Non-noticeable	0.1	NA	NA	0.1
			Cobalt	NA	NA	NA	NA	Thyroid	0.5	NA	NA	0.5
			Copper	NA	NA	NA	NA	Reproductive System	0.005	NA	NA	0.005
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0	NA	NA	0.0
			Manganese	NA	NA	NA	NA	Nervous System	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	1	NA	NA	1
			Chemical Total	NA	NA	NA	NA		4	NA	0.04	4
		Floodplain Erosion Total					NA					4
	Surface Soil Total						NA					4

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Reproductive System, Blood	NA	0.000000004	NA	0.000000004
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00005	NA	0.00005
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	NA	NA	NA	Reproductive System	NA	0.000005	NA	0.000005
			Cobalt	NA	NA	NA	NA	Reproductive System	NA	0.00001		0.00001
			Copper	NA	NA	NA	NA	Thyroid	NA	0.0001	NA	0.0001
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0007	NA	0.01
		Fugitive Emission Total					NA					0.01
	Air Total						NA					0.01
Total Fugitive Emission Soil							NA					4

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Total PAH Across All Media - On-Site							NA	Total Hazard Across All Media - On-Site				5
Total Lung/Respiratory Tract HI												0.0007
Total Cardiopulmonary HI												0.0
Total Nervous System HI												0.7
Total Skin HI												0
Total Thyroid HI												0.7
Total Gastrointestinal HI												0.7
Total Hair HI												0
Total Blood HI												0.004
Total Liver HI												0.0000001
Total Reproductive System HI												0.0000001
Total Endocrine System HI												0.0000001
Total Cardiovascular System HI												0.0000
Total PAH Across All Media - Flood-to-Ecorisk							NA	Total Hazard Across All Media - Flood-to-Ecorisk				4
Total Cardiopulmonary HI												0.2
Total Nervous System HI												0.4
Total Skin HI												0.5
Total Thyroid HI												0.0
Total Reproductive System HI												0.05
Total Hair HI												1
Total Liver HI												0.0000004
Total Respiratory System HI												0.05
Total Endocrine System HI												0.0000004
Total Blood HI												0.0000004
Total Cardiovascular System HI												0.0000

Table E-49R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.005	NA	0.0000	0.005
			Aluminum	NA	NA	NA	NA	Neurological System	0.05	NA	NA	0.05
			Arsenic	NA	NA	NA	NA	Skin	0.07	NA	0.0004	0.07
			Chromium	NA	NA	NA	NA	Hematological	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.07	NA	NA	0.07
			Copper	NA	NA	NA	NA	NA	0.001	NA	NA	0.001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.07	NA	NA	0.07
			Manganese	NA	NA	NA	NA	Neurological System	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.01	NA	NA	0.01
			Vanadium	NA	NA	NA	NA	Kidney	0.0004	NA	NA	0.0004
			Zinc	NA	NA	NA	NA	Blood	0.0004	NA	NA	0.0004
			Chemical Total	NA	NA	NA	NA		0.4	NA	0.02	0.4
		On-Site Total					NA					0.4
	Surface Soil Total						NA					0.4
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.0000001	NA	0.0000001
			Aluminum	NA	NA	NA	NA	Neurological System	NA	0.001	NA	0.001
			Arsenic	NA	NA	NA	NA	Developmental Cardiovascular System Neurological System Lung Skin	NA	0.00002	NA	0.00002
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.0000	NA	0.0000
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.00005	NA	0.00005
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	0.0005	NA	0.0005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.00007	NA	0.00007
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.007	NA	0.007
		On-Site Total					NA					0.007
	Air Total						NA					0.007
Total On-Site Soil							NA					0.5

Table E-49R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.002	NA	0.0002	0.002
			Aluminum	NA	NA	NA	NA	Nervous system	0.002	NA	NA	0.002
			Arsenic	NA	NA	NA	NA	Skin	0.004	NA	0.0005	0.005
			Chromium	NA	NA	NA	NA	None observed	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.005	NA	NA	0.005
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0005	NA	NA	0.0005
			Iron	NA	NA	NA	NA	Gastrointestinal	0.005	NA	NA	0.005
			Manganese	NA	NA	NA	NA	Nervous system	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.1	NA	NA	0.1
			Chemical Total	NA	NA	NA	NA		0.3	NA	0.0007	0.3
		Flenniken Branch Total					NA					0.3
	Surface Soil Total						NA					0.3

Table E-49R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Air	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	NA	NA	NA	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000004	NA	0.000000004
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00005	NA	0.00005
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	NA	NA	NA	Respiratory system	NA	0.00005	NA	0.00005
			Cobalt	NA	NA	NA	NA	Respiratory system	NA	0.00003	NA	0.00003
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.006	NA	0.006
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.007	NA	0.007
		Flenniken Branch Total					NA					0.3
	Air Total						NA					0.1
Total Flenniken Branch Soil							NA					0.4
						Total Risk Across All Media - On-Site	NA				Total Hazard Across All Media - On-Site	0.5
						Total Risk Across All Media - Flenniken Branch	NA				Total Hazard Across All Media - Flenniken Branch	0.4

Table E-50R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Future
Exposure Frequency=Resident
Exposure Age=Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	2.4E-06	NA	7.7E-07	3.2E-06	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Arsenic	9.7E-06	NA	5.4E-07	1.0E-05	Skin	NA	NA	NA	NA
			Chromium	5.4E-05	NA	NA	5.4E-05	Non-specified	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	Thyroid	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	Gastrointestinal	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Kidney	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	Blood	NA	NA	NA	NA
			Chemical Total	6.0E-05	NA	6.0E-07	6.2E-05		NA	NA	NA	NA
		On-Site Total					6.2E-05					NA
	Surface Soil Total						6.2E-05					NA
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	2.7E-11	NA	2.7E-11	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Arsenic	NA	1.[illegible]E-04	NA	1.[illegible]E-04	Developmental Cardiovascular System Neurological System Lung Skin	NA	NA	NA	NA
			Chromium	NA	1.0E-07	NA	1.0E-07	Respiratory System	NA	NA	NA	NA
			Cobalt	NA	4.[illegible]E-04	NA	4.[illegible]E-04	Respiratory System	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-07	NA	1.0E-07		NA	NA	NA	NA
		On-Site Total					1.0E-07					NA
	Air Total						1.0E-07					NA
Total On-Site Soil							6.2E-05					NA

Table E-50R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	1.1E-07	NA	1.4E-09	1.1E-07	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.2E-06	NA	9.4E-09	2.2E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.4E-07	NA	1.1E-0	2.5E-07	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.2E-0	NA	9.4E-09	3.1E-0	NA	NA	NA	NA	NA
			Chrysene	2.1E-09	NA	2.7E-09	4.[illegible]E-09	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	0E-07	NA	2.6E-0	3E-07	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous system	NA	NA	NA	NA
			Arsenic	5.7E-06	NA	3.1E-07	6.0E-06	Skin	NA	NA	NA	NA
			Chromium	4.2E-05	NA	NA	4.2E-05	NA	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Cyanide	NA	NA	NA	NA	Reproductive system	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Chemical Total	5.1E-05	NA	3.7E-07	5.1E-05		NA	NA	NA	NA
		Flenniken Branch Total					5.1E-05					NA
	Total Soil Total						5.1E-05					NA

Table E-50R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Frequency: Resident
Exposure Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PEF				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Dust	2,3,7,8-Tetrachlorodibenzo-p-dioxin	NA	2.4E-14	NA	2.4E-14	NA	NA	NA	NA	NA
			1,2,3,7,8-Pentachlorodibenzo-p-dioxin	NA	6.7E-12	NA	6.7E-12	NA	NA	NA	NA	NA
			1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	NA	7.4E-14	NA	7.4E-14	NA	NA	NA	NA	NA
			1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	NA	6.7E-14	NA	6.7E-14	NA	NA	NA	NA	NA
			Chromium	NA	6.5E-14	NA	6.5E-14	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	NA	9.2E-12	NA	9.2E-12	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Arsenic	NA	1.1E-04	NA	1.1E-04	Skin	NA	NA	NA	NA
			Chromium	NA	1.4E-07	NA	1.4E-07	NA	NA	NA	NA	NA
			Cobalt	NA	2.4E-04	NA	2.4E-04	NA	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	Reproductive System	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Chemical Total	NA	1.5E-07	NA	1.5E-07		NA	NA	NA	NA
		Fugitive Dust Total					1.5E-07					NA
	Air Total						1.5E-07					NA
Total Fugitive Dust Soil							5.1E-05					NA
Total Risk Across All Media - Cancer Risk							6.7E-05	Total Hazard Across All Media - Cancer Risk				NA
Total Risk Across All Media - Fugitive Dust							5.1E-05	Total Hazard Across All Media - Fugitive Dust				NA

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Future
Exposure Frequency=Resident
Exposure Age=Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.4	NA	0.001	0.4
			Aluminum	NA	NA	NA	NA	Nervous System	0.4	NA	NA	0.4
			Arsenic	NA	NA	NA	NA	Skin	0.4	NA	0.001	0.4
			Chromium	NA	NA	NA	NA	Non-specified	0.1	NA	NA	0.1
			Cobalt	NA	NA	NA	NA	Thyroid	0.4	NA	NA	0.4
			Copper	NA	NA	NA	NA	NA	0.1	NA	NA	0.1
			Iron	NA	NA	NA	NA	Gastrointestinal	0.4	NA	NA	0.4
			Manganese	NA	NA	NA	NA	Nervous System	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	0.4	NA	NA	0.4
			Vanadium	NA	NA	NA	NA	Kidney	0.005	NA	NA	0.005
			Zinc	NA	NA	NA	NA	Blood	0.001	NA	NA	0.001
			Chemical Total	NA	NA	NA	NA		2	NA	0.002	2
		On-Site Total					NA					2
	Surface Soil Total						NA					2
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.0000000000	NA	0.0000000000
			Aluminum	NA	NA	NA	NA	Nervous System Developmental Cardiovascular System Nervous System Lung Skin	NA	0.0001	NA	0.0001
			Arsenic	NA	NA	NA	NA		NA	0.000001	NA	0.000001
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.000004	NA	0.000004
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.000004	NA	0.000004
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.000004	NA	0.000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0005	NA	0.0005
		On-Site Total					NA					0.0005
	Air Total						NA					0.0005
Total On-Site Soil							NA					2

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	NA	NA	NA	Developmental	0.00[illegible]	NA	0.000[illegible]	0.00[illegible]
			Aluminum	NA	NA	NA	NA	Nervous system	0.00[illegible]	NA	NA	0.00[illegible]
			Arsenic	NA	NA	NA	NA	Skin	0.2	NA	0.000[illegible]	0.2
			Chromium	NA	NA	NA	NA	None observed	0.00[illegible]	NA	NA	0.00[illegible]
			Cobalt	NA	NA	NA	NA	Thyroid	0.[illegible]	NA	NA	0.[illegible]
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0[illegible]	NA	NA	0.0[illegible]
			Iron	NA	NA	NA	NA	Gastrointestinal	0.[illegible]	NA	NA	0.[illegible]
			Manganese	NA	NA	NA	NA	Nervous system	0.05	NA	NA	0.05
			Thallium	NA	NA	NA	NA	Hair	0.7	NA	NA	0.7
			Chemical Total	NA	NA	NA	NA		2	NA	0.001	2
		Flenniken Branch Total					NA					2
	Total Soil Total						NA					2

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	**********	NA	**********
			Aluminum	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	*******	NA	*******
			Chromium	NA	NA	NA	NA	Respiratory System	NA	*******	NA	*******
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	*******	NA	*******
			Copper	NA	NA	NA	NA	Thyroid	NA	****	NA	****
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	****	NA	****
		Fugitive Emission Total					NA					****
	Air Total						NA					****
Total Fugitive Emission Soil							NA					2

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
							Total Risk Across All Media - On-Site	NA				Total Hazard Across All Media - On-Site	2
												Total Lung/Respiratory Tract HI	0.0005
												Total Developmental HI	0.3
												Total Nervous System HI	0.3
												Total Skin HI	0.4
												Total Thyroid HI	0.4
												Total Gastrointestinal HI	0.3
												Total Hair HI	0.4
												Total Blood HI	0.01
												Total Liver HI	0.00000001
												Total Reproductive System HI	0.00000001
												Total Endocrine System HI	0.00000001
												Total Cardiovascular System HI	0.0001
							Total Risk Across All Media - Flenniken Branch	NA				Total Hazard Across All Media - Flenniken Branch	2
												Total Developmental HI	0.1
												Total Nervous System HI	0.1
												Total Skin HI	0.2
												Total Thyroid HI	0.3
												Total Reproductive System HI	0.03
												Total Hair HI	1
												Total Liver HI	0.000000003
												Total Reproductive System HI	0.03
												Total Endocrine System HI	0.000000003
												Total Blood HI	0.000000003
												Total Cardiovascular System HI	0.0001

Table E-52R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.02	NA	0.00001	0.02
			Aluminum	NA	NA	NA	NA	Nervous System	0.04	NA	NA	0.04
			Arsenic	NA	NA	NA	NA	Skin	0.04	NA	0.0001	0.04
			Chromium	NA	NA	NA	NA	Hematological	0.0007	NA	NA	0.0007
			Cobalt	NA	NA	NA	NA	Thyroid	0.04	NA	NA	0.04
			Copper	NA	NA	NA	NA	NA	0.0006	NA	NA	0.0006
			Iron	NA	NA	NA	NA	Gastrointestinal	0.04	NA	NA	0.04
			Manganese	NA	NA	NA	NA	Nervous System	0.0006	NA	NA	0.0006
			Thallium	NA	NA	NA	NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA	NA	Kidney	0.0005	NA	NA	0.0005
			Zinc	NA	NA	NA	NA	Blood	0.0001	NA	NA	0.0001
			Chemical Total	NA	NA	NA	NA		0.02	NA	0.00002	0.02
		On-Site Total					NA					0.02
	Surface Soil Total						NA					0.02
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Lower Respiratory System Developmental Endocrine System Reproductive System Blood	NA	0.00000000	NA	0.00000000
			Aluminum	NA	NA	NA	NA	Nervous System Developmental Cardiovascular System Nervous System Lung Skin	NA	0.0001	NA	0.0001
			Arsenic	NA	NA	NA	NA		NA	0.0000001	NA	0.0000001
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.0000004	NA	0.0000004
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.0000004	NA	0.0000004
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.0000004	NA	0.0000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0005	NA	0.0005
		On-Site Total					NA					0.0005
	Air Total						NA					0.0005
Total On-Site Soil							NA					0.02

Table E-52R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	NA	NA	NA	Developmental	0.000	NA	0.00004	0.0009
			Aluminum	NA	NA	NA	NA	Nervous system	0.000	NA	NA	0.000
			Arsenic	NA	NA	NA	NA	Skin	0.002	NA	0.00007	0.002
			Chromium	NA	NA	NA	NA	None observed	0.0006	NA	NA	0.0006
			Cobalt	NA	NA	NA	NA	Thyroid	0.002	NA	NA	0.002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.004	NA	NA	0.004
			Manganese	NA	NA	NA	NA	Nervous system	0.0005	NA	NA	0.0005
			Thallium	NA	NA	NA	NA	Hair	0.007	NA	NA	0.007
			Chemical Total	NA	NA	NA	NA		0.02	NA	0.0001	0.02
		Flenniken Branch Total					NA					0.02
	Total Soil Total						NA					0.02

Table E-52R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Frequency: Present
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PEF				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Reproductive System, Blood	NA	[illegible]	NA	[illegible]
			Aluminum	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	[illegible]	NA	[illegible]
			Chromium	NA	NA	NA	NA	Respiratory System	NA	[illegible]	NA	[illegible]
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	[illegible]	NA	[illegible]
			Copper	NA	NA	NA	NA	Thyroid	NA	[illegible]	NA	[illegible]
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	[illegible]	NA	[illegible]
		Fugitive Emission Total					NA					[illegible]
	Air Total						NA					[illegible]
Total Fugitive Emission Soil							NA					[illegible]
Total PEF Access All Media - Cancer							NA	Total HQ Access All Media - Cancer				[illegible]
Total PEF Access All Media - Fugitive Emission							NA	Total HQ Access All Media - Fugitive Emission				[illegible]

Table E-53
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	2.0E-05	--	1.2E-06	2.1E-05	--	--	--	--	--
			4,4'-DDD	9.9E-08	--	9.5E-07	1.0E-06	--	--	--	--	--
			Benzene	7.9E-07	--	1.2E-07	9.1E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	4.1E-06	--	2.8E-04	2.9E-04	--	--	--	--	--
			Bromodichloromethane	2.5E-07	--	1.8E-08	2.7E-07	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	3.6E-06	--	3.3E-07	3.9E-06	--	--	--	--	--
			Dibenzofuran	--	--	--	--	--	--	--	--	--
			Dieldrin	7.0E-06	--	1.3E-05	2.0E-05	--	--	--	--	--
			Ethylbenzene	2.7E-07	--	1.6E-07	4.3E-07	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	1.5E-05	--	6.0E-05	7.5E-05	--	--	--	--	--
			Phenol	--	--	--	--	--	--	--	--	--
			Tetrachloroethene	1.6E-07	--	9.4E-08	2.5E-07	--	--	--	--	--
			Trichloroethene	1.7E-06	--	2.8E-07	2.0E-06	--	--	--	--	--
			1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Antimony	--	--	--	--	--	--	--	--	--
			Arsenic	2.7E-04	--	1.5E-06	2.7E-04	--	--	--	--	--
			Beryllium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	5.6E-04	--	1.4E-04	7.0E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--
			Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Silver	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	8.6E-04	--	5.0E-04	1.4E-03		--	--	--	--

Table E-53
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
		Shallow Groundwater Total					1.4E-03					--
	Total Shallow Groundwater Total						1.4E-03					--
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			Benzene	--	9.6E-11	--	9.6E-11	--	--	--	--	--
			Bromodichloromethane	--	8.6E-11	--	8.6E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	1.9E-09	--	1.9E-09	--	--	--	--	--
			Chlorobenzene	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	4.7E-11	--	4.7E-11	--	--	--	--	--
			Naphthalene	--	6.3E-10	--	6.3E-10	--	--	--	--	--
			Tetrachloroethene	--	1.2E-11	--	1.2E-11	--	--	--	--	--
			Trichloroethene	--	7.2E-11	--	7.2E-11	--	--	--	--	--
			m-,o-,p-Xylene	--	--	--	--	--	--	--	--	--
			Chemical Total	--	2.3E-09	--	2.3E-09		--	--	--	--
		Shallow Groundwater Total					2.3E-09					--
	Air Total						2.3E-09					--
Total Shallow Groundwater							1.4E-03					--
Groundwater	Groundwater	Deep	1,2-Dichloroethane	1.4E-06	--	6.8E-06	1.5E-06	--	--	--	--	--
			2,4-Dinitrotoluene	5.1E-05	--	3.1E-06	5.4E-05	--	--	--	--	--
			2,6-Dinitrotoluene	9.0E-05	--	6.6E-06	9.6E-05	--	--	--	--	--
			Benzene	6.1E-07	--	9.1E-08	7.0E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	1.2E-05	--	8.3E-04	8.4E-04	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	8.0E-07	--	7.2E-08	8.7E-07	--	--	--	--	--
			Dieldrin	7.2E-06	--	1.3E-05	2.1E-05	--	--	--	--	--
			Heptachlor epoxide	6.3E-06	--	7.8E-06	1.4E-05	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	1.3E-05	--	5.0E-05	6.3E-05	--	--	--	--	--
			Trichloroethene	4.9E-07	--	8.1E-08	5.7E-07	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Arsenic	1.3E-04	--	7.1E-07	1.3E-04	--	--	--	--	--
			Beryllium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	3.8E-04	--	9.3E-05	4.7E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--

Table E-53
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Strontium	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	6.9E-04	--	1.0E-03	1.7E-03		--	--	--	--
		Deep Groundwater Total					1.7E-03					--
	Total Deep Groundwater Total						1.7E-03					--
Groundwater	Air	Deep	1,2-Dichloroethane	--	2.7E-10	--	2.7E-10	--	--	--	--	--
			Benzene	--	7.4E-11	--	7.4E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	4.1E-10	--	4.1E-10	--	--	--	--	--
			Naphthalene	--	3.2E-10	--	3.2E-10	--	--	--	--	--
			Trichloroethene	--	2.1E-11	--	2.1E-11	--	--	--	--	--
			Chemical Total	--	1.1E-09	--	1.1E-09		--	--	--	--
		Deep Groundwater Total					1.1E-09					--
	Air Total						1.1E-09					--
Total Deep Groundwater							1.7E-03					--
			Total Risk Across All Media - Shallow Groundwater				1.4E-03	Total Hazard Across All Media - Shallow Groundwater				--
			Total Risk Across All Media - Deep Groundwater				1.7E-03	Total Hazard Across All Media - Deep Groundwater				--

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.13	--	0.0093	0.14
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.014	--	0.0028	0.017
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.057	--	4.8	4.8
			Bromodichloromethane	--	--	--	--	Kidney	0.00080	--	0.000068	0.00087
			Bromomethane	--	--	--	--	Gastrointestinal	0.052	--	0.0021	0.054
			Chloroform	--	--	--	--	Liver, Blood	0.045	--	0.0049	0.050
			Dibenzofuran	--	--	--	--	Whole Body	0.080	--	0.17	0.25
			Dieldrin	--	--	--	--	Liver	0.034	--	0.076	0.11
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.00096	--	0.00069	0.0017
			Naphthalene	--	--	--	--	Body Weight	0.0078	--	0.0062	0.014
			Pentachlorophenol	--	--	--	--	Liver	0.030	--	0.14	0.17
			Phenol	--	--	--	--	Body Weight	0.026	--	0.0016	0.028
			Tetrachloroethene	--	--	--	--	Nervous System	0.049	--	0.035	0.084
			Trichloroethene	--	--	--	--	Cardiovascular System	0.20	--	0.040	0.24
			(m-and/or p-)xylene	--	--	--	--	Body Weight	0.0022	--	0.0017	0.0040
			Aluminum	--	--	--	--	Nervous System	2.8	--	0.012	2.8
			Antimony	--	--	--	--	Blood	1.0	--	0.029	1.0
			Arsenic	--	--	--	--	Skin	2.3	--	0.010	2.3
			Beryllium	--	--	--	--	Gastrointestinal	0.26	--	0.16	0.42
			Cadmium	--	--	--	--	Kidney	0.23	--	0.021	0.25
			Chromium	--	--	--	--	None observed	0.52	--	0.092	0.61
			Cobalt	--	--	--	--	Thyroid	190	--	0.34	190
			Copper	--	--	--	--	--	0.35	--	0.0015	0.35
			Cyanide	--	--	--	--	Reproductive System	0.89	--	0.0039	0.89
			Iron	--	--	--	--	Gastrointestinal	0.18	--	0.00080	0.18
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	143	--	16	159
			Mercury	--	--	--	--	Kidney	1.2	--	0.073	1.2
			Molybdenum	--	--	--	--	Blood	1.2	--	0.0053	1.2
			Nickel	--	--	--	--	Body Weight	1.9	--	0.042	1.9
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.17	--	0.00077	0.17
			Strontium	--	--	--	--	Bone	0.15	--	0.00066	0.15
			Thallium	--	--	--	--	Hair	113	--	0.5	114
			Vanadium	--	--	--	--	Kidney	0.23	--	0.039	0.27
			Zinc	--	--	--	--	Blood	3.9	--	0.010	3.9
			Chemical Total	--	--	--	--		465	--	22	487
		Shallow Groundwater Total					--					487

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					487
Total Shallow Groundwater							--					487
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.010	--	0.000061	0.011
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.32	--	0.024	0.34
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.78	--	0.069	0.84
			Benzene	--	--	--	--	Blood	0.011	--	0.0022	0.013
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.17	--	14	14
			Bromomethane	--	--	--	--	Cardiovascular	0.10	--	0.0042	0.107
			Chloroform	--	--	--	--	Liver, Blood	0.010	--	0.0011	0.011
			Dieldrin	--	--	--	--	Liver	0.035	--	0.079	0.11
			Heptachlorepoxide	--	--	--	--	Liver	0.21	--	0.31	0.52
			Naphthalene	--	--	--	--	Body Weight	0.0040	--	0.003	0.007
			Pentachlorophenol	--	--	--	--	Liver	0.025	--	0.12	0.14
			Trichloroethene	--	--	--	--	Cardiovascular System	0.058	--	0.012	0.069
			Aluminum	--	--	--	--	Nervous System	0.19	--	0.000085	0.19
			Arsenic	--	--	--	--	Skin	1.1	--	0.0049	1.1
			Barium	--	--	--	--	Cardiovascular	0.12	--	0.075	0.20
			Cadmium	--	--	--	--	Kidney	0.27	--	0.02	0.30
			Chromium	--	--	--	--	None observed	0.35	--	0.062	0.41
			Cobalt	--	--	--	--	Thyroid	2.5	--	0.0045	2.5
			Copper	--	--	--	--	--	0.043	--	0.000019	0.044
			Cyanide	--	--	--	--	Reproductive System	0.91	--	0.0040	0.92
			Iron	--	--	--	--	Gastrointestinal	0.89	--	0.0009	0.90
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	209	--	23	232
			Mercury	--	--	--	--	Kidney	0.026	--	0.0016	0.027
			Molybdenum	--	--	--	--	Blood	2.0	--	0.0068	2.0
			Nickel	--	--	--	--	Body Weight	0.12	--	0.0027	0.12
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.34	--	0.0015	0.34
			Strontium	--	--	--	--	Bone	0.71	--	0.0012	0.72
			Thallium	--	--	--	--	Hair	87	--	0.38	87
			Vanadium	--	--	--	--	Kidney	0.28	--	0.047	0.33
			Zinc	--	--	--	--	Blood	0.021	--	0.000055	0.021
			Chemical Total	--	--	--	--		307	--	38	345
		Deep Groundwater Total					--					345
	Total Deep Groundwater Total						--					345
Total Deep Groundwater							--					345
			Total Risk Across All Media - Shallow Groundwater				--	Total Hazard Across All Media - Shallow Groundwater				487

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Blood HI	6.5
											Total Liver HI	5.5
											Total Kidney HI	1.3
											Total Body Weight HI	2.0
											Total Whole Body HI	0.25
											Total Nervous System HI	16.3
											Total Cardiovascular System HI	0.24
											Total Skin HI	2.3
											Total Gastrointestinal HI	0.66
											Total Thyroid HI	190
											Total Reproductive System HI	0.37
											Total Bone HI	0.15
											Total Hair HI	114
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				345
											Total Kidney HI	0.66
											Total Nervous System HI	233
											Total Blood HI	0.09
											Total Liver HI	16
											Total Spleen HI	0.34
											Total Skin HI	1.5
											Total Bone HI	0.72
											Total Cardiovascular System HI	0.009
											Total Gastrointestinal HI	1.2
											Total Thyroid HI	2.5
											Total Reproductive System HI	0.92
											Total Hair HI	87
											Total Body Weight HI	0.13

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.076	--	0.0043	0.0801
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.0084	--	0.0012	0.009
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.034	--	2.2	2.3
			Bromodichloromethane	--	--	--	--	Kidney	0.000043	--	0.000032	0.000051
			Bromomethane	--	--	--	--	Gastrointestinal	0.031	--	0.00094	0.0399
			Chloroform	--	--	--	--	Liver, Blood	0.027	--	0.0023	0.030
			Dibenzofuran	--	--	--	--	Whole Body	0.043	--	0.079	0.13
			Dieldrin	--	--	--	--	Liver	0.0204	--	0.0358	0.056
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.000053	--	0.000032	0.000085
			Naphthalene	--	--	--	--	Body Weight	0.0047	--	0.0029	0.007
			Pentachlorophenol	--	--	--	--	Liver	0.013	--	0.05	0.064
			Phenol	--	--	--	--	Body Weight	0.01	--	0.00072	0.01
			Tetrachloroethene	--	--	--	--	Nervous System	0.029	--	0.01	0.04
			Trichloroethene	--	--	--	--	Cardiovascular System	0.12	--	0.019	0.14
			1,2,3-trichloropropane	--	--	--	--	Body Weight	0.0013	--	0.00081	0.0022
			Aluminum	--	--	--	--	Nervous System	1.7	--	0.010	1.7
			Antimony	--	--	--	--	Blood	0.59	--	0.024	0.62
			Arsenic	--	--	--	--	Skin	1.4	--	0.0063	1.4
			Barium	--	--	--	--	Gastrointestinal	0.15	--	0.13	0.29
			Cadmium	--	--	--	--	Kidney	0.14	--	0.017	0.16
			Chromium	--	--	--	--	None observed	0.31	--	0.074	0.39
			Cobalt	--	--	--	--	Thyroid	114	--	0.27	114
			Copper	--	--	--	--	--	0.21	--	0.0012	0.21
			Cyanide	--	--	--	--	Reproductive System	0.53	--	0.0012	0.54
			Iron	--	--	--	--	Gastrointestinal	0.11	--	0.00065	0.11
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	86	--	13	99
			Mercury	--	--	--	--	Kidney	0.70	--	0.059	0.76
			Molybdenum	--	--	--	--	Blood	0.72	--	0.004	0.72
			Nickel	--	--	--	--	Body Weight	1.1	--	0.004	1.2
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.105	--	0.00062	0.11
			Strontium	--	--	--	--	Bone	0.090	--	0.00055	0.09
			Thallium	--	--	--	--	Hair	0.6	--	0.40	0.8
			Vanadium	--	--	--	--	Kidney	0.14	--	0.031	0.17
			Zinc	--	--	--	--	Blood	2.3	--	0.0063	2.3
			Chemical Total	--	--	--	--		279	--	16	296
		Shallow Groundwater Total					--					296

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					2%
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	Blood	--	0.000000.4	--	0.000000.4
			Benzene	--	--	--	--	Blood	--	0.000001.2	--	0.000001.2
			Bromodichloromethane	--	--	--	--	--	--	--	--	--
			Bromomethane	--	--	--	--	Respiratory System	--	0.000003.6	--	0.000003.6
			Chloroform	--	--	--	--	Liver	--	0.000002.4	--	0.000002.4
			Dibenzofuran	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	--	--	--	Developmental	--	0.000000005.4	--	0.000000005.4
			Naphthalene	--	--	--	--	Respiratory System	--	0.000001.8	--	0.000001.8
			Tetrachloroethene	--	--	--	--	Nervous System	--	0.000000.4	--	0.000000.4
			Trichloroethene	--	--	--	--	Immune System	--	0.000002.6	--	0.000002.6
			Trichlorofluoromethane	--	--	--	--	Nervous System	--	0.000000.25	--	0.000000.25
			Chemical Total	--	--	--	--		--	0.000006.3	--	0.000006.3
		Shallow Groundwater Total					--					0.000006.3
	Air Total						--					0.000006.3
Total Shallow Groundwater							--					2%
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.000.0	--	0.00027	0.000.3
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.19	--	0.011	0.20
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.47	--	0.032	0.50
			Benzene	--	--	--	--	Blood	0.006.5	--	0.001	0.007.4
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.10	--	6.5	6.6
			Bromomethane	--	--	--	--	Gastrointestinal	0.062	--	0.0019	0.064
			Chloroform	--	--	--	--	Liver, Blood	0.006.04	--	0.0005	0.006.6
			Dieldrin	--	--	--	--	Liver	0.021	--	0.037	0.058
			Heptachlorepoxide	--	--	--	--	Liver	0.12	--	0.15	0.27
			Naphthalene	--	--	--	--	Body Weight	0.0024	--	0.0015	0.0039
			Pentachlorophenol	--	--	--	--	Liver	0.015	--	0.055	0.070
			Trichloroethene	--	--	--	--	Cardiovascular System	0.035	--	0.0054	0.0402
			Aluminum	--	--	--	--	Nervous System	0.12	--	0.000009	0.12
			Arsenic	--	--	--	--	Skin	0.67	--	0.0040	0.67
			Barium	--	--	--	--	Gastrointestinal	0.072	--	0.061	0.13
			Cadmium	--	--	--	--	Kidney	0.16	--	0.020	0.18
			Chromium	--	--	--	--	Nonspecified	0.21	--	0.050	0.26
			Cobalt	--	--	--	--	Thyroid	1.5	--	0.006	1.5
			Copper	--	--	--	--	--	0.026	--	0.000015	0.026
			Cyanide	--	--	--	--	Reproductive System	0.55	--	0.0003	0.55
			Iron	--	--	--	--	Gastrointestinal	0.54	--	0.0002	0.54
			Lead	--	--	--	--	--	--	--	--	--

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Manganese	--	--	--	--	Nervous System	1.25	--	1.9	1.44
			Mercury	--	--	--	--	Kidney	0.015	--	0.0013	0.017
			Molybdenum	--	--	--	--	Blood	1.2	--	0.0071	1.2
			Nickel	--	--	--	--	Body Weight	0.072	--	0.0021	0.075
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.21	--	0.0012	0.21
			Strontium	--	--	--	--	Bone	0.43	--	0.0025	0.43
			Thallium	--	--	--	--	Hair	52	--	0.0100	53
			Vanadium	--	--	--	--	Kidney	0.17	--	0.0033	0.21
			Zinc	--	--	--	--	Blood	0.012	--	0.0000	0.012
			Chemical Total	--	--	--	--		185	--	26	211
		Deep Groundwater Total					--					211
	Total Deep Groundwater Total						--					211
Groundwater	Air	Deep	1,2-Dichloroethane	--	--	--	--	Nervous System	--	0.0000043	--	0.0000043
			Benzene	--	--	--	--	Blood	--	0.00000092	--	0.00000092
			Bromomethane	--	--	--	--	Reproductive System	--	0.000017	--	0.000017
			Chloroform	--	--	--	--	Liver	--	0.00000053	--	0.00000053
			Naphthalene	--	--	--	--	Reproductive System	--	0.0000092	--	0.0000092
			Tetrachloroethene	--	--	--	--	Immune System	--	0.0000074	--	0.0000074
			Chemical Total	--	--	--	--		--	0.0000040	--	0.0000040
		Deep Groundwater Total					--					0.0000040
	Air Total						--					0.0000040
Total Deep Groundwater							--					211
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				26
Total Blood HI												3.9
Total Liver HI												2.6
Total Kidney HI												0.16
Total Body Weight HI												1.2
Total Nervous System HI												101
Total Cardiovascular System HI												0.14
Total Skin HI												1.5
Total Gastrointestinal HI												0.43
Total Thyroid HI												114
Total Reproductive System HI												0.54
Total Bone HI												0.090
Total Hair HI												53
Total Developmental HI												0.000000054
Total Respiratory System HI												0.000027

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Total Immune System HI												0.000026
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				211
Total Kidney HI												0.41
Total Nervous System HI												145
Total Blood HI												16
Total Liver HI												7.4
Total Spleen HI												0.50
Total Gastrointestinal HI												0.74
Total Cardiovascular System HI												0.040
Total Skin HI												0.33
Total Bone HI												0.43
Total Hair HI												53
Total Thyroid HI												1.5
Total Reproductive System HI												0.55
Total Body Weight HI												0.073

Table E-56
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	6.4E-06	--	5.6E-07	6.9E-06	--	--	--	--	--
			4,4'-DDD	3.1E-06	--	4.4E-07	4.7E-07	--	--	--	--	--
			Benzene	2.5E-07	--	5.4E-08	3.0E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	1.3E-06	--	1.3E-04	1.3E-04	--	--	--	--	--
			Bromodichloromethane	8.1E-08	--	8.2E-09	8.9E-08	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	1.1E-06	--	1.5E-07	1.3E-06	--	--	--	--	--
			Chlorodibromo	--	--	--	--	--	--	--	--	--
			Dieldrin	2.2E-06	--	6.0E-06	8.2E-06	--	--	--	--	--
			Ethylbenzene	8.6E-08	--	7.4E-08	1.6E-07	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	4.9E-06	--	2.8E-05	3.2E-05	--	--	--	--	--
			Phenol	--	--	--	--	--	--	--	--	--
			Tetrachloroethene	5.0E-08	--	4.3E-08	9.3E-08	--	--	--	--	--
			Trichloroethene	5.5E-07	--	1.3E-07	6.8E-07	--	--	--	--	--
			Trichlorofluoromethane	--	--	--	--	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Antimony	--	--	--	--	--	--	--	--	--
			Arsenic	8.5E-05	--	4.7E-07	8.6E-05	--	--	--	--	--
			Barium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	2.0E-04	--	--	2.0E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--
			Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Strontium	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	3.0E-04	--	1.6E-04	4.6E-04		--	--	--	--
		Shallow Groundwater Total					4.6E-04					--

Table E-56
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						4.6E-04					--
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			Benzene	--	3.6E-11	--	3.6E-11	--	--	--	--	--
			Bromodichloromethane	--	3.2E-11	--	3.2E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	6.9E-10	--	6.9E-10	--	--	--	--	--
			Dibenzofuran	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	1.7E-11	--	1.7E-11	--	--	--	--	--
			Naphthalene	--	2.4E-10	--	2.4E-10	--	--	--	--	--
			Tetrachloroethene	--	4.6E-12	--	4.6E-12	--	--	--	--	--
			Trichloroethene	--	2.7E-11	--	2.7E-11	--	--	--	--	--
			Trimethylbenzene	--	--	--	--	--	--	--	--	--
			Chemical Total	--	1.0E-09	--	1.0E-09		--	--	--	--
		Shallow Groundwater Total					1.0E-09					--
	Air Total						1.0E-09					--
Total Shallow Groundwater							4.6E-04					--
Groundwater	Groundwater	Deep	1,2-Dichloroethane	4.4E-07	--	3.1E-06	4.7E-07	--	--	--	--	--
			2,4-Dinitrotoluene	1.6E-05	--	1.4E-06	1.8E-05	--	--	--	--	--
			2,6-Dinitrotoluene	2.8E-05	--	3.0E-06	3.1E-05	--	--	--	--	--
			Benzene	1.9E-07	--	4.2E-08	2.3E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	3.8E-06	--	3.8E-04	3.8E-04	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	2.5E-07	--	3.3E-08	2.9E-07	--	--	--	--	--
			Dieldrin	2.3E-06	--	6.1E-06	8.4E-06	--	--	--	--	--
			Heptachlorepoxide	2.0E-06	--	3.6E-06	5.6E-06	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	4.1E-06	--	2.3E-05	2.7E-05	--	--	--	--	--
			Trichloroethene	1.6E-07	--	3.8E-08	2.0E-07	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Arsenic	4.1E-05	--	2.2E-07	4.1E-05	--	--	--	--	--
			Beryllium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	1.3E-04	--	--	1.3E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--
			Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--

Table E-56
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Strontium	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	2.3E-04	--	4.2E-04	6.5E-04		--	--	--	--
		Deep Groundwater Total					6.5E-04					--
	Total Deep Groundwater Total						6.5E-04					--
Groundwater	Air	Deep	1,2-Dichloroethane	--	1.0E-10	--	1.0E-10	--	--	--	--	--
			Benzene	--	2.8E-11	--	2.8E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	1.5E-10	--	1.5E-10	--	--	--	--	--
			Naphthalene	--	1.2E-10	--	1.2E-10	--	--	--	--	--
			Trichloroethene	--	7.8E-12	--	7.8E-12	--	--	--	--	--
			Chemical Total	--	4.1E-10	--	4.1E-10		--	--	--	--
		Deep Groundwater Total					4.1E-10					--
	Air Total						4.1E-10					--
Total Deep Groundwater							6.5E-04					--
						Total Risk Across All Media - Shallow Groundwater	4.6E-04				Total Hazard Across All Media - Shallow Groundwater	--
						Total Risk Across All Media - Deep Groundwater	6.5E-04				Total Hazard Across All Media - Deep Groundwater	--

Table E-67
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.063	--	0.00066	0.070
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.0070	--	0.0016	0.0086
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.029	--	3.4	3.4
			Bromodichloromethane	--	--	--	--	Kidney	0.000040	--	0.000046	0.00045
			Bromomethane	--	--	--	--	Gastrointestinal	0.026	--	0.0014	0.027
			Chloroform	--	--	--	--	Liver, Blood	0.023	--	0.0035	0.026
			Dibromochloromethane	--	--	--	--	Whole Body	0.040	--	0.12	0.16
			Dieldrin	--	--	--	--	Liver	0.017	--	0.054	0.071
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.000046	--	0.000049	0.00097
			Naphthalene	--	--	--	--	Body Weight	0.0029	--	0.0044	0.0063
			Pentachlorophenol	--	--	--	--	Liver	0.015	--	0.10	0.11
			Phenol	--	--	--	--	Body Weight	0.013	--	0.0011	0.0141
			Tetrachloroethene	--	--	--	--	Nervous System	0.024	--	0.025	0.049
			Trichloroethene	--	--	--	--	Cardiovascular System	0.10	--	0.028	0.127
			Trichlorofluoromethane	--	--	--	--	Body Weight	0.00011	--	0.00012	0.00023
			Aluminum	--	--	--	--	Nervous System	1.4	--	0.00062	1.4067
			Antimony	--	--	--	--	Blood	0.50	--	0.015	0.510
			Arsenic	--	--	--	--	Skin	1.2	--	0.0051	1.169
			Barium	--	--	--	--	Gastrointestinal	0.13	--	0.081	0.210
			Cadmium	--	--	--	--	Kidney	0.12	--	0.0100	0.1267
			Chromium	--	--	--	--	None observed	0.26	--	0.046	0.307
			Cobalt	--	--	--	--	Thyroid	95	--	0.17	95.16
			Copper	--	--	--	--	--	0.17	--	0.00077	0.17529
			Cyanide	--	--	--	--	Reproductive System	0.44	--	0.0020	0.4450
			Iron	--	--	--	--	Gastrointestinal	0.090	--	0.000040	0.091
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	72	--	7.9	80
			Mercury	--	--	--	--	Kidney	0.56	--	0.007	0.62
			Molybdenum	--	--	--	--	Blood	0.60	--	0.0026	0.60
			Nickel	--	--	--	--	Body Weight	0.74	--	0.021	0.76
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.087	--	0.000038	0.087
			Strontium	--	--	--	--	Bone	0.075	--	0.000003	0.075
			Thallium	--	--	--	--	Hair	57	--	0.25	57
			Vanadium	--	--	--	--	Kidney	0.11	--	0.019	0.13
			Zinc	--	--	--	--	Blood	1.9	--	0.0051	1.9
			Chemical Total	--	--	--	--		232	--	12	245
		Shallow Groundwater Total					--					245

Table E-67
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					245
Total Shallow Groundwater							--					245
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.0050	--	0.000061	0.0056
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.16	--	0.024	0.18
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.39	--	0.067	0.46
			Benzene	--	--	--	--	Blood	0.0054	--	0.0022	0.0075
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.064	--	14	14
			Bromomethane	--	--	--	--	Gastrointestinal	0.052	--	0.0042	0.056
			Chloroform	--	--	--	--	Liver, Blood	0.0050	--	0.0011	0.0061
			Dieldrin	--	--	--	--	Liver	0.017	--	0.079	0.096
			Heptachlorepoxide	--	--	--	--	Liver	0.10	--	0.31	0.42
			Naphthalene	--	--	--	--	Body Weight	0.0020	--	0.0031	0.0051
			Pentachlorophenol	--	--	--	--	Liver	0.012	--	0.12	0.13
			Tetrachloroethene	--	--	--	--	Gastrointestinal System	0.029	--	0.012	0.040
			Aluminum	--	--	--	--	Nervous System	0.096	--	0.00013	0.097
			Arsenic	--	--	--	--	Skin	0.55	--	0.0024	0.56
			Barium	--	--	--	--	Gastrointestinal	0.060	--	0.033	0.093
			Cadmium	--	--	--	--	Kidney	0.14	--	0.012	0.15
			Chromium	--	--	--	--	None observed	0.18	--	0.031	0.21
			Cobalt	--	--	--	--	Thyroid	1.3	--	0.0022	1.3
			Copper	--	--	--	--	--	0.022	--	0.000010	0.022
			Cyanide	--	--	--	--	Reproductive System	0.46	--	0.0020	0.46
			Iron	--	--	--	--	Gastrointestinal	0.45	--	0.0020	0.45
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	104	--	12	116
			Mercury	--	--	--	--	Kidney	0.013	--	0.0006	0.014
			Molybdenum	--	--	--	--	Blood	1.0	--	0.0044	1.0
			Nickel	--	--	--	--	Body Weight	0.060	--	0.0013	0.062
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.17	--	0.000076	0.17
			Strontium	--	--	--	--	Bone	0.36	--	0.0016	0.36
			Thallium	--	--	--	--	Hair	43	--	0.19	44
			Vanadium	--	--	--	--	Kidney	0.14	--	0.024	0.16
			Zinc	--	--	--	--	Blood	0.010	--	0.000027	0.010
			Chemical Total	--	--	--	--		154	--	26	180
		Deep Groundwater Total					--					180
	Total Deep Groundwater Total						--					180
Total Deep Groundwater							--					180
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				245

Table E-67
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Blood HI	3.2
											Total Liver HI	3.8
											Total Kidney HI	0.88
											Total Body Weight HI	1.0
											Total Nervous System HI	31
											Total Cardiovascular System HI	0.15
											Total Skin HI	1.3
											Total Gastrointestinal HI	0.33
											Total Thyroid HI	95
											Total Reproductive System HI	0.45
											Total Bone HI	0.075
											Total Whole Body HI	0.2
											Total Hair HI	57
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				130
											Total Kidney HI	0.3
											Total Nervous System HI	1.6
											Total Blood HI	1.4
											Total Liver HI	15
											Total Spleen HI	0.46
											Total Skin HI	0.73
											Total Thyroid HI	1.3
											Total Gastrointestinal HI	0.50
											Total Bone HI	0.36
											Total Hair HI	44
											Total Cardiovascular System HI	0.040
											Total Reproductive System HI	0.46
											Total Body Weight HI	0.067

Table E-58
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.038	--	0.0029	0.041
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.0042	--	0.00078	0.0050
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.017	--	1.5	1.5
			Bromodichloromethane	--	--	--	--	Kidney	0.00024	--	0.000021	0.00026
			Bromomethane	--	--	--	--	Gastrointestinal	0.016	--	0.00061	0.016
			Chloroform	--	--	--	--	Liver, Blood	0.014	--	0.0015	0.015
			Dibenzofuran	--	--	--	--	Whole Body	0.024	--	0.052	0.076
			Dieldrin	--	--	--	--	Liver	0.0102	--	0.023	0.034
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.00029	--	0.00021	0.00050
			Naphthalene	--	--	--	--	Body Weight	0.0024	--	0.0019	0.0042
			Pentachlorophenol	--	--	--	--	Liver	0.0090	--	0.043	0.052
			Phenol	--	--	--	--	Body Weight	0.0078	--	0.00047	0.0083
			Tetrachloroethene	--	--	--	--	Nervous System	0.015	--	0.011	0.026
			Trichloroethene	--	--	--	--	Cardiovascular System	0.060	--	0.012	0.072
			(m-and/or p-)xylene	--	--	--	--	Body Weight	0.00067	--	0.00053	0.0012
			Aluminum	--	--	--	--	Nervous System	0.84	--	0.0051	0.85
			Antimony	--	--	--	--	Blood	0.30	--	0.012	0.31
			Arsenic	--	--	--	--	Skin	0.70	--	0.0042	0.70
			Beryllium	--	--	--	--	Gastrointestinal	0.077	--	0.067	0.14
			Cadmium	--	--	--	--	Kidney	0.070	--	0.0084	0.078
			Chromium	--	--	--	--	None observed	0.16	--	0.038	0.19
			Cobalt	--	--	--	--	Thyroid	57	--	0.14	57
			Copper	--	--	--	--	--	0.10	--	0.00063	0.11
			Cyanide	--	--	--	--	Reproductive System	0.27	--	0.0016	0.27
			Iron	--	--	--	--	Gastrointestinal	0.054	--	0.00033	0.055
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	43	--	6.5	50
			Mercury	--	--	--	--	Kidney	0.35	--	0.030	0.38
			Molybdenum	--	--	--	--	Blood	0.36	--	0.0022	0.36
			Nickel	--	--	--	--	Body Weight	0.57	--	0.017	0.58
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.052	--	0.00031	0.053
			Strontium	--	--	--	--	Bone	0.045	--	0.00027	0.045
			Thallium	--	--	--	--	Hair	34	--	0.20	34
			Vanadium	--	--	--	--	Kidney	0.069	--	0.016	0.085
			Zinc	--	--	--	--	Blood	1.2	--	0.0042	1.2
			Chemical Total	--	--	--	--		140	--	8.7	148
		Shallow Groundwater Total					--					148

Table E-68
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					148
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	Blood	--	0.000000.4	--	0.000000.4
			Benzene	--	--	--	--	Blood	--	0.0000012	--	0.0000012
			Bromodichloromethane	--	--	--	--	--	--	--	--	--
			Bromomethane	--	--	--	--	Respiratory System	--	0.000003.6	--	0.000003.6
			Chloroform	--	--	--	--	Liver	--	0.0000024	--	0.0000024
			Dibromochloromethane	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	--	--	--	Developmental	--	0.000000054	--	0.000000054
			Naphthalene	--	--	--	--	Respiratory System	--	0.000018	--	0.000018
			Tetrachloroethene	--	--	--	--	Nervous System	--	0.0000004	--	0.0000004
			Trichloroethene	--	--	--	--	Immune System	--	0.000002.6	--	0.000002.6
			Trichlorofluoromethane	--	--	--	--	Nervous System	--	0.0000025	--	0.0000025
			Chemical Total	--	--	--	--		--	0.000006.3	--	0.000006.3
		Shallow Groundwater Total					--					0.000006.3
	Air Total						--					0.000006.3
Total Shallow Groundwater							--					148
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.0020	--	0.00027	0.0023
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.096	--	0.011	0.11
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.23	--	0.032	0.27
			Benzene	--	--	--	--	Blood	0.0032	--	0.000091	0.0041
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.050	--	6.5	6.6
			Bromomethane	--	--	--	--	Gastrointestinal	0.031	--	0.0019	0.033
			Chloroform	--	--	--	--	Liver, Blood	0.0030	--	0.00051	0.0035
			Dieldrin	--	--	--	--	Liver	0.010	--	0.037	0.047
			Heptachlorepoxide	--	--	--	--	Liver	0.062	--	0.15	0.21
			Naphthalene	--	--	--	--	Body Weight	0.0012	--	0.0015	0.0027
			Pentachlorophenol	--	--	--	--	Liver	0.0075	--	0.055	0.062
			Trichloroethene	--	--	--	--	Cardiovascular System	0.017	--	0.0054	0.023
			Aluminum	--	--	--	--	Nervous System	0.053	--	0.000035	0.053
			Arsenic	--	--	--	--	Skin	0.33	--	0.0020	0.34
			Beryllium	--	--	--	--	Gastrointestinal	0.026	--	0.031	0.057
			Cadmium	--	--	--	--	Kidney	0.082	--	0.010	0.092
			Chromium	--	--	--	--	None observed	0.11	--	0.025	0.13
			Cobalt	--	--	--	--	Thyroid	0.76	--	0.0018	0.76
			Copper	--	--	--	--	--	0.013	--	0.000073	0.013
			Cyanide	--	--	--	--	Reproductive System	0.27	--	0.0017	0.28
			Iron	--	--	--	--	Gastrointestinal	0.27	--	0.0016	0.27
			Lead	--	--	--	--	--	--	--	--	--

Table E-68
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Manganese	--	--	--	--	Nervous System	0.3	--	9.4	72
			Mercury	--	--	--	--	Kidney	0.0077	--	0.00006	0.0084
			Molybdenum	--	--	--	--	Blood	0.0	--	0.0006	0.0
			Nickel	--	--	--	--	Body Weight	0.006	--	0.0011	0.007
			Selenium	--	--	--	--	Liver Blood Skin Nervous System	0.10	--	0.00002	0.10
			Strontium	--	--	--	--	Bone	0.21	--	0.0013	0.22
			Thallium	--	--	--	--	Hair	26	--	0.16	26
			Vanadium	--	--	--	--	Kidney	0.064	--	0.019	0.10
			Zinc	--	--	--	--	Blood	0.00002	--	0.000022	0.00002
			Chemical Total	--	--	--	--		92	--	16	109
		Deep Groundwater Total					--					109
	Total Deep Groundwater Total						--					109
Groundwater	Air	Deep	1,2-Dichloroethane	--	--	--	--	Nervous System	--	0.0000043	--	0.0000043
			Benzene	--	--	--	--	Blood	--	0.00000092	--	0.00000092
			Bromomethane	--	--	--	--	Reproductive System	--	0.000017	--	0.000017
			Chloroform	--	--	--	--	Liver	--	0.00000053	--	0.00000053
			Naphthalene	--	--	--	--	Reproductive System	--	0.0000092	--	0.0000092
			Trichloroethene	--	--	--	--	Immune System	--	0.0000074	--	0.0000074
			Chemical Total	--	--	--	--		--	0.0000040	--	0.0000040
		Deep Groundwater Total					--					0.0000040
	Air Total						--					0.0000040
Total Deep Groundwater							--					109
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				145
Total Blood HI												2.0
Total Liver HI												1.7
Total Kidney HI												0.54
Total Body Weight HI												0.0
Total Nervous System HI												51
Total Gastrointestinal System HI												0.072
Total Skin HI												0.76
Total Cardiovascular HI												0.21
Total Thyroid HI												57
Total Reproductive System HI												0.27
Total Whole Body HI												0.076
Total Bone HI												0.045
Total Hair HI												24
Total Developmental HI												0.000000054

Table E-68
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Respiratory System HI	0.000027
											Total Immune System HI	0.000026
			Total Risk Across All Media - Deep Groundwater				--	Total Hazard Across All Media - Deep Groundwater				10[illegible]
											Total Endocrine HI	0.10
											Total Nervous System HI	72
											Total Blood HI	0.33
											Total Liver HI	7.1
											Total Spleen HI	0.27
											Total Skin HI	0.44
											Total Thyroid HI	0.76
											Total Reproductive System HI	0.38
											Total Gastrointestinal HI	0.37
											Total Cardiovascular System HI	0.023
											Total Bone HI	0.22
											Total Hair HI	26
											Total Respiratory System HI	0.000026
											Total Immune System HI	0.0000074
											Total Body Weight HI	0.040

Table E-59
Summary of Receptor Risks and Hazards for COPCs - Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	1.0E-04	---	1.0E-04	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.30	---	0.30
			1,2-Dichloroethane	---	3.5E-03	---	3.5E-03	Nervous System	---	52	--	52
			Benzene	---	5.8E-06	---	5.8E-06	Blood	---	0.067	---	0.067
			Chloroform	---	9.8E-06	---	9.8E-06	Liver	---	0.012	---	0.012
			Chloromethane	---	---	---	--	Nervous System	---	11	---	11
			Ethylbenzene	---	2.8E-06	---	2.8E-06	Developmental	---	0.0030	--	0.0030
			Chemical Total	---	3.6E-03	---	3.6E-03		---	63	---	63
Total Indoor Air							3.6E-03					63
						Total Risk	3.6E-03				Total Hazard	63
											Total Developmental HI	0.0030
											Total Liver HI	0.012
											Total Blood HI	0.37
											Total Nervous System HI	63

Table E-60
Summary of Receptor Risks and Hazards for COPCs - Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	3.9E-05	---	3.9E-05	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.12	---	0.12
			1,2-Dichloroethane	---	1.4E-03	---	1.4E-03	Nervous System	---	20	--	20
			Benzene	---	2.2E-06	---	2.2E-06	Blood	---	0.026	---	0.026
			Chloroform	---	3.8E-06	---	3.8E-06	Liver	---	0.0045	--	0.0045
			Chloromethane	---	---	---	--	Nervous System	---	4.1	---	4.1
			Ethylbenzene	---	1.1E-06	---	1.1E-06	Developmental	---	0.0012	--	0.0012
			Chemical Total	---	1.4E-03	---	1.4E-03		---	24	---	24
Total Indoor Air							1.4E-03					24
						Total Risk	1.4E-03				Total Hazard	24
											Total Developmental HI	0.0012
											Total Liver HI	0.0045
											Total Blood HI	0.14
											Total Nervous System HI	24

Table E-61
Summary of Receptor Risks and Hazards for COPCs - Child Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	--	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	0.32	--	---	0.32
			Chromium	3.7E-04	---	---	3.7E-04	None quantified	0.55	--	--	0.55
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	1.8E-03	---	---	1.8E-03		119	--	---	119
Total Knob Creek Carp							1.8E-03					119
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.1E-05	---	---	1.1E-05	Developmental	1.5	--	---	1.5
			PCB Dioxin-like Congener TEQ	6.7E-05	---	---	6.7E-05	Developmental	8.6	--	--	8.6
			PCB-1260	3.6E-05	---	---	3.6E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	2.6E-04	---	---	2.6E-04	None quantified	0.39	--	--	0.39
			Mercury	---	---	---	--	Kidney	5.0	--	---	5.0
			Chemical Total	3.8E-04	---	---	3.8E-04		15	--	---	15
Total Knob Creek Largemouth Bass							3.8E-04					15
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	---	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	0.32	--	---	0.32
			Chromium	1.9E-04	---	---	1.9E-04	None quantified	0.28	--	--	0.28
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	2.8	--	---	2.8
			Chemical Total	1.7E-03	---	---	1.7E-03		122	--	---	122
Total Knob Creek All Species							1.7E-03					122
Total Risk - Carp							1.8E-03	Total Hazard - Carp				119
								Total Developmental HI				119
								Total Skin HI				0.32
Total Risk - Largemouth Bass							3.8E-04	Total Hazard - Largemouth Bass				15
								Total Developmental HI				10
								Total Kidney HI				5.0
Total Risk - All Species							1.7E-03	Total Hazard - All Species				122
								Total Developmental HI				119
								Total Skin HI				0.32
								Total Kidney HI				2.8

Table E-62
Summary of Receptor Risks and Hazards for COPCs - Child Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	--	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	26	--	--	26
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye - Immune System	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	0.079	--	---	0.079
			Chromium	9.4E-05	---	---	9.4E-05	None Quotient	0.14	--	--	0.14
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	4.6E-04	---	---	4.6E-04		30	--	---	30
Total Knob Creek Carp							4.6E-04					30
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	2.8E-06	---	---	2.8E-06	Developmental	0.36	--	---	0.36
			PCB Dioxin-like Congener TEQ	1.7E-05	---	---	1.7E-05	Developmental	2.2	--	--	2.2
			PCB-1260	8.9E-06	---	---	8.9E-06	Eye - Immune System	---	--	---	--
			Chromium	6.6E-05	---	---	6.6E-05	None Quotient	0.096	--	--	0.096
			Mercury	---	---	---	--	Kidney	1.3	--	---	1.3
			Chemical Total	9.5E-05	---	---	9.5E-05		3.9	--	---	3.9
Total Knob Creek Largemouth Bass							9.5E-05					3.9
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	---	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	26	--	--	26
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye - Immune System	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	0.079	--	---	0.079
			Chromium	4.8E-05	---	---	4.8E-05	None Quotient	0.070	--	--	0.070
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	0.71	--	---	0.71
			Chemical Total	4.2E-04	---	---	4.2E-04		31	--	---	31
Total Knob Creek All Species							4.2E-04					31
						Total Fish - Carp	4.6E-04				Total Hazard - Carp	30
											Total Developmental HI	30
											Total Skin HI	0.079
						Total Fish - Largemouth Bass	9.5E-05				Total Hazard - Largemouth Bass	3.9
											Total Developmental HI	2.5
											Total Kidney HI	1.3
						Total Fish - All Species	4.2E-04				Total Hazard - All Species	31
											Total Developmental HI	30
											Total Skin HI	0.079
											Total Kidney HI	0.71

Table E-63
Summary of Receptor Risks and Hazards for COPCs - Adult Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	--	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	0.12	--	---	0.12
			Chromium	1.1E-04	---	---	1.1E-04	None quantified	0.20	--	--	0.20
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	2.5E-03	---	---	2.5E-03		45	--	---	45
Total Knob Creek Carp							2.5E-03					45
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.8E-05	---	---	1.8E-05	Developmental	0.55	--	---	0.55
			PCB Dioxin-like Congener TEQ	1.1E-04	---	---	1.1E-04	Developmental	3.2	--	--	3.2
			PCB-1260	5.8E-05	---	---	5.8E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	8.1E-05	---	---	8.1E-05	None quantified	0.14	--	--	0.14
			Mercury	---	---	---	--	Kidney	1.9	--	---	1.9
			Chemical Total	2.7E-04	---	---	2.7E-04		6	--	---	6
Total Knob Creek Largemouth Bass							2.7E-04					6
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	---	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	0.12	--	---	0.12
			Chromium	5.8E-05	---	---	5.8E-05	None quantified	0.10	--	--	0.10
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	1.1	--	---	1.1
			Chemical Total	2.4E-03	---	---	2.4E-03		46	--	---	46
Total Knob Creek All Species							2.4E-03					46
						Total Risk - Carp	2.5E-03				Total Hazard - Carp	45
											Total Developmental HI	44
											Total Skin HI	0.12
						Total Risk - Largemouth Bass	2.7E-04				Total Hazard - Largemouth Bass	6.8
											Total Developmental HI	3.8
											Total Kidney HI	1.9
						Total Risk - All Species	2.4E-03				Total Hazard - All Species	46
											Total Developmental HI	44
											Total Skin HI	0.12
											Total Kidney HI	1.1

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Adult Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	0.49	--	--	0.49
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye - Immune System	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	0.030	--	---	0.030
			Chromium	2.9E-05	---	---	2.9E-05	None quantified	0.051	--	--	0.051
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	4.3E-04	---	---	4.3E-04		11	--	---	11
Total Knob Creek Carp							4.3E-04					11
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	4.6E-06	---	---	4.6E-06	Developmental	0.14	--	---	0.14
			PCB Dioxin-like Congener TEQ	2.7E-05	---	---	2.7E-05	Developmental	0.81	--	--	0.81
			PCB-1260	1.4E-05	---	---	1.4E-05	Eye - Immune System	---	--	---	--
			Chromium	2.0E-05	---	---	2.0E-05	None quantified	0.036	--	--	0.036
			Mercury	---	---	---	--	Kidney	0.47	--	---	0.47
			Chemical Total	4.7E-05	---	---	4.7E-05		1.5	--	---	1.5
Total Knob Creek Largemouth Bass							4.7E-05					1.5
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	0.49	--	---	0.49
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye - Immune System	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	0.030	--	---	0.030
			Chromium	1.5E-05	---	---	1.5E-05	None quantified	0.026	--	--	0.026
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	0.27	--	---	0.27
			Chemical Total	4.1E-04	---	---	4.1E-04		11	--	---	11
Total Knob Creek All Species							4.1E-04					11
						Total Risk - Carp	4.3E-04				Total Hazard - Carp	11
											Total Developmental HI	11
											Total Skin HI	0.030
						Total Risk - Largemouth Bass	4.7E-05				Total Hazard - Largemouth Bass	1.5
											Total Developmental HI	0.95
											Total Kidney HI	0.47
						Total Risk - All Species	4.1E-04				Total Hazard - All Species	11
											Total Developmental HI	11
											Total Skin HI	0.030
											Total Kidney HI	0.27

Table E-65R
Risk Summary - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-frame: Current Future
Exposed Population: On-Site Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.2E-06	NA	1.4E-07	1.3E-06	Developmental	0.0004	NA	0.00004	0.0004
			Arsenic	4.3E-06	NA	1.0E-06	5.3E-06	Skin	0.003	NA	0.00003	0.003
			Chromium	5.6E-06	NA	NA	5.6E-06	Non-observed	0.001	NA	NA	0.001
			Chemical Total	1.2E-05	NA	1.1E-06	1.3E-05		0.3	NA	0.001	0.3
		On-Site Total					1.3E-05					0.3
	Surface Soil Total						1.3E-05					0.3
Total On-Site Soil							1.3E-05					0.3
Soil	Surface Soil	Floodplain Ecorisk	Arsenic	4.7E-06	NA	5.3E-07	5.2E-06	Skin	0.003	NA	0.00004	0.003
			Chromium	4.9E-06	NA	NA	4.9E-06	Non-observed	0.001	NA	NA	0.001
			Chemical Total	9.6E-06	NA	7.7E-07	1.0E-05		0.2	NA	0.00005	0.2
		Floodplain Ecorisk Total					1.0E-05					0.2
	Surface Soil Total						1.0E-05					0.2
Total Floodplain Ecorisk Soil							1.0E-05					0.2
Total Risk across all Media - On-Site							1.3E-05	Total Hazard across all Media - On-Site				0.3
Total Risk across all Media - Floodplain Ecorisk							1.0E-05	Total Hazard across all Media - Floodplain Ecorisk				0.2

Table E-66
Risk Summary - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	1.2E-05	--	--	1.2E-05	Nervous System, Blood, Liver	--	--	--	--
			bis(2-Ethylhexyl)phthalate	2.5E-06	--	--	2.5E-06	Liver	--	--	--	--
			Chloroform	2.2E-06	--	--	2.2E-06	Liver, Blood	--	--	--	--
			Dieldrin	4.2E-06	--	--	4.2E-06	Liver	--	--	--	--
			Pentachlorophenol	9.2E-06	--	--	9.2E-06	Liver	--	--	--	--
			Aluminum	--	--	--	--	Nervous System	1.2	--	--	1.2
			Arsenic	1.6E-04	--	--	1.6E-04	Skin	--	--	--	--
			Chromium	1.2E-04	--	--	1.2E-04	None Observed	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	8.2	--	--	8.2
			Manganese	--	--	--	--	Nervous System	6.2	--	--	6.2
			Thallium	--	--	--	--	Hair	49	--	--	49
			Zinc	--	--	--	--	Blood	1.7	--	--	1.7
			Chemical Total	3.1E-04	--	--	3.1E-04		195	--	--	195
Total Shallow Groundwater							3.1E-04					195
Groundwater	Groundwater	Deep	2,4-Dinitrotoluene	3.0E-05	--	--	3.0E-05	Nervous System, Blood, Liver	--	--	--	--
			2,6-Dinitrotoluene	5.3E-05	--	--	5.3E-05	Spleen	--	--	--	--
			bis(2-Ethylhexyl)phthalate	7.2E-06	--	--	7.2E-06	Liver	--	--	--	--
			Dieldrin	4.3E-06	--	--	4.3E-06	Liver	--	--	--	--
			Heptachlor epoxide	3.8E-06	--	--	3.8E-06	Liver	--	--	--	--
			Pentachlorophenol	7.6E-06	--	--	7.6E-06	Liver	--	--	--	--
			Arsenic	7.7E-05	--	--	7.7E-05	Skin	--	--	--	--
			Chromium	8.1E-05	--	--	8.1E-05	None Observed	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	1.1	--	--	1.1
			Manganese	--	--	--	--	Nervous System	90	--	--	90
			Thallium	--	--	--	--	Hair	37	--	--	37
			Chemical Total	2.6E-04	--	--	2.6E-04		128	--	--	128
Total Deep Groundwater							2.6E-04					128
Total Risk Across All Media - Shallow Groundwater							3.1E-04	Total Hazard Across All Media - Shallow Groundwater				195
Total Risk Across All Media - Deep Groundwater							2.6E-04	Total Hazard Across All Media - Deep Groundwater				128

Table E-67
Risk Summary - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	1.4E-06	--	--	1.4E-06	Nervous System, Blood, Liver	--	--	--	--
			Pentachlorophenol	1.1E-06	--	--	1.1E-06	Liver	--	--	--	--
			Arsenic	1.9E-05	--	--	1.9E-05	Skin	--	--	--	--
			Chromium	1.4E-05	--	--	1.4E-05	None observed	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	20	--	--	20
			Manganese	--	--	--	--	Nervous System	15	--	--	15
			Thallium	--	--	--	--	Hair	12	--	--	12
			Chemical Total	3.6E-05	--	--	3.6E-05		48	--	--	48
Total Shallow Groundwater							3.6E-05					48
			2,4-Dinitrotoluene	3.7E-06	--	--	3.7E-06	Nervous System, Blood, Liver	--	--	--	--
			2,6-Dinitrotoluene	6.4E-06	--	--	6.4E-06	Spleen	--	--	--	--
			Arsenic	9.2E-06	--	--	9.2E-06	Skin	--	--	--	--
			Chromium	9.7E-06	--	--	9.7E-06	None observed	--	--	--	--
			Manganese	--	--	--	--	Nervous System	22	--	--	22
			Thallium	--	--	--	--	Hair	9.0	--	--	9.0
			Chemical Total	2.9E-05	--	--	2.9E-05		32	--	--	32
Total Deep Groundwater							2.9E-05					32
Total Risk Across All Media - Shallow Groundwater							3.6E-05	Total Hazard Across All Media - Shallow Groundwater				48
Total Risk Across All Media - Deep Groundwater							2.9E-05	Total Hazard Across All Media - Deep Groundwater				32

Table E-68
Risk Summary - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.3E-05	---	2.3E-05	---	---	--	--	--
			1,2-Dichloroethane	---	8.1E-04	---	8.1E-04	Nervous System	---	12	--	12
			Benzene	---	1.3E-06	---	1.3E-06	Blood	---	--	---	--
			Chloroform	---	2.3E-06	---	2.3E-06	Liver	---	--	---	--
			Chloromethane	---	---	---	--	Nervous System	---	2.5	---	2.5
			Chemical Total	---	8.3E-04	---			---	15	---	15
Total Indoor Air							8.3E-04					15
						Total Risk	8.3E-04				Total Hazard	15

Table E-69
Risk Summary - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.8E-06	---	2.8E-06	---	---	--	--	--
			1,2-Dichloroethane	---	9.7E-05	---	9.7E-05	Nervous System	---	1.5	--	1.5
			Chemical Total	---	9.9E-05	---	9.9E-05		---	1.5	---	1.5
Total Indoor Air							9.9E-05					1.5
						Total Risk	9.9E-05				Total Hazard	1.5

Table E-70R
Risk Summary - Trespasser
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	Arsenic	1.4E-06	NA	2.9E-07	1.7E-06	Skin	0.02	NA	0.005	0.03
			Chromium	5.0E-06	NA	NA	5.0E-06	None Considered	0.003	NA	NA	0.003
			Chemical Total	6.7E-06	NA	2.9E-07	7.1E-06		0.2	NA	0.01	0.3
		On-Site Total					7.1E-06					0.3
	Surface Soil Total						7.1E-06					0.3
Total On-Site Soil							7.1E-06					0.3
Soil	Surface Soil	Fleemiken Branch	Arsenic	1.4E-06	NA	1.7E-07	1.6E-06	Skin	0.02	NA	0.003	0.02
			Chromium	3.8E-06	NA	NA	3.8E-06	None Considered	0.006	NA	NA	0.006
			Chemical Total	5.5E-06	NA	2.1E-07	5.8E-06		0.2	NA	0.004	0.2
		Fleemiken Branch Total					5.8E-06					0.2
	Surface Soil Total						5.8E-06					0.2
Total Fleemiken Branch Soil							5.9E-06					0.2
						Total Risk Across All Media - On-Site	7.1E-06				Total Hazard Across All Media - On-Site	0.3
						Total Risk Across All Media - Fleemiken Branch	5.9E-06				Total Hazard Across All Media - Fleemiken Branch	0.2

Table E-71R
Risk Summary - Trespasser
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (hours): Current/Future
Exposure Frequency: Trespasser
Exposure Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	Chromium	1.2E-11	NA	NA	1.2E-11	None identified	0.0002	NA	NA	0.0002
			Chemical Total	1.7E-11	NA	2.4E-11	1.7E-11		0.1	NA	0.000	0.1
		On-Site Total					1.7E-11					0.1
	Surface Soil Total						1.7E-11					0.1
Total On-Site Soil							1.7E-11					0.00
Total Risk Across All Media - On-Site							1.7E-11	Total Hazard Across All Media - On-Site				0.00

Table E-72R
Risk Summary - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Current/Future
Exposure Population: Recreational User
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.4E-06	NA	6.7E-07	1.4E-06	Developmental	0.2	NA	0.0001	0.2
			Arsenic	5.[illegible]E-06	NA	4.6E-07	6.2E-06	Skin	0.1	NA	0.001	0.2
			Chromium	4.6E-05	NA	NA	4.6E-05	Non-cancer	0.05	NA	NA	0.05
			Chemical Total	4.[illegible]E-05	NA	5.4E-07	4.[illegible]E-05		2	NA	0.002	2
		On-Site Total					4.[illegible]E-05					2
	Surface Soil Total						4.[illegible]E-05					2
Total On-Site Soil							4.[illegible]E-05					2
Soil	Surface Soil	Floodplain Beach	Benzo(a)pyrene	1.4E-06	NA	5.2E-07	1.9E-06	NA	NA	NA	NA	NA
			Arsenic	4.4E-06	NA	2.7E-07	4.6E-06	Skin	0.004	NA	0.0007	0.004
			Chromium	2.7E-05	NA	NA	2.7E-05	Non-cancer	0.04	NA	NA	0.04
			Chemical Total	4.4E-05	NA	0.0E+00	4.4E-05		1	NA	0.001	1
		Floodplain Beach Total					4.4E-05					1
	Surface Soil Total						4.4E-05					1
Total Floodplain Beach Soil							4.4E-05					1
Total Risk Across All Media - On-Site							4.4E-05	Total Hazard Across All Media - On-Site				2
Total Risk Across All Media - Floodplain Beach							4.4E-05	Total Hazard Across All Media - Floodplain Beach				1

Table E-73R
Risk Summary - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	Chromium	4.4E-06	NA	NA	4.4E-06	None observed	0.006	NA	NA	0.006
			Chemical Total	5.3E-06	NA	E-0	5.4E-06		0.2	NA	0.00	0.2
		On-Site Total					5.4E-06					0.2
	Surface Soil Total						5.4E-06					0.2
Total On-Site Soil							5.4E-06					0.2
Soil	Surface Soil	Flenniken Branch	Chromium	3.4E-06	NA	NA	3.4E-06	None observed	0.005	NA	NA	0.005
			Chemical Total	4.1E-06	NA	1.1E-07	4.2E-06		0.1	NA	0.002	0.1
		Flenniken Branch Total					4.2E-06					0.1
	Surface Soil Total						4.2E-06					0.1
Total Flenniken Branch Soil							4.2E-06					0.1
						Total Risk Across All Media - On-Site	5.4E-06				Total Hazard Across All Media - On-Site	0.2
						Total Risk Across All Media - Flenniken Branch	4.2E-06				Total Hazard Across All Media - Flenniken Branch	0.1

Table E-74R
Risk Summary - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Current/Future
Exposure Population: Recreational User
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	Arsenic	1.[illegible]E-07	NA	4.[illegible]E-07	2.[illegible]E-07	None	0.001	NA	0.0004	0.002
			Chromium	2.1E-07	NA	NA	2.1E-07	Not quantified	0.0005	NA	NA	0.0005
			Chemical Total	4.[illegible]E-07	NA	4.[illegible]E-07	4.[illegible]E-07		0.002	NA	0.001	0.002
		On-Site Total					4.[illegible]E-07					0.002
	Surface Soil Total						4.[illegible]E-07					0.002
Total On-Site Soil							4.[illegible]E-07					0.002
Soil	Surface Soil	Floodplain Beach	Arsenic	1.0E-07	NA	2.2E-07	1.[illegible]E-07	None	0.000	NA	0.0002	0.001
			Chromium	1.0E-07	NA	NA	1.0E-07	Not quantified	0.0004	NA	NA	0.0004
			Chemical Total	2.0E-07	NA	2.2E-07	4.[illegible]E-07		0.1	NA	0.0002	0.1
		Floodplain Beach Total					4.[illegible]E-07					0.1
	Surface Soil Total						4.[illegible]E-07					0.1
Total Floodplain Beach Soil							4.[illegible]E-07					0.1
Total PAH Across All Media - On-Site							4.[illegible]E-07	Total Hazard Across All Media - On-Site				0.2
Total PAH Across All Media - Floodplain Beach							4.[illegible]E-07	Total Hazard Across All Media - Floodplain Beach				0.1

Table E-75R
Risk Summary - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD/TEQ	5.4E-06	NA	3.6E-07	5.7E-06	Developmental	NA	NA	NA	NA
			Arsenic	2.2E-05	NA	2.5E-06	2.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	None observed	NA	NA	NA	NA
			Chemical Total	1.6E-04	NA	4.7E-06	1.5E-04		NA	NA	NA	NA
		On-Site Total					1.5E-04					NA
	Total Soil Total						1.5E-04					NA
Total On-Site Soil							1.5E-04					NA
Soil	Surface Soil	Flenniken Branch	Benzo(a)pyrene	4.1E-06	NA	1.2E-06	5.9E-06	NA	NA	NA	NA	NA
			2,3,7,8-TCDD/TEQ	1.9E-06	NA	1.2E-07	2.0E-06	Developmental	NA	NA	NA	NA
			Arsenic	1.3E-05	NA	1.5E-06	1.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	NA	NA	NA	NA	NA
			Chemical Total	1.4E-04	NA	3.0E-06	1.4E-04		NA	NA	NA	NA
		Flenniken Branch Total					1.4E-04					NA
	Surface Soil Total						1.4E-04					NA
Total Flenniken Branch Soil							1.4E-04					NA
						Total Risk Across All Media - On-Site	1.5E-04				Total Hazard Across All Media - On-Site	NA
						Total Risk Across All Media - Flenniken Branch	1.4E-04				Total Hazard Across All Media - Flenniken Branch	NA

Table E-76R
Risk Summary - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.5	NA	0.04	0.6
			Aluminum	NA	NA	NA	NA	Nervous system	0.6	NA	NA	0.6
			Arsenic	NA	NA	NA	NA	Skin	0.7	NA	0.06	0
			Chromium	NA	NA	NA	NA	None observed	0.2	NA	NA	0.2
			Cobalt	NA	NA	NA	NA	Thyroid	0.7	NA	NA	0.7
			Copper	NA	NA	NA	NA	NA	0.1	NA	NA	0.1
			Iron	NA	NA	NA	NA	Gastrointestinal	0.7	NA	NA	0.7
			Manganese	NA	NA	NA	NA	Nervous system	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	0	NA	NA	0
			Vanadium	NA	NA	NA	NA	Kidney	0.1	NA	NA	0.1
			Chemical Total	NA	NA	NA	NA		5	NA	0.09	5
		On-Site Total					NA					5
	Surface Soil Total						NA					5
Total On-Site Soil							NA					5
Soil	Surface Soil	Flenniken Branch	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.2	NA	0.009	0.2
			Aluminum	NA	NA	NA	NA	Nervous system	0.2	NA	NA	0.2
			Arsenic	NA	NA	NA	NA	Skin	0.4	NA	0.04	0.5
			Chromium	NA	NA	NA	NA	None observed	0.1	NA	NA	0.1
			Cobalt	NA	NA	NA	NA	Thyroid	0.5	NA	NA	0.5
			Iron	NA	NA	NA	NA	Gastrointestinal	0.6	NA	NA	0.6
			Manganese	NA	NA	NA	NA	Nervous system	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	1	NA	NA	1
			Chemical Total	NA	NA	NA	NA		4	NA	0.04	4
		Flenniken Branch Total					NA					4
	Surface Soil Total						NA					4
Total Flenniken Branch Soil							NA					4
						Total Risk Across All Media - On-Site	NA				Total Hazard Across All Media - On-Site	5
						Total Risk Across All Media - Flenniken Branch	NA				Total Hazard Across All Media - Flenniken Branch	4

Table E-77R
Risk Summary - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD(TEQ)	2.4E-06	NA	7.7E-0[illegible]	2.4E-06	Developmental	NA	NA	NA	NA
			Arsenic	9.7E-06	NA	5.3E-07	1.0E-05	Skin	NA	NA	NA	NA
			Chromium	5.4E-05	NA	NA	5.4E-05	None observed	NA	NA	NA	NA
			Chemical Total	6.6E-05	NA	6.0E-07	6.7E-05		NA	NA	NA	NA
		On-Site Total					6.7E-05					NA
	Surface Soil Total						6.7E-05					NA
Total On-Site Soil							6.7E-05					NA
Soil	Surface Soil	Flenniken Branch	Benzo(a)pyrene	2.2E-06	NA	9.4E-09	2.2E-06	NA	NA	NA	NA	NA
			Arsenic	5.7E-06	NA	3.1E-07	6.0E-06	Skin	NA	NA	NA	NA
			Chromium	4.2E-05	NA	NA	4.2E-05	NA	NA	NA	NA	NA
			Chemical Total	5.1E-05	NA	3.7E-07	5.1E-05		NA	NA	NA	NA
		Flenniken Branch Total					5.1E-05					NA
	Total Soil Total						5.1E-05					NA
Total Flenniken Branch Soil							5.1E-05					NA
						Total Risk Across All Media - On-Site	6.7E-05				Total Hazard Across All Media - On-Site	NA
						Total Risk Across All Media - Flenniken Branch	5.1E-05				Total Hazard Across All Media - Flenniken Branch	NA

Table E-78
Risk Summary - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	2.0E-05	---	1.2E-06	2.1E-05	---	---	--	--	--
			bis(2-Ethylhexyl)phthalate	4.1E-06	---	2.8E-04	2.9E-04	---	---	--	--	--
			Chloroform	3.6E-06	---	---	3.6E-06	---	---	--	---	--
			Dieldrin	7.0E-06	---	1.3E-05	2.0E-05	---	---	--	---	--
			Pentachlorophenol	1.5E-05	---	6.0E-05	7.5E-05	---	---	--	--	--
			Tetrachloroethene	1.7E-06	---	---	1.7E-06	---	---	--	---	--
			Arsenic	2.7E-04	---	1.5E-06	2.7E-04	---	---	--	---	--
			Chromium	5.6E-04	---	1.4E-04	7.0E-04	---	---	--	---	--
			Chemical Total	8.6E-04	---	5.0E-04	1.4E-03		---	--	---	--
		Shallow Groundwater Total					1.4E-03					--
	Total Shallow Groundwater Total						1.4E-03					--
Total Shallow Groundwater							1.4E-03					--
Groundwater	Groundwater	Deep	1,2-Dichloroethane	1.4E-06	---	---	1.4E-06	---	---	--	--	--
			2,4-Dinitrotoluene	5.1E-05	---	3.1E-06	5.4E-05	---	---	--	--	--
			2,6-Dinitrotoluene	9.0E-05	---	6.6E-06	9.6E-05	---	---	--	--	--
			bis(2-Ethylhexyl)phthalate	1.2E-05	---	8.3E-04	8.4E-04	---	---	--	--	--
			Dieldrin	7.2E-06	---	1.3E-05	2.1E-05	---	---	--	---	--
			Heptachlor epoxide	6.3E-06	---	7.8E-06	1.4E-05	---	---	--	--	--
			Pentachlorophenol	1.3E-05	---	5.0E-05	6.3E-05	---	---	--	--	--
			Arsenic	1.3E-04	---	---	1.3E-04	---	---	--	---	--
			Chromium	3.8E-04	---	9.3E-05	4.7E-04	---	---	--	---	--
			Chemical Total	6.9E-04	---	1.0E-03	1.7E-03		---	--	---	--
		Deep Groundwater Total					1.7E-03					--
	Total Deep Groundwater Total						1.7E-03					--
Total Deep Groundwater							1.7E-03					--
Total Risk Across All Media - Shallow Groundwater							1.4E-03	Total Hazard Across All Media - Shallow Groundwater				--
Total Risk Across All Media - Deep Groundwater							1.7E-03	Total Hazard Across All Media - Deep Groundwater				--

Table E-79
Risk Summary - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	4.8	4.8
			Aluminum	--	--	--	--	Nervous system	2.8	--	--	2.8
			Arsenic	--	--	--	--	Skin	2.3	--	--	2.3
			Cobalt	--	--	--	--	Thyroid	190	--	--	190
			Manganese	--	--	--	--	Nervous system	143	--	16	159
			Mercury	--	--	--	--	Kidney	1.2	--	--	1.2
			Molybdenum	--	--	--	--	Blood	1.2	--	--	1.2
			Nickel	--	--	--	--	Body Weight	1.9	--	--	1.9
			Thallium	--	--	--	--	Hair	113	--	--	113
			Zinc	--	--	--	--	Blood	3.9	--	--	3.9
			Chemical Total	--	--	--	--		480	--	21	480
		Shallow Groundwater Total					--					480
	Total Shallow Groundwater Total						--					480
Total Shallow Groundwater							--					480
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	14	14
			Arsenic	--	--	--	--	Skin	1.1	--	--	1.1
			Cobalt	--	--	--	--	Thyroid	2.5	--	--	2.5
			Manganese	--	--	--	--	Nervous system	209	--	23	232
			Molybdenum	--	--	--	--	Blood	2.0	--	--	2.0
			Thallium	--	--	--	--	Hair	87	--	--	87
			Chemical Total	--	--	--	--		301	--	37	338
		Deep Groundwater Total					--					338
	Total Deep Groundwater Total						--					338
Total Deep Groundwater							--					338
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				480
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				338

Table E-80
Risk Summary - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	2.2	2.2
			Aluminum	--	--	--	--	Nervous System	1.7	--	--	1.7
			Arsenic	--	--	--	--	Skin	1.4	--	--	1.4
			Cobalt	--	--	--	--	Thyroid	114	--	--	114
			Manganese	--	--	--	--	Nervous System	86	--	13	99
			Nickel	--	--	--	--	Body Weight	1.1	--	--	1.1
			Thallium	--	--	--	--	Hair	0.8	--	--	0.8
			Zinc	--	--	--	--	Blood	2.3	--	--	2.3
			Chemical Total	--	--	--	--		275	--	15	290
		Shallow Groundwater Total					--					290
	Total Shallow Groundwater Total						--					290
Total Shallow Groundwater							--					290
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	0.5	0.5
			Cobalt	--	--	--	--	Thyroid	152	--	--	152
			Manganese	--	--	--	--	Nervous System	125	--	19	144
			Molybdenum	--	--	--	--	Blood	1.2	--	--	1.2
			Thallium	--	--	--	--	Hair	52	--	--	52
			Chemical Total	--	--	--	--		180	--	25	205
		Deep Groundwater Total					--					205
	Total Deep Groundwater Total						--					205
Total Deep Groundwater							--					205
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				290
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				205

Table E-81
Risk Summary - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	6.4E-06	...	...	6.4E-06	...	...	...	...	...
			bis(2-Ethylhexyl)phthalate	1.3E-06	...	1.3E-04	1.3E-04	...	...	...	...	...
			Chloroform	1.1E-06	...	...	1.1E-06	...	...	...	...	...
			Dieldrin	2.2E-06	...	6.0E-06	2E-06	...	...	...	...	...
			Pentachlorophenol	4.9E-06	...	2.[illegible]E-05	3.2E-05	...	...	...	...	...
			Arsenic	5E-05	...	...	5E-05	...	...	...	...	...
			Chemical Total	2.9E-04	...	1.6E-04	4.6E-04		...	...	...	...
		Shallow Groundwater Total					4.6E-04					...
	Total Shallow Groundwater Total						4.6E-04					...
Total Shallow Groundwater							4.6E-04					...
Groundwater	Groundwater	Deep	2,4-Dinitrotoluene	1.6E-05	...	1.4E-06	1.[illegible]E-05	...	...	...	...	...
			2,6-Dinitrotoluene	2.[illegible]E-05	...	3.0E-06	3.1E-05	...	...	...	...	...
			bis(2-Ethylhexyl)phthalate	3.[illegible]E-06	...	3.[illegible]E-04	3.[illegible]E-04	...	...	...	...	...
			Dieldrin	2.3E-06	...	6.1E-06	4E-06	...	...	...	...	...
			Heptachlorepoxide	2.0E-06	...	3.6E-06	5.6E-06	...	...	...	...	...
			Pentachlorophenol	4.1E-06	...	2.3E-05	2.7E-05	...	...	...	...	...
			Arsenic	4.1E-05	...	...	4.1E-05	...	...	...	...	...
			Chemical Total	2.3E-04	...	4.2E-04	6.5E-04		...	...	...	...
		Deep Groundwater Total					6.5E-04					...
	Total Deep Groundwater Total						6.5E-04					...
Total Deep Groundwater							6.5E-04					...
Total Risk Across All Media - Shallow Groundwater							4.6E-04	Total Hazard Across All Media - Shallow Groundwater				...
Total Risk Across All Media - Deep Groundwater							6.5E-04	Total Hazard Across All Media - Deep Groundwater				...

Table E-82
Risk Summary - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	3.4	3.4
			Manganese	--	--	--	--	Nervous System	72	--	7.9	79.7
			Chemical Total	--	--	--	--		232	--	11	244
		Shallow Groundwater Total					--					244
	Total Shallow Groundwater Total						--					244
Total Shallow Groundwater							--					244
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	14	14
			Cobalt	--	--	--	--	Thyroid	1.3	--	--	1.3
			Manganese	--	--	--	--	Nervous System	104	--	12	116
			Thallium	--	--	--	--	Hair	43	--	--	43
			Chemical Total	--	--	--	--		149	--	25	174
		Deep Groundwater Total					--					174
	Total Deep Groundwater Total						--					174
Total Deep Groundwater							--					174
Total PAH Risk - All Media - Shallow Groundwater							--	Total Hazard Index - All Media - Shallow Groundwater				244
Total PAH Risk - All Media - Deep Groundwater							--	Total Hazard Index - All Media - Deep Groundwater				174

Table E-83
Risk Summary - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	1.5	1.5
			Cobalt	--	--	--	--	Thyroid	57	--	--	57
			Manganese	--	--	--	--	Nervous System	43	--	6.5	50
			Thallium	--	--	--	--	Hair	34	--	--	34
			Zinc	--	--	--	--	Blood	1.2	--	--	1.2
			Chemical Total	--	--	--	--		135	--	8	143
		Shallow Groundwater Total					--					143
	Total Shallow Groundwater Total						--					143
Total Shallow Groundwater							--					143
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	6.5	6.5
			Manganese	--	--	--	--	Nervous System	63	--	9	72
			Thallium	--	--	--	--	Hair	26	--	--	26
			Chemical Total	--	--	--	--		89	--	16	105
		Deep Groundwater Total					--					105
	Total Deep Groundwater Total						--					105
Total Deep Groundwater							--					105
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				143
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				105

Table E-84
Risk Summary - Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	1.0E-04	---	1.0E-04	---	---	--	--	--
			1,2-Dichloroethane	---	3.5E-03	---	3.5E-03	Nervous System	---	52	--	52
			Benzene	---	5.8E-06	---	5.8E-06	Blood	---	--	---	--
			Chloroform	---	9.8E-06	---	9.8E-06	Liver	---	--	---	--
			Chloromethane	---	---	---	--	Nervous System	---	11	---	11
			Ethylbenzene	---	2.8E-06	---	2.8E-06	Developmental	---	--	--	--
			Chemical Total	---	3.6E-03	---	3.6E-03		---	63	---	63
Total Indoor Air							3.6E-03					63
						Total Risk	3.6E-03				Total HI	63

Table E-85
Risk Summary - Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	3.9E-05	---	3.9E-05	---	---	--	--	--
			1,2-Dichloroethane	---	1.4E-03	---	1.4E-03	Nervous System	---	20	--	20
			Benzene	---	2.2E-06	---	2.2E-06	Blood	---	--	---	--
			Chloroform	---	3.8E-06	---	3.8E-06	Liver	---	--	---	--
			Chloromethane	---	---	---	--	Nervous System	---	4.1	---	4.1
			Ethylbenzene	---	1.1E-06	---	1.1E-06	Developmental	---	--	--	--
			Chemical Total	---	1.4E-03	---	1.4E-03		---	24	---	24
Total Indoor Air							1.4E-03					24
						Total Risk	1.4E-03				Total Hazard	24

Table E-86
Risk Summary - Child Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Gap	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	--	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	---	--	---	--
			Chromium	3.7E-04	---	---	3.7E-04	None observed	---	--	--	--
			Chemical Total	1.8E-03	---	---	1.8E-03		119	--	---	119
Total Knob Creek Gap							1.8E-03					119
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.1E-05	---	---	1.1E-05	Developmental	1.5	--	---	1.5
			PCB Dioxin-like Congener TEQ	6.7E-05	---	---	6.7E-05	Developmental	8.6	--	--	8.6
			PCB-1260	3.6E-05	---	---	3.6E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	2.6E-04	---	---	2.6E-04	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	5.0	--	---	5.0
			Chemical Total	3.8E-04	---	---	3.8E-04		15	--	---	15
Total Knob Creek Largemouth Bass							3.8E-04					15
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	---	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	---	--	---	--
			Chromium	1.9E-04	---	---	1.9E-04	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	2.8	--	---	2.8
			Chemical Total	1.7E-03	---	---	1.7E-03		121	--	---	121
Total Knob Creek All Species							1.7E-03					121
Total Risk - Gap							1.8E-03	Total Hazard - Gap				119
Total Risk - Largemouth Bass							3.8E-04	Total Hazard - Largemouth Bass				15
Total Risk - All Species							1.7E-03	Total Hazard - All Species				121

Table E-87
Risk Summary - Child Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	--	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	28	--	--	28
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	---	--	---	--
			Chromium	9.4E-05	---	---	9.4E-05	None quantified	---	--	--	--
			Chemical Total	4.6E-04	---	---	4.6E-04		30	--	---	30
Total Knob Creek Carp							4.6E-04					30
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	2.8E-06	---	---	2.8E-06	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	1.7E-05	---	---	1.7E-05	Developmental	2.2	--	--	2.2
			PCB-1260	8.9E-06	---	---	8.9E-06	Eye, Immune, Liver	---	--	---	--
			Chromium	6.6E-05	---	---	6.6E-05	None quantified	---	--	--	--
			Mercury	---	---	---	--	Kidney	1.3	--	---	1.3
			Chemical Total	9.5E-05	---	---	9.5E-05		3.4	--	---	3.4
Total Knob Creek Largemouth Bass							9.5E-05					3.4
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	---	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	28	--	--	28
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	---	--	---	--
			Chromium	4.8E-05	---	---	4.8E-05	None quantified	---	--	--	--
			Chemical Total	4.2E-04	---	---	4.2E-04		30	--	---	30
Total Knob Creek All Species							4.2E-04					30
Total Risk - Carp							4.6E-04	Total Hazard - Carp				30
Total Risk - Largemouth Bass							9.5E-05	Total Hazard - Largemouth Bass				3.4
Total Risk - All Species							4.2E-04	Total Hazard - All Species				30

Table E-88
Risk Summary - Adult Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	--	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	---	--	---	--
			Chromium	1.1E-04	---	---	1.1E-04	None observed	---	--	--	--
			Chemical Total	2.5E-03	---	---	2.5E-03		44	--	---	44
Total Knob Creek Carp							2.5E-03					44
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.8E-05	---	---	1.8E-05	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	1.1E-04	---	---	1.1E-04	Developmental	3.2	--	--	3.2
			PCB-1260	5.8E-05	---	---	5.8E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	8.1E-05	---	---	8.1E-05	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	1.9	--	---	1.9
			Chemical Total	2.7E-04	---	---	2.7E-04		5	--	---	5
Total Knob Creek Largemouth Bass							2.7E-04					5
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	---	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	---	--	---	--
			Chromium	5.8E-05	---	---	5.8E-05	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	1.1	--	---	1.1
			Chemical Total	2.4E-03	---	---	2.4E-03		46	--	---	46
Total Knob Creek All Species							2.4E-03					46
Total Risk - Carp							2.5E-03	Total Hazard - Carp				44
Total Risk - Largemouth Bass							2.7E-04	Total Hazard - Largemouth Bass				5
Total Risk - All Species							2.4E-03	Total Hazard - All Species				46

Table E-89
Risk Summary - Adult Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	---	--	--	--
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye, Immune system	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	---	--	---	--
			Chromium	2.9E-05	---	---	2.9E-05	None observed	---	--	--	--
			Chemical Total	6.3E-04	---	---	6.3E-04		11	--	---	11
Total Knob Creek Carp							6.3E-04					11
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	4.6E-06	---	---	4.6E-06	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	2.7E-05	---	---	2.7E-05	Developmental	---	--	--	--
			PCB-1260	1.4E-05	---	---	1.4E-05	Eye, Immune system	---	--	---	--
			Chromium	2.0E-05	---	---	2.0E-05	None observed	---	--	--	--
			Chemical Total	6.7E-05	---	---	6.7E-05		---	--	---	--
Total Knob Creek Largemouth Bass							6.7E-05					--
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye, Immune system	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	---	--	---	--
			Chromium	1.5E-05	---	---	1.5E-05	None observed	---	--	--	--
			Chemical Total	6.1E-04	---	---	6.1E-04		11	--	---	11
Total Knob Creek All Species							6.1E-04					11
Total Fish - Carp							6.3E-04	Total Hazard - Carp				11
Total Fish - Largemouth Bass							6.7E-05	Total Hazard - Largemouth Bass				--
Total Fish - All Species							6.1E-04	Total Hazard - All Species				11

APPENDIX A
SURFACE WATER EVALUATION

Appendix A
Surface Water Evaluation
Smokey Mountain Smelters
Knoxville, Tennessee

As noted in Section 4, based on the minimum likelihood of human health exposure to surface water and the low levels observed in the available surface water data, the surface water contact exposure scenarios were eliminated from consideration. This risk-based surface water screening evaluation was the basis of that determination.

Based on the minimum likelihood of human health exposure to surface water on-site and along Flenniken Branch, it was assumed that the surface water contact exposure scenarios for these EAs should be eliminated from consideration in the HHRA. To account for potential human health exposure to surface water in the Knob Creek Embayment, a risk-based surface water screening evaluation was performed.

There were 9 surface water samples collected within Knob Creek Embayment. Several VOCs and inorganics were detected in Knob Creek surface water. Table A-1 presents a summary of the analytes detected in surface water collected from Knob Creek, the screening toxicity value, and whether the maximum detected concentration exceeded the screening toxicity value. Updated National Recommended Water Quality Criteria (WQC) (EPA, 2014e) were used as the primary reference for the screening toxicity value. In the absence of a WQC, a site-specific surface water value for recreational exposure was calculated using the EPA on-line RSL calculator (EPA, 2015c) and input values used are as noted on Table A-2.

All of the detected chemicals were below the screening value, with the exception of arsenic and manganese. The ratios of the maximum detected concentrations to the RSLs for arsenic and manganese were 178 and 4.4. The ratios calculated from comparisons of soil, groundwater, and fish concentrations with their RSLs were either similar or much greater (groundwater). Additionally, the WQCs were used as a primary reference. If site-specific RSLs were used as screening toxicity values, manganese would not be a COPC and the arsenic ratio would be 1.6. From this, it is clear that the contribution to risks from the surface water pathway would be very small compared to the risks from

other pathways. Considering the minimal likelihood of human exposure to surface water and that the contribution to overall risk would be minimal, the surface water pathway was not quantitatively evaluated further in this risk assessment.

Table A-1
Occurrence, Distribution, and Selection of Contaminants of Potential Concern - Surface Water
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Contaminant	Minimum Concentration	Maximum Concentration	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Screening Toxicity Value (N/C) (2)	COPC Flag (Y/N)	Rationale for Selection or Deletion
Tuckaleechee Embayment	67641	Acetone	12	12	ug/l	SMSSA20	1/4	10 - 10	12	41000 n	NO	BSL
	71432	Benzene	0.13	0.13	ug/l	SMSSA20	1/4	5 - 5	0.13	2.2	NO	BSL
	100414	Ethylbenzene	0.14	0.14	ug/l	SMSSA20	1/4	5 - 5	0.14	530	NO	BSL
	179601231	m- and p-Xylene	0.46	0.46	ug/l	SMSSA20	1/4	5 - 5	0.46	NEA	NO	NEA
	95476	o-Xylene	0.21	0.21	ug/l	SMSSA20	1/4	5 - 5	0.21	1170 n	NO	BSL
	108883	Toluene	0.54	0.54	ug/l	SMSSA20	1/4	5 - 5	0.54	1000	NO	BSL
	95636	1,2,4-Trimethylbenzene	0.18	0.18	ug/l	SMSSA20	1/2	5 - 5	0.18	NEA	NO	NEA
	7429905	Aluminum	130	490	ug/l	SMSSA17	8/9	200 - 200	490	46700 n	NO	BSL
	7440382	Arsenic	1	3.2	ug/l	SMSSA07	4/9	1 - 10	3.2	0.018	YES	ASL
	7440393	Barium	30	40	ug/l	SMSSA17	6/9	200 - 200	40	1000	NO	BSL
	7440702	Calcium	39000	62000	ug/l	SMSSA17	9/9	NA	62000	NUT	NO	NUT
	7440508	Copper	2	2	ug/l	SMSSA07	1/9	10 - 25	2	1300	NO	BSL
	57125	Cyanide	2.1	2.1	ug/l	SMSSA07	1/9	10 - 15	2.1	140.00	NO	BSL
	7439896	Iron	260	990	ug/l	SMSSA17	8/9	270 - 270	990	32700 n	NO	BSL
	7439921	Lead	1.1	1.2	ug/l	SMSSA17	2/9	1 - 10	1.2	15	NO	BSL
	7439954	Magnesium	3200	6500	ug/l	SMSSA20	9/9	NA	6500	NUT	NO	NUT
	7439965	Manganese	130	220	ug/l	SMSSA18, SMSSA19, SMSSA20	9/9	NA	220	50	YES	ASL
	7440097	Potassium	1400	2100	ug/l	SMSSA07	7/9	5000 - 5000	2100	NUT	NO	NUT
	7440235	Sodium	10000	32000	ug/l	SMSSA17	9/9	NA	32000	NUT	NO	NUT
	7440246	Strontium	120	160	ug/l	SMSSA17	5/5	NA	160	28000 n	NO	BSL
	7440315	Tin	17	17	ug/l	SMSSA20	1/5	15 - 15	17	28000 n	NO	BSL
	7440666	Zinc	2.6	7.8	ug/l	SMSSA20	2/9	10 - 60	7.8	5000	NO	BSL
	Conventional											
	7664417	Ammonia as N	67.7	160	ug/l	SMSSA20	3/3	NA	160	NEA	NO	NEA
	16887006	Chloride	15500	58600	ug/l	SMSSA20	5/5	NA	58600	NEA	NO	NEA
	16984488	Fluoride	74	240	ug/l	SMSSA20	2/5	1000 - 1000	240	1870 n	NO	BSL
	14797558	Nitrate as N	73	2300	ug/l	SMSSA20	4/4	NA	2300	10000	NO	BSL
	14797650	Nitrite as N	67	67	ug/l	SMSSA07	1/3	100 - 100	67	4670 n	NO	BSL
	14265442	Orthophosphate as P	19	19	ug/l	SMSSA20	1/4	1000 - 1000	19	NEA	NO	NEA
	14808798	Sulfate as SO4	1000	12200	ug/l	SMSSA20	5/5	NA	12200	NEA	NO	NEA
	18496258	Sulfide	200	200	ug/l	SMSSA20	1/1	NA	200	NEA	NO	NEA

Note: none

(1) Maximum detected concentration used for screening

(2) Nutrient Recommended Ambient Criteria AQC (water + organism) from EPA 2014c. In the absence of a AQC, tap water RSL were used (Regional Screening Levels, 2015).

ASL = above screening level

BSL = below screening level

n = screened against screening level at a target risk of 1E-06

NA = not applicable

NEA = No benchmark available

nc = non-screened against screening level at a target hazard quotient of 0.1

NUT = essential nutrient

Table A-2
Site-Specific Recreator Equation Inputs for Surface Water
Smokey Mountain Smelters
Knoxville, Tennessee

Variable	Value
TR (target cancer risk) unitless	0.000001
ED_{recw} (exposure duration - recreator) year	26
ED_{recwa} (exposure duration - adult) year	20
ED_{recwc} (exposure duration - child) year	6
ED_{0-2} (mutagenic exposure duration) year	2
ED_{2-6} (mutagenic exposure duration) year	4
ED_{6-16} (mutagenic exposure duration) year	10
ED_{16-30} (mutagenic exposure duration) year	10
THQ (target hazard quotient) unitless	0.1
LT (lifetime - recreator) year	70
EF (exposure frequency) day/year	104
EF_{recwa} (adult exposure frequency) day/year	104
EF_{recwc} (child exposure frequency) day/year	104
EF_{0-2} (mutagenic exposure frequency) day/year	104
EF_{2-6} (mutagenic exposure frequency) day/year	104
EF_{6-16} (mutagenic exposure frequency) day/year	104
EF_{16-30} (mutagenic exposure frequency) day/year	104
$ET_{recw-adj}$ (age-adjusted exposure time) hour/event	2
$ET_{recw-madj}$ (mutagenic age-adjusted exposure time)	2
ET_{recwa} (adult exposure time) hour/event	2
ET_{recwc} (child exposure time) hour/event	2
$ET_{recw0-2}$ (mutagenic exposure time) hour/event	2
$ET_{recw2-6}$ (mutagenic exposure time) hour/event	2
$ET_{recw6-16}$ (mutagenic exposure time) hour/event	2
$ET_{recw16-30}$ (mutagenic exposure time) hour/event	2
EV_{recwa} (adult) events/day	1
EV_{recwc} (child) events/day	1
EV_{0-2} (mutagenic) events/day	1
EV_{2-6} (mutagenic) events/day	1
EV_{6-16} (mutagenic) events/day	1
EV_{16-30} (mutagenic) events/day	1
BW_{recwc} (body weight - child) kg	15
BW_{recwa} (body weight - adult) kg	80
BW_{0-2} (mutagenic body weight) kg	15
BW_{2-6} (mutagenic body weight) kg	15
BW_{6-16} (mutagenic body weight) kg	80
BW_{16-30} (mutagenic body weight) kg	80
SA_{recwc} (skin surface area - child) cm^2	6378
SA_{recwa} (skin surface area - adult) cm^2	20900
SA_{0-2} (skin surface area - mutagenic) cm^2	6378
SA_{2-6} (skin surface area - mutagenic) cm^2	6378
SA_{6-16} (skin surface area - mutagenic) cm^2	20900
SA_{16-30} (skin surface area - mutagenic) cm^2	20900
SA_{0-2} (mutagenic skin surface area) cm^2	6378
SA_{2-6} (mutagenic skin surface area) cm^2	6378
SA_{6-16} (mutagenic skin surface area) cm^2	20900
SA_{16-30} (mutagenic skin surface area) cm^2	20900
$IFW_{rec-adj}$ (age-adjusted water intake rate) L/kg	6.76
$IFWM_{rec-adj}$ (mutagenic age-adjusted water intake rate)	27.387
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm^2-event/kg	808724.8
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm^2-	2501865.6
IRW_{recwa} (water intake rate - adult) L/hr	0.05
IRW_{recwc} (water intake rate - child) L/hr	0.05
IRW_{0-2} (mutagenic water intake rate) L/hr	0.05
IRW_{2-6} (mutagenic water intake rate) L/hr	0.05
IRW_{6-16} (mutagenic water intake rate) L/hr	0.05
IRW_{16-30} (mutagenic water intake rate) L/hr	0.05
l_{sc} (apparent thickness of stratum corneum) cm	0.001

Output generated 18FEB2015:13:05:42

APPENDIX B
ProUCL OUTPUTS

APPENDIX B-1
ON-SITE SURFACE SOIL

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File [illegible]
Full Precision OFF
Confidence Coefficient [illegible]
Number of Bootstrap Operations [illegible]

Aluminum

General Statistics

Number of Valid Observations [illegible]

Number of Distinct Observations [illegible]

Raw Statistics

Minimum [illegible]
Maximum [illegible]
Mean [illegible]
Geometric Mean [illegible]
Median [illegible]
SD [illegible]
Std. Error of Mean [illegible]
Coefficient of Variation [illegible]
Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]
Maximum of Log Data [illegible]
Mean of Log Data [illegible]
SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]
Shapiro-Wilk critical value [illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]
95% Modified-t UCL (Johnson-1978) [illegible]

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]
Shapiro-Wilk critical value [illegible]

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL [illegible]
95% Chebyshev (MVUE) UCL [illegible]
97.5% Chebyshev (MVUE) UCL [illegible]
99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected) [illegible]
Theta Star [illegible]
nu star [illegible]
A-D Test Statistic [illegible]
Anderson-Darling Test Statistic [illegible]
Kolmogorov-Smirnov Test Statistic [illegible]
Kolmogorov-Smirnov critical value [illegible]

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when k star > 0.5) [illegible]
95% Adjusted Gamma UCL (use when k star ≤ 0.5) [illegible]

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL [illegible]
95% Jackknife UCL [illegible]
95% Standard Bootstrap UCL [illegible]
95% Bootstrap-t UCL [illegible]
95% Hall's Bootstrap UCL [illegible]
95% Percentile Bootstrap UCL [illegible]
95% BCA Bootstrap UCL [illegible]
95% Chebyshev(Mean, Sd) UCL [illegible]
97.5% Chebyshev(Mean, Sd) UCL [illegible]
99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

Use 95% Chebyshev(Mean, Sd) UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 22

Raw Statistics

Minimum: 6.9
Maximum: 6
Mean: 15.99
Geometric Mean: 14.99
Median: 15
SD: 6.051
Std. Error of Mean: 0.64
Coefficient of Variation: 0.7
Skewness: 1.2

Log-transformed Statistics

Minimum of Log Data: 1.9
Maximum of Log Data: 5.4
Mean of Log Data: 2.70
SD of Log Data: 0.61

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.911
Shapiro Wilk Critical Value: 0.947
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.9
Shapiro Wilk Critical Value: 0.947
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 17.44
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL (Chen-1995): 17.5
95% Modified-UCL (Johnson-1977): 17.47

Assuming Lognormal Distribution

95% H-UCL: 17.59
95% Chebyshev (MVUE) UCL: 19.67
97.5% Chebyshev (MVUE) UCL: 21.27
99% Chebyshev (MVUE) UCL: 24.4

Gamma Distribution Test

K-Star (bias corrected): 7.442
Theta Star: 2.149
MLE of Mean: 15.99
MLE of Standard Deviation: 5.62
nu star: 72.9
Approximate Chi Square Value: 05.667
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 66.5

Anderson-Darling Test Statistic: 0.49
Anderson-Darling 5% Critical Value: 0.751
Kolmogorov-Smirnov Test Statistic: 0.052
Kolmogorov-Smirnov 5% Critical Value: 0.127
Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 17.41
95% Jackknife UCL: 17.44
95% Standard Error Trap UCL: 17
95% Error Trap UCL: 17.66
95% Half Error Trap UCL: 17.69
95% Percentile Error Trap UCL: 17.42
95% Error Error Trap UCL: 17.61
95% Chebyshev (Mean, Sd) UCL: 19.76
97.5% Chebyshev (Mean, Sd) UCL: 21.9
99% Chebyshev (Mean, Sd) UCL: 24.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 17.47
95% Adjusted Gamma UCL (Use when n >= 40): 17.52

Potential UCL to Use

Use 95% Approximate Gamma UCL: 17.47

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Chromium

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 27

Raw Statistics

Minimum: 14
Maximum: 4
Mean: 2.41
Geometric Mean: 29.0
Median: 2
SD: 17.6
Std. Error of Mean: 2.4
Coefficient of Variation: 0.5
Skewness: 1.744

Log-transformed Statistics

Minimum of Log Data: 2.6
Maximum of Log Data: 4.4
Mean of Log Data: 6
SD of Log Data: 0.45

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.794
Shapiro Wilk Critical Value: 0.947
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.9
Shapiro Wilk Critical Value: 0.947
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 6.57
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL (Chen-1995): 7.15
95% Modified-UCL (Johnson-1978): 6.67

Assuming Lognormal Distribution

95% H-UCL: 1
95% Chebyshev (MVUE) UCL: 41.51
97.5% Chebyshev (MVUE) UCL: 45.59
99% Chebyshev (MVUE) UCL: 5

Gamma Distribution Test

K-Star (bias corrected): 4.42
Theta Star: 7.19
MLE of Mean: 2.41
MLE of Standard Deviation: 15.4
nu star: 4.4
Approximate Chi Square Value (.05): 6.7
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 5

Anderson-Darling Test Statistic: 1
Anderson-Darling 5% Critical Value: 0.754
Kolmogorov-Smirnov Test Statistic: 0.14
Kolmogorov-Smirnov 5% Critical Value: 0.127
Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL: 6.49
95% Jackknife UCL: 6.57
95% Standard Error Trap UCL: 6.49
95% Error Trap UCL: 7.7
95% Half Error Trap UCL: 7.26
95% Percentile Error Trap UCL: 6
95% Error Error Trap UCL: 7.1
95% Chebyshev (Mean, Sd) UCL: 4.22
97.5% Chebyshev (Mean, Sd) UCL: 47.9
99% Chebyshev (Mean, Sd) UCL: 57.09

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n>=40): 6.7
95% Adjusted Gamma UCL (Use when n<=40): 6.5

Potential UCL to Use

Use 95% Student's UCL: 6.57
or 95% Modified-UCL: 6.67

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Cobalt

General Statistics

Number of valid observations [illegible]

Number of Distinct observations [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of Log Data [illegible]

SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic [illegible]

Shapiro Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic [illegible]

Shapiro Wilk Critical Value [illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]

95% Modified-Bootstrap-t UCL (Johnson-1978) [illegible]

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected MLE) [illegible]

Theta Star [illegible]

nu star [illegible]

MLE of Standard Deviation [illegible]

nu star [illegible]

approximate Chi Square Value (.05, df) [illegible]

adjusted Level of Significance [illegible]

adjusted Chi Square Value [illegible]

Anderson-Darling Test Statistic [illegible]

Anderson-Darling 5% critical value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov 5% critical value [illegible]

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCA Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Assuming Gamma Distribution

95% approximate Gamma UCL (use when n>=50) [illegible]

95% adjusted Gamma UCL (use when n<50) [illegible]

Potential UCL to Use

95% approximate Gamma UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Copper

General Statistics

Number of Valid Observations [illegible]

Number of Distinct Observations [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of Log Data [illegible]

SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL [illegible]

95% Modified-Johnson UCL [illegible]

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected) [illegible]

Theta Star [illegible]

nu star [illegible]

A-D Test Statistic [illegible]

Anderson-Darling Critical Value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov Critical Value [illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernible Distribution (0.05)

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when k star > 0.1) [illegible]

95% Adjusted Gamma UCL (use when k star ≤ 0.1) [illegible]

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCA Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

95% Chebyshev(Mean, Sd) UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Iron

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 0

Raw Statistics

Minimum: 16.000
Maximum: 92.000
Mean: 5.67
Geometric Mean: 5.92
Median: 40.000
SD: 12.15
Std. Error of Mean: 1.759
Coefficient of Variation: 0.4
Skewness: 1.97

Log-transformed Statistics

Minimum of Log Data: 9.6
Maximum of Log Data: 11.4
Mean of Log Data: 10.4
SD of Log Data: 0.21

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.71
Shapiro Wilk Critical Value: 0.947

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 7.92
95% Modified-UCL (Johnson-1978): 4.01

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.977
Shapiro Wilk Critical Value: 0.947

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 4.2
95% Chebyshev (MVUE) UCL: 4.52
97.5% Chebyshev (MVUE) UCL: 4.56
99% Chebyshev (MVUE) UCL: 5.757

Gamma Distribution Test

Kolmogorov Corrected: 0.2
Theta Star: 10
MLE of Mean: 5.67
MLE of Standard Deviation: 11.09
nu star: 90.96
Approximate Chi Square Value (.05): 40.6
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 6

Anderson-Darling Test Statistic: 0.9
Anderson-Darling 5% Critical Value: 0.749
Kolmogorov-Smirnov Test Statistic: 0.0
Kolmogorov-Smirnov 5% Critical Value: 0.127

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 2.70
95% Adjusted Gamma UCL (Use when n < 40): 6.2

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 2.61
95% Jackknife UCL: 1
95% Standard Bootstrap UCL: 2.0
95% Bootstrap-t UCL: 9.011
95% Hall's Bootstrap UCL: 40.1
95% Percentile Bootstrap UCL: 2.4
95% BCA Bootstrap UCL: 7
95% Chebyshev (Mean, Sd) UCL: 4.0
97.5% Chebyshev (Mean, Sd) UCL: 4.6
99% Chebyshev (Mean, Sd) UCL: 5.2

Potential UCL to Use

Use 95% Approximate Gamma UCL: 2.70

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Manganese

General Statistics

Number of Valid Observations [illegible]

Number of Distinct Observations [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of Log Data [illegible]

SD of Log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]

95% Modified-Bootstrap-t UCL (Johnson-1978) [illegible]

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected MLE) [illegible]

Theta Star [illegible]

nu star [illegible]

MLE of Mean [illegible]

MLE of Standard Deviation [illegible]

nu hat [illegible]

Approximate Chi Square Value (.05) [illegible]

Adjusted Level of Significance [illegible]

Adjusted Chi Square Value [illegible]

Anderson-Darling Test Statistic [illegible]

Anderson-Darling Critical Value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov Critical Value [illegible]

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=40) [illegible]

95% Adjusted Gamma UCL (use when n<40) [illegible]

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCA Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

Use 95% Approximate Gamma UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Zinc

General Statistics

Number of Valid Observations: 49

Number of Distinct Observations: 5

Raw Statistics

Minimum: 4
Maximum: 4200
Mean: 2767
Geometric Mean: 1119
Median: 65
SD: 6.6
Std. Error of Mean: 90.9
Coefficient of Variation: 2.02
Skewness: 5.245

Log-transformed Statistics

Minimum of Log Data: 5.26
Maximum of Log Data: 4
Mean of Log Data: 4.717
SD of Log Data: 1.15

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic: 0.406
Shapiro Wilk Critical Value: 0.947
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic: 0.49
Shapiro Wilk Critical Value: 0.947
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 4.29
95% UCLs (Adjusted for Skewness)
95% Adjusted-CLT UCL (Chen-1995): 4.92
95% Modified-UCL (Johnson-1977): 4.407

Assuming Lognormal Distribution

95% H-UCL: 0
95% Chebyshev (MVUE) UCL: 99
97.5% Chebyshev (MVUE) UCL: 47.7
99% Chebyshev (MVUE) UCL: 1

Gamma Distribution Test

K-Star (bias corrected): 0.644
Theta Star: 4.29
MLE of Mean: 2767
MLE of Standard Deviation: 44.9
Nu Star: 0
Approximate Chi Square Value (.05): 1
Adjusted Level of Significance: 0.0451
Adjusted Chi Square Value: 45.6

Anderson-Darling Test Statistic: 4.452
Anderson-Darling 5% Critical Value: 0.799
Kolmogorov-Smirnov Test Statistic: 0.255
Kolmogorov-Smirnov 5% Critical Value: 0.12
Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL: 4.26
95% Jackknife UCL: 4.29
95% Standard Error Trap UCL: 4.2
95% Error Trap UCL: 75
95% Half Error Trap UCL: 95.4
95% Percentile Error Trap UCL: 447
95% Error Error Trap UCL: 506
95% Chebyshev (Mean, Sd) UCL: 67
97.5% Chebyshev (Mean, Sd) UCL: 44.9
99% Chebyshev (Mean, Sd) UCL: 11.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 1
95% Adjusted Gamma UCL (Use when n < 40): 4

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL: 67

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Mercury

General Statistics

Total Number of observations	4	Number of Distinct Observations	[illegible]
Number of Detects	47	Number of Non-Detects	1
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	1
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Average Detect	[illegible]	Percent Non-Detects	[illegible]
Median Detect	[illegible]	SD Detects	[illegible]
Standard Error of Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Detected data NOT Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	[illegible]	Detected data NOT Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D critical value	[illegible]	Detected data NOT Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S critical value	[illegible]	Detected data NOT Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square value (.05,...)	[illegible]	adjusted Chi Square value (.05,...)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection levels or single DL

GROS may not be used when kstar of detected data is small such as < 1.0

For such situations, GROS method may yield incorrect values of UCLs and BTLs

For gamma distributed detected data, BTLs and UCLs may be computed using gamma distribution on the imputed data

Mean	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (beta)	[illegible]
approximate Chi Square value (.05,...)	[illegible]	adjusted Chi Square value (.05,...)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Detected data NOT Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	[illegible]	Detected data NOT Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in original scale	[illegible]	Mean in Log scale	[illegible]
SD in original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL in original scale	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (BCA) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in original scale	[illegible]	Mean in Log scale	[illegible]
SD in original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (use when n>=50)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% Hall's Bootstrap UCL [illegible]

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix B-1
ProUCL Output - On-Site Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Vanadium

General Statistics

Total Number of observations	40	Number of Distinct observations	[illegible]
		Number of Missing observations	
Minimum	17	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	Std Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	[illegible]	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]
		95% Modified-Bootstrap-t UCL (Johnson-1978)	[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**	
5% A-D critical value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S critical value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]	95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk critical value	[illegible]	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**	
5% Lilliefors critical value	[illegible]	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of logged Data	[illegible]
Maximum of Logged Data	[illegible]	SD of logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]	99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Adjusted Gamma UCL	[illegible]

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.
These recommendations are based upon various factors such as skewness, sample size, and the number of distinct or detected data.
However, it may be noted that the Chebyshev inequality based UCLs may provide much higher coverage than the other UCLs.
For additional insight the user may want to consult a statistician.

APPENDIX B-2
ON-SITE TOTAL SOIL

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

[illegible]

Aluminum

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

[illegible]

Assuming Gamma Distribution

[illegible]

Potential UCLs to Use

[illegible]

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations: 2

Raw Statistics

Minimum: 0.14
Maximum: 0.6
Mean: 15.71
Geometric Mean: 1.77
Median: 15
SD: 6.2
Std. Error of Mean: 0.64
Coefficient of Variation: 0.4
Skewness: 0.4

Log-transformed Statistics

Minimum of Log Data: -1.966
Maximum of Log Data: -5.4
Mean of Log Data: 2.622
SD of Log Data: 0.7

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic: 0.112
Lilliefors Critical Value: 0.122

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-UCL: 17.16

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 17.24
95% Modified-UCL (Johnson-1978): 17.17

Lognormal Distribution Test

Lilliefors Test Statistic: 0.20
Lilliefors Critical Value: 0.122

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 22.2
95% Chebyshev (MVUE) UCL: 26.57
97.5% Chebyshev (MVUE) UCL: 0.2
99% Chebyshev (MVUE) UCL: 7.69

Gamma Distribution Test

Kolmogorov-Smirnov Test Statistic: 0.1
Theta Star: 4.211
MLE of Mean: 15.71
MLE of Standard Deviation: 1.4
Nu Star: 95.5
Approximate Chi Square Value (0.05): 50.4
Adjusted Level of Significance: 0.0455
Adjusted Chi Square Value: 49

Anderson-Darling Test Statistic: 1.6
Anderson-Darling 5% Critical Value: 0.754
Kolmogorov-Smirnov Test Statistic: 0.141
Kolmogorov-Smirnov 5% Critical Value: 0.12

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n = 40): 17.7
95% Adjusted Gamma UCL (Use when n = 40): 17.79

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 17.1
95% Jackknife UCL: 17.16
95% Standard Error Trap UCL: 17.19
95% Error Trap UCL: 17.2
95% Half Error Trap UCL: 17.4
95% Percentile Error Trap UCL: 17.17
95% Error Error Trap UCL: 17.2
95% Chebyshev (Mean, Sd) UCL: 19.4
97.5% Chebyshev (Mean, Sd) UCL: 21.11
99% Chebyshev (Mean, Sd) UCL: 24

Potential UCL to Use

Use 95% Student's-UCL: 17.16

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Chromium

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations: 1

Raw Statistics

Minimum: 14
Maximum: 14
Mean: 1[illegible]
Geometric Mean: 2[illegible]
Median: 2[illegible]
SD: 1[illegible]
Std. Error of Mean: 2[illegible]
Coefficient of Variation: 0.51[illegible]
Skewness: 1.[illegible]

Log-transformed Statistics

Minimum of Log Data: 2.[illegible]
Maximum of Log Data: 4.[illegible]
Mean of Log Data: [illegible]
SD of Log Data: 0.44

Relevant UCL Statistics

Normal Distribution Test

Lilliefor Test Statistic: 0.1[illegible]
Lilliefor Critical Value: 0.1[illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 7.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 7.5
95% Modified-UCL (Johnson-1978): 7.1

Lognormal Distribution Test

Lilliefor Test Statistic: 0.0[illegible]
Lilliefor Critical Value: 0.1[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 7.05
95% Chebyshev of MVUE UCL: 4.[illegible]
97.5% Chebyshev of MVUE UCL: 4.[illegible]
99% Chebyshev of MVUE UCL: 5.[illegible]

Gamma Distribution Test

K-Star (bias corrected): 4.[illegible]
Theta Star: 7.[illegible]
MLE of Mean: [illegible]
MLE of Standard Deviation: 15.[illegible]
nu star: 4[illegible]
Approximate Chi Square Value: 0.5[illegible]
Adjusted Level of Significance: 0.0455
Adjusted Chi Square Value: 4.[illegible]

Anderson-Darling Test Statistic: 0.[illegible]
Anderson-Darling 5% Critical Value: 0.754
Kolmogorov-Smirnov Test Statistic: 0.11
Kolmogorov-Smirnov 5% Critical Value: 0.1[illegible]

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 6.[illegible]
95% Adjusted Gamma UCL (Use when n < 40): 7.[illegible]

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 7.0
95% Jackknife UCL: 7.1
95% Standard Error Trap UCL: 6.[illegible]
95% Error Trap UCL: [illegible]
95% Half Error Trap UCL: 7.[illegible]
95% Percentile Error Trap UCL: 7.[illegible]
95% Error Error Trap UCL: 7.[illegible]
95% Chebyshev of Mean, Sd UCL: 4.[illegible]
97.5% Chebyshev of Mean, Sd UCL: 4.[illegible]
99% Chebyshev of Mean, Sd UCL: 5.[illegible]

Potential UCL to Use

Use 95% Approximate Gamma UCL: 6.[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Cobalt

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

[illegible]

Assuming Gamma Distribution

[illegible]

Potential UCLs to Use

[illegible]

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Copper

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernible Distribution (0.05)

Nonparametric Statistics

[illegible]

Assuming Gamma Distribution

[illegible]

Potential UCL to Use

[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Iron

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations:

Raw Statistics

Minimum: 16000
Maximum: 92000
Mean: 6[illegible]
Geometric Mean: 4442
Median: 5000
SD: 1[illegible]5
Std. Error of Mean: 17[illegible]
Coefficient of Variation: 0.[illegible]47
Skewness: 1.[illegible]16

Log-transformed Statistics

Minimum of Log Data: 9.[illegible]
Maximum of Log Data: 11.4
Mean of Log Data: 10.45
SD of Log Data: 0.[illegible]5

Relevant UCL Statistics

Normal Distribution Test

Lilliefor Test Statistic: 0.11
Lilliefor Critical Value: 0.1[illegible]

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 9[illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 95[illegible]1
95% Modified-UCL (Johnson-1978): 9[illegible]65

Lognormal Distribution Test

Lilliefor Test Statistic: 0.09
Lilliefor Critical Value: 0.1[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 9[illegible]4
95% Chebyshev (MVUE) UCL: 4[illegible]
97.5% Chebyshev (MVUE) UCL: 4[illegible]
99% Chebyshev (MVUE) UCL: 5[illegible]

Gamma Distribution Test

K-Star (bias corrected): 9[illegible]
Theta Star: 97
MLE of Mean: 6[illegible]
MLE of Standard Deviation: 1[illegible]
nu star: 96[illegible]5
Approximate Chi Square Value (05): 9[illegible]
Adjusted Level of Significance: 0.0455
Adjusted Chi Square Value: 95[illegible]

Anderson-Darling Test Statistic: 0.[illegible]4
Anderson-Darling 5% Critical Value: 0.75
Kolmogorov-Smirnov Test Statistic: 0.0[illegible]
Kolmogorov-Smirnov 5% Critical Value: 0.1[illegible]

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 9[illegible]4
95% Adjusted Gamma UCL (Use when n < 40): 9[illegible]7

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 9[illegible]
95% Jackknife UCL: 9[illegible]
95% Standard Error Trap UCL: 9[illegible]
95% Error Trap UCL: 9[illegible]
95% Half Error Trap UCL: 4[illegible]
95% Percentile Error Trap UCL: 9[illegible]
95% Error Error Trap UCL: 9[illegible]
95% Chebyshev (Mean, Sd) UCL: 4[illegible]
97.5% Chebyshev (Mean, Sd) UCL: 4[illegible]
99% Chebyshev (Mean, Sd) UCL: 5[illegible]

Potential UCL to Use

Use 95% Student's UCL: 9[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Manganese

General Statistics

[illegible]

Raw Statistics

[illegible]

Log-transformed Statistics

[illegible]

Relevant UCL Statistics

Normal Distribution Test

[illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

[illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

[illegible]

95% UCLs (Adjusted for Skewness)

[illegible]

Assuming Lognormal Distribution

[illegible]

Gamma Distribution Test

[illegible]

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

[illegible]

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

[illegible]

Potential UCL to Use

[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Zinc

General Statistics

Number of Valid Observations: 5

Number of Distinct Observations: 7

Raw Statistics

Minimum: 94

Maximum: 4200

Mean: 2647

Geometric Mean: 1101

Median: 65

SD: 1[illegible]

Std. Error of Mean: 4[illegible]

Coefficient of Variation: 2[illegible]

Skewness: 5.447

Log-transformed Statistics

Minimum of Log Data: 5[illegible]

Maximum of Log Data: [illegible]

Mean of Log Data: 4.701

SD of Log Data: 1.1[illegible]

Relevant UCL Statistics

Normal Distribution Test

Lilliefor Test Statistic: 0.[illegible]54

Lilliefor Critical Value: 0.1[illegible]

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's UCL: 4[illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 4[illegible]

95% Modified-UCL (Johnson-1978): 4[illegible]

Gamma Distribution Test

K-Star (bias corrected): 0.[illegible]

Theta Star: [illegible]

MLE of Mean: 2647

MLE of Standard Deviation: 2[illegible]

nu star: 70[illegible]

Approximate Chi Square Value: 0.5[illegible]

Adjusted Level of Significance: 0.0455

Adjusted Chi Square Value: 51.[illegible]

Anderson-Darling Test Statistic: 4.[illegible]

Anderson-Darling 5% Critical Value: 0.[illegible]

Kolmogorov-Smirnov Test Statistic: 0.[illegible]

Kolmogorov-Smirnov 5% Critical Value: 0.1[illegible]

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n>=40): 5[illegible]

95% Adjusted Gamma UCL (Use when n>=40): [illegible]

Potential UCL to Use

Lognormal Distribution Test

Lilliefor Test Statistic: 0.[illegible]1

Lilliefor Critical Value: 0.1[illegible]

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL: 4[illegible]

95% Chebyshev (MVUE) UCL: 7[illegible]

97.5% Chebyshev (MVUE) UCL: 4[illegible]

99% Chebyshev (MVUE) UCL: 5[illegible]

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL: 4[illegible]

95% Jackknife UCL: 4[illegible]

95% Standard Error Trap UCL: 4[illegible]

95% Error Trap UCL: 6[illegible]

95% Half Error Trap UCL: [illegible]

95% Percentile Error Trap UCL: 4[illegible]

95% Error Error Trap UCL: 5[illegible]

95% Chebyshev (Mean, Sd) UCL: [illegible]

97.5% Chebyshev (Mean, Sd) UCL: 7[illegible]

99% Chebyshev (Mean, Sd) UCL: 11[illegible]

UCL 95% Chebyshev (Mean, Sd) UCL: [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-2
ProUCL Output - On-Site Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Mercury

General Statistics

Total Number of observations	51	Number of Distinct Observations	[illegible]
Number of Detects	50	Number of Non-Detects	1
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	1
Minimum Detect	0.0117	Minimum Non-Detect	0.17
Maximum Detect	0.24	Maximum Non-Detect	0.17
Average Detect	0.0[illegible]5	Percent Non-Detects	1.96%
Median Detect	0.114	SD Detects	0.15
Log-mean Detect	0.07[illegible]	CV Detects	1.[illegible]15
Skewness Detects	4.[illegible]	Kurtosis Detects	24.7
Mean of Logged Detects	-2.[illegible]4	SD of Logged Detects	0.751

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.51	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	0.947	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.2[illegible]4	**Lilliefors GOF Test**	
5% Lilliefors critical value	0.1[illegible]5	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.11	Standard Error of Mean	0.0[illegible]2
SD	0.147	95% KM (BCA) UCL	0.15
95% KM (t) UCL	0.14	95% KM (Percentile Bootstrap) UCL	0.14[illegible]
95% KM (z) UCL	0.14	95% KM (Bootstrap t) UCL	0.1[illegible]
90% KM (Chebyshev) UCL	0.17[illegible]	95% KM (Chebyshev) UCL	0.2[illegible]4
97.5% KM (Chebyshev) UCL	0.2[illegible]4	99% KM (Chebyshev) UCL	0.[illegible]1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]7	**Anderson-Darling GOF Test**	
5% A-D critical value	0.7[illegible]7	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.2[illegible]7	**Kolmogorov-Smirnoff GOF**	
5% K-S critical value	0.1[illegible]7	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.514	k star (bias corrected MLE)	1.441
Theta hat (MLE)	0.0775	Theta star (bias corrected MLE)	0.0764
nu hat (MLE)	151.4	nu star (bias corrected)	144.1
MLE Mean (bias corrected)	0.114	MLE Sd (bias corrected)	0.0961

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.54	nu hat (KM)	54.4
approximate Chi Square value (.05, df)	41.55	adjusted Chi Square value (.05, df)	41.1
95% Gamma approximate KM-UCL (use when df>=50)	0.157	95% Gamma adjusted KM-UCL (use when df<50)	0.151

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied ND values or single DL

GROS may not be used when kstar of detected data < small such as 0.1

For such situations, GROS method may not be valid to calculate UCL and ET

For gamma distributed detected data, BTA and UCL may be computed using gamma distributed KM estimates

Mean	0.0117	Mean	0.11
SD	0.0[illegible]4	SD	0.0[illegible]1
SE of Mean	0.147		1.1
k hat (MLE)	1.5	k star (bias corrected MLE)	1.441
Theta hat (MLE)	0.0[illegible]	Theta star (bias corrected MLE)	0.0775
nu hat (MLE)	151.4	nu star (bias corrected)	144
MLE Mean (bias corrected)	0.11	MLE Sd (bias corrected)	0.0[illegible]7
		adjusted Level of Significance (beta)	0.0[illegible]5
approximate Chi Square value (144.000, .05)	1.21	adjusted Chi Square value (144.000, beta)	1.11
95% Gamma approximate UCL (use when df>=50)	0.1[illegible]	95% Gamma adjusted UCL (use when df<50)	0.1[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9[illegible]7	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk critical value	0.947	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.15[illegible]	**Lilliefors GOF Test**	
5% Lilliefors critical value	0.1[illegible]5	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in original scale	0.11	Mean in Log scale	-2.[illegible]
SD in original scale	0.14[illegible]	SD in Log scale	0.74
95% KM (BCA) UCL in original scale	0.14	95% Percentile Bootstrap UCL	0.15
95% Exact Bootstrap UCL	0.1[illegible]	95% Bootstrap t UCL	0.1
95% H-UCL in Log scale	0.1		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in original scale	0.114	Mean in Log scale	-2.5
SD in original scale	0.14[illegible]	SD in Log scale	0.74
95% UCL in original scale	0.14	95% H-Stat UCL	0.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 0.14

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulations summarized in Singh, Maslia and Armbya, 2002.
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX B-3
FLENNIKEN BRANCH SURFACE SOIL

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	tb_cc.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations: 13	Number of Distinct Observations: 11

Raw Statistics	Log-transformed Statistics
Minimum: 4500	Minimum of Log Data: 8.412
Maximum: 18000	Maximum of Log Data: 9.798
Mean: 11592	Mean of Log Data: 9.268
Geometric Mean: 10593	SD of Log Data: 0.467
Median: 11000	
SD: 4622	
Std. Error of Mean: 1282	
Coefficient of Variation: 0.399	
Skewness: -0.23	

Relevant UCL Statistics

Normal Distribution Test	Lognormal Distribution Test
Shapiro-Wilk Test Statistic: 0.932	Shapiro-Wilk Test Statistic: 0.899
Shapiro-Wilk Critical Value: 0.866	Shapiro-Wilk Critical Value: 0.866
Data appear Normal at 5% Significance Level	Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-t UCL: 13877	95% H-UCL: 15625
95% UCLs (Adjusted for Skewness)	95% Chebyshev (MVUE) UCL: 18468
95% Adjusted-CLT UCL (Chen-1995): 13613	97.5% Chebyshev (MVUE) UCL: 21393
95% Modified-t UCL (Johnson-1978): 13863	99% Chebyshev (MVUE) UCL: 27140

Gamma Distribution Test	Data Distribution
k star (bias corrected): 4.444	Data appear Normal at 5% Significance Level
Theta Star: 2609	
MLE of Mean: 11592	
MLE of Standard Deviation: 5499	
nu star: 115.5	
Approximate Chi Square Value (.05): 91.72	**Nonparametric Statistics**
Adjusted Level of Significance: 0.0301	95% CLT UCL: 13701
Adjusted Chi Square Value: 88.7	95% Jackknife UCL: 13877
	95% Standard Bootstrap UCL: 13691
Anderson-Darling Test Statistic: 0.477	95% Bootstrap-t UCL: 13815
Anderson-Darling 5% Critical Value: 0.736	95% Hall's Bootstrap UCL: 13596
Kolmogorov-Smirnov Test Statistic: 0.188	95% Percentile Bootstrap UCL: 13585
Kolmogorov-Smirnov 5% Critical Value: 0.237	95% BCA Bootstrap UCL: 13546
Data appear Gamma Distributed at 5% Significance Level	95% Chebyshev (Mean, Sd) UCL: 17180
	97.5% Chebyshev (Mean, Sd) UCL: 19597
Assuming Gamma Distribution	99% Chebyshev (Mean, Sd) UCL: 24346
95% Approximate Gamma UCL (Use when n >= 40): 14602	
95% Adjusted Gamma UCL (Use when n < 40): 15100	

Potential UCL to Use — Use 95% Student's-t UCL: 13877

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 13

Number of Distinct Observations: 12

Raw Statistics

Minimum: 4.1

Maximum: 15

Mean: 8.585

Geometric Mean: 8.009

Median: 8.4

SD: 3.205

Std. Error of Mean: 0.889

Coefficient of Variation: 0.373

Skewness: 0.339

Log-transformed Statistics

Minimum of Log Data: 1.411

Maximum of Log Data: 2.708

Mean of Log Data: 2.081

SD of Log Data: 0.398

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic: 0.968

Shapiro-Wilk Critical Value: 0.866

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro-Wilk Test Statistic: 0.957

Shapiro-Wilk Critical Value: 0.866

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL: 10.17

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995): 10.14

95% Modified-t UCL (Johnson-1978): 10.19

Assuming Lognormal Distribution

95% H-UCL: 10.91

95% Chebyshev (MVUE) UCL: 12.83

97.5% Chebyshev (MVUE) UCL: 14.66

99% Chebyshev (MVUE) UCL: 18.24

Gamma Distribution Test

k star (bias corrected): 5.718

Theta Star: 1.501

nu star: 148.7

MLE of Mean: 8.585

MLE of Standard Deviation: 3.59

nu hat: 148.7

Approximate Chi Square Value (.05): 121.5

Adjusted Level of Significance: 0.0301

Adjusted Chi Square Value: 118

Anderson-Darling Test Statistic: 0.212

Anderson-Darling 5% Critical Value: 0.735

Kolmogorov-Smirnov Test Statistic: 0.113

Kolmogorov-Smirnov 5% Critical Value: 0.237

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40): 10.51

95% Adjusted Gamma UCL (Use when n < 40): 10.82

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL: 10.05

95% Jackknife UCL: 10.17

95% Standard Error of Mean: 0.97

95% Bootstrap (%) UCL: 10.29

95% Hall's Bootstrap UCL: 10.27

95% Percentile Bootstrap UCL: 9.962

95% BCa Bootstrap UCL: 10

95% Chebyshev(Mean, Sd) UCL: 12.46

97.5% Chebyshev(Mean, Sd) UCL: 14.14

99% Chebyshev(Mean, Sd) UCL: 17.43

Potential UCL to Use

Use 95% Student's-t UCL: 10.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

PCB-1260 (Aroclor 1260)

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
		Percent Non-Detects	11.11%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.017	Minimum Detected	-4.075
Maximum Detected	0.23	Maximum Detected	-1.47
Mean of Detected	0.0716	Mean of Detected	-3.002
SD of Detected	0.0706	SD of Detected	0.901
Minimum Non-Detect	0.013	Minimum Non-Detect	-4.343
Maximum Non-Detect	0.013	Maximum Non-Detect	-4.343

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.78	Shapiro Wilk Test Statistic	0.951
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0644	Mean	-3.228
SD	0.0696	SD	1.081
95% DL/2 Student's-t UCL	0.108	95% H-Stat DL/2 UCL	0.263
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0604	Mean in Log Scale	-3.251
SD	0.0709	SD in Log Scale	1.127
95% MLE Student's-t UCL	0.104	Mean in Original Scale	0.0643
95% MLE Tiku UCL	0.103	SD in Original Scale	0.0697
		95% BCA UCL	0.107
		95% Percentile Bootstrap UCL	0.102
		95% BCA Bootstrap UCL	0.121
		95% H UCL	0.298

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.029	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.0696	
nu star	16.46	
A-D Test Statistic	0.316	Nonparametric Statistics
5% A-D Critical Value	0.728	Kaplan-Meier (KM) Method
K-S Test Statistic	0.728	Mean 0.0656
5% K-S Critical Value	0.299	SD 0.0646
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 0.023
		95% KM (t) UCL 0.108
Assuming Gamma Distribution		95% KM (z) UCL 0.103
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 0.108
Minimum	0.000001	95% KM (bootstrap t) UCL 0.153
Maximum	0.23	95% KM (BCA) UCL 0.108
Mean	0.0637	95% KM (Percentile Bootstrap) UCL 0.104
Median	0.038	95% KM (Chebyshev) UCL 0.166
SD	0.0703	97.5% KM (Chebyshev) UCL 0.209
k star	0.372	99% KM (Chebyshev) UCL 0.295
Theta Star	0.171	
nu star	6.688	Potential UCLs to Use
approx Chi2	2.001	95% KM (BCA) UCL 0.108
95% Gamma approximate UCL (use when n >= 40)	0.213	
95% adjusted Gamma UCL (use when n < 40)	0.283	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2008).

For additional insight, the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Chromium

General Statistics

Total Number of Observation	1[illegible]	Number of Distinct Observation	1[illegible]
		Number of Missing Observation	1
Minimum	11	Mean	[illegible]
Maximum	4[illegible]	Median	[illegible]1
SD	10[illegible]	Std. Error of Mean	[illegible]
Coefficient of Variation	0.4[illegible]	Skewness	1.[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.[illegible]	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.15[illegible]	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.[illegible]	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]1
		95% Modified-t UCL (Johnson-1978)	[illegible]4

Gamma GOF Test

A-D Test Statistic	0.[illegible]5	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7[illegible]5	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.[illegible]7	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.57[illegible]	k star (bias corrected MLE)	5.104
Theta hat (MLE)	[illegible].51	Theta star (bias corrected MLE)	4.517
nu hat (MLE)	171	nu star (bias corrected)	1[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	10.1
		approximate Chi Square Value (0.05)	107.[illegible]
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	10[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible].59	95% Adjusted Gamma UCL (use when n<50)	[illegible].49

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9[illegible]5	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.[illegible]	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.09[illegible]	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.[illegible]	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible].[illegible]	Mean of logged Data	[illegible].1
Maximum of Logged Data	[illegible].71	SD of logged Data	0.404

Assuming Lognormal Distribution

95% H-UCL	[illegible]4.5	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]4.4	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	4[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]7.7	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]7.49	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible].51	95% Percentile Bootstrap UCL	[illegible]7.54
95% BCa Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	40[illegible]	99% Chebyshev (Mean, Sd) UCL	50[illegible]

Suggested UCL to Use

95% Student's-t UCL	[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulation results will not cover all Real-world data sets;
For additional insight the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Cobalt

General Statistics

Total Number of Observation	10	Number of Distinct Observation	7
		Number of Missing Observation	[illegible]
Minimum	[illegible]	Mean	10.[illegible]
Maximum	15	Median	11
SD	[illegible].45	Std. Error of Mean	[illegible].71
Coefficient of Variation	[illegible].06	Skewness	[illegible].4

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible].95[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible].4[illegible]	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible].1[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible].[illegible]	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1[illegible].14	95% Adjusted-CLT UCL (Chen-1995)	1[illegible].1[illegible]
		95% Modified-t UCL (Johnson-1978)	1[illegible].[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible].41	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	[illegible].7[illegible]5	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible].146	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	[illegible].[illegible]6	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible].6[illegible]	k star (bias corrected MLE)	1[illegible].[illegible]4
Theta hat (MLE)	[illegible].41[illegible]	Theta star (bias corrected MLE)	[illegible].9[illegible]5
nu hat (MLE)	5[illegible].[illegible]7	nu star (bias corrected)	[illegible].5[illegible]
MLE Mean (bias corrected)	10.[illegible]4	MLE Sd (bias corrected)	[illegible].54[illegible]
		approximate Chi Square Value (0.05)	[illegible].5
Adjusted Level of Significance	[illegible].[illegible]7	Adjusted Chi Square Value	[illegible].4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1[illegible].5	95% Adjusted Gamma UCL (use when n<50)	1[illegible].[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible].954	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	[illegible].4[illegible]	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible].156	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	[illegible].[illegible]	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible].[illegible]7	Mean of logged Data	[illegible].[illegible]
Maximum of Logged Data	[illegible].7[illegible]	SD of logged Data	[illegible].[illegible]

Assuming Lognormal Distribution

95% H-UCL	1[illegible].44	90% Chebyshev (MVUE) UCL	1[illegible].[illegible]5
95% Chebyshev (MVUE) UCL	14[illegible].[illegible]	97.5% Chebyshev (MVUE) UCL	15.[illegible]
99% Chebyshev (MVUE) UCL	1[illegible].[illegible]5		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1[illegible].[illegible]	95% Jackknife UCL	1[illegible].14
95% Standard Bootstrap UCL	11.[illegible]	95% Bootstrap-t UCL	1[illegible].[illegible]
95% Hall's Bootstrap UCL	1[illegible].[illegible]	95% Percentile Bootstrap UCL	11.[illegible]7
95% BCa Bootstrap UCL	1[illegible].[illegible]7		
90% Chebyshev(Mean, Sd) UCL	1[illegible].[illegible]	95% Chebyshev(Mean, Sd) UCL	1[illegible].[illegible]
97.5% Chebyshev(Mean, Sd) UCL	15.[illegible]	99% Chebyshev(Mean, Sd) UCL	17.95

Suggested UCL to Use

95% Student's-t UCL	1[illegible].14

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulation results will not cover all Real-world data sets;
For additional insight the user may want to consult a statistician.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Iron

General Statistics

Total Number of Observation	1[illegible]	Number of Distinct Observation	[illegible]
		Number of Missing Observation	1
Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	Std. Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]
		95% Modified-t UCL (Johnson-1978)	[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	[illegible]	Data Not Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]	95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data Not Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of logged Data	[illegible]
Maximum of Logged Data	[illegible]	SD of logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCa Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]	99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Student's-t UCL	[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulation results will not cover all Real World data sets;
For additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Appendix B-3
ProUCL Output - Flenniken Branch Surface Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Manganese

General Statistics

Total Number of Observation	1[illegible]	Number of Distinct Observation	11
		Number of Missing Observation	1
Minimum	4.0[illegible]	Mean	[illegible]
Maximum	1[illegible].00	Median	[illegible]
SD	[illegible]	Std. Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	[illegible]	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**
5% Lilliefors Critical Value	[illegible]	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	[illegible]	95% Adjusted-CLT UCL (Chen-1995)	[illegible]
		95% Modified-t UCL (Johnson-1978)	[illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]	95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	[illegible]	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	[illegible]	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of logged Data	[illegible]
Maximum of Logged Data	[illegible]	SD of logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]	90% Chebyshev (MVUE) UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]	97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]	95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]	95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCa Bootstrap UCL	[illegible]		
90% Chebyshev (Mean, Sd) UCL	[illegible]	95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]	99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Student's-t UCL	[illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). However, simulations results will not cover all Real World data sets;
For additional insight the user may want to consult a statistician.

APPENDIX B-4
FLENNIKEN BRANCH TOTAL SOIL

Appendix B-4
ProUCL Output - Flenniken Branch Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	tb_ts.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations: 13	Number of Distinct Observations: 11

Raw Statistics	Log-transformed Statistics
Minimum: 4500	Minimum of Log Data: 8.412
Maximum: 18000	Maximum of Log Data: 9.798
Mean: 11592	Mean of Log Data: 9.268
Geometric Mean: 10593	SD of Log Data: 0.467
Median: 11000	
SD: 4622	
Std. Error of Mean: 1282	
Coefficient of Variation: 0.399	
Skewness: -0.23	

Relevant UCL Statistics

Normal Distribution Test	Lognormal Distribution Test
Shapiro-Wilk Test Statistic: 0.932	Shapiro-Wilk Test Statistic: 0.899
Shapiro-Wilk Critical Value: 0.866	Shapiro-Wilk Critical Value: 0.866
Data appear Normal at 5% Significance Level	Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-t UCL: 13877	95% H-UCL: 15625
95% UCLs (Adjusted for Skewness)	95% Chebyshev (MVUE) UCL: 18468
95% Adjusted-CLT UCL (Chen-1995): 13613	97.5% Chebyshev (MVUE) UCL: 21393
95% Modified-t UCL (Johnson-1978): 13863	99% Chebyshev (MVUE) UCL: 27140

Gamma Distribution Test	Data Distribution
k-star (bias corrected): 4.444	Data appear Normal at 5% Significance Level
Theta Star: 2609	
MLE of Mean: 11592	
MLE of Standard Deviation: 5499	
nu star: 115.5	
Approximate Chi Square Value (.05): 91.72	**Nonparametric Statistics**
Adjusted Level of Significance: 0.0301	95% CLT UCL: 13701
Adjusted Chi Square Value: 88.7	95% Jackknife UCL: 13877
	95% Standard Bootstrap UCL: 13572
Anderson-Darling Test Statistic: 0.477	95% Bootstrap-t UCL: 13793
Anderson-Darling 5% Critical Value: 0.736	95% Hall's Bootstrap UCL: 13547
Kolmogorov-Smirnov Test Statistic: 0.188	95% Percentile Bootstrap UCL: 13523
Kolmogorov-Smirnov 5% Critical Value: 0.237	95% BCA Bootstrap UCL: 13746
Data appear Gamma Distributed at 5% Significance Level	95% Chebyshev (Mean, Sd) UCL: 17180
	97.5% Chebyshev (Mean, Sd) UCL: 19597
Assuming Gamma Distribution	99% Chebyshev (Mean, Sd) UCL: 24346
95% Approximate Gamma UCL (Use when n >= 40): 14602	
95% Adjusted Gamma UCL (Use when n >= 40): 15100	

Potential UCL to Use	Use 95% Student's-t UCL: 13877

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positively skewed data sets.

Appendix B-4
ProUCL Output - Flenniken Branch Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

Arsenic

General Statistics

Number of Valid Observations: 13	Number of Distinct Observations: 12

Raw Statistics	Log-transformed Statistics
Minimum: 4.1	Minimum of Log Data: 1.411
Maximum: 15	Maximum of Log Data: 2.708
Mean: 8.585	Mean of Log Data: 2.081
Geometric Mean: 8.009	SD of Log Data: 0.398
Median: 8.4	
SD: 3.205	
Std. Error of Mean: 0.889	
Coefficient of Variation: 0.373	
Skewness: 0.339	

Relevant UCL Statistics

Normal Distribution Test	Lognormal Distribution Test
Shapiro-Wilk Test Statistic: 0.968	Shapiro-Wilk Test Statistic: 0.957
Shapiro-Wilk Critical Value: 0.866	Shapiro-Wilk Critical Value: 0.866
Data appear Normal at 5% Significance Level	**Data appear Lognormal at 5% Significance Level**

Assuming Normal Distribution	Assuming Lognormal Distribution
95% Student's-UCL: 10.17	95% H-UCL: 10.91
95% UCLs (Adjusted for Skewness)	95% Chebyshev (MVUE) UCL: 12.83
95% Adjusted-CLT UCL (Chen-1995): 10.14	97.5% Chebyshev (MVUE) UCL: 14.66
95% Modified-UCL (Johnson-1978): 10.18	99% Chebyshev (MVUE) UCL: 18.24

Gamma Distribution Test	Data Distribution
k star (bias corrected): 5.718	**Data appear Normal at 5% Significance Level**
Theta Star: 1.501	
MLE of Mean: 8.585	
MLE of Standard Deviation: 3.59	
nu star: 148.7	
Approximate Chi Square Value (.05): 121.5	**Nonparametric Statistics**
Adjusted Level of Significance: 0.0301	95% CLT UCL: 10.05
Adjusted Chi Square Value: 118	95% Jackknife UCL: 10.17
	95% Standard Bootstrap UCL: 9.968
Anderson-Darling Test Statistic: 0.212	95% Bootstrap-t UCL: 10.28
Anderson-Darling 5% Critical Value: 0.735	95% Hall's Bootstrap UCL: 10.21
Kolmogorov-Smirnov Test Statistic: 0.113	95% Percentile Bootstrap UCL: 10.08
Kolmogorov-Smirnov 5% Critical Value: 0.237	95% BCA Bootstrap UCL: 10.02
Data appear Gamma Distributed at 5% Significance Level	95% Chebyshev (Mean, Sd) UCL: 12.46
	97.5% Chebyshev (Mean, Sd) UCL: 14.14
Assuming Gamma Distribution	99% Chebyshev (Mean, Sd) UCL: 17.43
95% Approximate Gamma UCL (Use when n = 40): 10.51	
95% Adjusted Gamma UCL (Use when n = 40): 10.82	

Potential UCL to Use	Use 95% Student's-UCL: 10.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Appendix B-4
ProUCL Output - Flenniken Branch Total Soil
Smokey Mountain Smelters
Knoxville, Tennessee

PCB-1260 (Aroclor 1260)

General Statistics

Number of Valid Data	9	Number of Detected Data	8
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
		Percent Non-Detects	11.11%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.017	Minimum Detected	-4.075
Maximum Detected	0.23	Maximum Detected	-1.47
Mean of Detected	0.0716	Mean of Detected	-3.002
SD of Detected	0.0706	SD of Detected	0.901
Minimum Non-Detect	0.013	Minimum Non-Detect	-4.343
Maximum Non-Detect	0.013	Maximum Non-Detect	-4.343

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.78	Shapiro Wilk Test Statistic	0.951
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0644	Mean	-3.228
SD	0.0696	SD	1.081
95% DL/2 Student's-t UCL	0.108	95% H-Stat DL/2 UCL	0.263
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0604	Mean in Log Scale	-3.251
SD	0.0709	SD in Log Scale	1.127
95% MLE Student's-t UCL	0.104	Mean in Original Scale	0.0643
95% MLE Chebyshev UCL	0.103	SD in Original Scale	0.0697
		95% Student's-t UCL	0.107
		95% Percentile Bootstrap UCL	0.103
		95% BCA Bootstrap UCL	0.117
		95% H-UCL	0.298

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.029	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.0696	
nu star	16.46	
A-D Test Statistic	0.316	Nonparametric Statistics
5% A-D Critical Value	0.728	Kaplan-Meier (KM) Method
K-S Test Statistic	0.728	Mean 0.0656
5% K-S Critical Value	0.299	SD 0.0646
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 0.023
		95% KM (t) UCL 0.108
Assuming Gamma Distribution		95% KM (z) UCL 0.103
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 0.108
Minimum	0.000001	95% KM (bootstrap t) UCL 0.153
Maximum	0.23	95% KM (BCA) UCL 0.103
Mean	0.0637	95% KM (Percentile Bootstrap) UCL 0.106
Median	0.038	95% KM (Chebyshev) UCL 0.166
SD	0.0703	97.5% KM (Chebyshev) UCL 0.209
k star	0.372	99% KM (Chebyshev) UCL 0.295
Theta Star	0.171	
nu star	6.688	Potential UCLs to Use
approx Chi2	2.001	95% KM (BCA) UCL 0.103
95% Gamma approximate UCL (use when n >= 40)	0.213	
95% adjusted Gamma UCL (use when n < 40)	0.283	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2008).

For additional insight, the user may want to consult a statistician.

APPENDIX B-5
SHALLOW GROUNDWATER

Appendix B-5
ProUCL Output - Shallow Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File: [illegible]

Full Precision: OFF

Confidence Coefficient: 95%

Number of Bootstrap Operations: 2000

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation: [illegible]

From File: [illegible]

Full Precision: OFF

Confidence Coefficient: 95%

Number of Bootstrap Operations: 2000

(m - and/or p-)Xylene

General Statistics

Total Number of Observations	40	Number of Distinct Observations	14
Number of Detects	17	Number of Non-Detects	23
Number of Distinct Detects	10	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Average Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTs and MLEs may be improved using gamma distribution in KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (0.0115)	[illegible]
approximate Chi Square Value (0.115, df)	[illegible]	adjusted Chi Square Value (0.115, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% EPA - E Approach UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HOR (UCL log ROS)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% HOR (t) UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

1,2,4-Trimethylbenzene

General Statistics

Total Number of Observations	19	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	15
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.12	Minimum Non-Detect	0.5
Maximum Detect	4	Maximum Non-Detect	5
Variance Detects	2.7	Percent Non-Detects	78.9%
Mean Detects	1.54	Total Detects	11.6
Median Detects	1.2	Total Detect Frequency	0.609
Skewness Detects	0.0[illegible]	Kurtosis Detects	5.[illegible]
Mean of Logged Detects	0.4[illegible]	SD of Logged Detects	1.11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.[illegible]	Standard Error of Mean	0.15
SD	1.[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.7	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.[illegible]	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	0.0[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	5.[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.7[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.2[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.[illegible]4	k star (bias corrected MLE)	0.[illegible]
Theta hat (MLE)	2.[illegible]4	Theta star (bias corrected MLE)	5.17
nu hat (MLE)	5.15	nu star (bias corrected)	2.[illegible]
MLE Mean (bias corrected)	1.[illegible]4	MLE Sd (bias corrected)	2.[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.[illegible]	nu hat (KM)	1.[illegible]
approximate Chi Square Value (1, α)	5.[illegible]	adjusted Chi Square Value (1, β)	5.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	1.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	2.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values for UCLs and ETLs

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.[illegible]	Mean	0.41
Maximum	4	Median	0.51
SD	1.[illegible]	CV	1.[illegible]
k hat (MLE)	0.471	k star (bias corrected MLE)	0.4[illegible]
Theta hat (MLE)	1.[illegible]1	Theta star (bias corrected MLE)	2.14
nu hat (MLE)	15.[illegible]	nu star (bias corrected)	17.[illegible]
MLE Mean (bias corrected)	0.41	MLE Sd (bias corrected)	1.[illegible]
		adjusted Level of significance (β)	0.0[illegible]
approximate Chi Square Value (17, α)	[illegible]	adjusted Chi Square Value (17, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	1.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.7[illegible]4	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.74	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.75	Mean in Log Scale	1.[illegible]4
SD in Original Scale	1.12	SD in Log Scale	1.41
95% UCL (assumes normality of ROS data)	1.[illegible]5	95% Percentile Bootstrap UCL	1.4[illegible]
95% BCA Bootstrap UCL	1.[illegible]7	95% Bootstrap t UCL	1.5[illegible]
95% H-UCL (Log ROS)	2.4[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	1.[illegible]	95% KM (UCL of mean, Land)	2.[illegible]
KM (SD of logged)	1.41	95% KM (95% H-UCL)	2.[illegible]4
KM (standard error of mean of logged)	0.[illegible]1		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.[illegible]4	Mean in Log Scale	0.141
SD in Original Scale	1.[illegible]	SD in Log Scale	1.[illegible]4
95% UCL (assumes normality of DL/2 data)	2.15	95% Hall's UCL	[illegible]14

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.7	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006).

However simulation results will not cover all Real World data sets; in addition, recommendations based on the sample data size may change.

2,4-Dinitrotoluene

General Statistics

Total Number of Observations	4	Number of Distinct Observations	3
Number of Detects	4	Number of Non-Detects	0
Number of Distinct Detects	4	Number of Distinct Non-Detects	0
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Mean Detects	[illegible]	Percent Non-Detects	[illegible]%
Median Detects	[illegible]	SD Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (4.[illegible], 0.1)	[illegible]	adjusted Chi Square Value (4.[illegible], 0.1)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be impacted using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level (0.[illegible])	[illegible]
approximate Chi Square Value ([illegible], 0.1)	[illegible]	adjusted Chi Square Value ([illegible], 0.1)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM UCL (KM Log)	[illegible]
KM (SD of logged)	[illegible]	95% KM (Jackknife) UCL (KM Log)	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% KM (t) UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Aluminum

General Statistics

Total Number of Observations: 4 | Number of Distinct Observations: [illegible]

Number of Detects: [illegible] | Number of Non-Detects: [illegible]

Number of Distinct Detects: [illegible] | Number of Distinct Non-Detects: [illegible]

Minimum Detect: 4 | Minimum Non-Detect: [illegible]

Maximum Detect: [illegible] | Maximum Non-Detect: [illegible]

Mean Detects: 4.E+4 | Percent Non-Detects: [illegible] %

Median Detects: [illegible] | Detects: 4 [illegible]

Median Detects: [illegible] | [illegible] Detects: [illegible]

Skewness Detects: [illegible] | Kurtosis Detects: [illegible]

Mean of Logged Detects: [illegible] | Dev of Logged Detects: [illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: [illegible] | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: [illegible] | Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic: [illegible] | **Lilliefors GOF Test**

5% Lilliefors Critical Value: [illegible] | Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: [illegible] | Standard Error of Mean: [illegible]

[illegible]

95% KM (t) UCL: [illegible] | 95% KM (Percentile Bootstrap) UCL: [illegible]

95% KM (z) UCL: [illegible] | 95% KM (BCA Bootstrap) UCL: [illegible]

95% KM (Chebyshev) UCL: [illegible] | 95% KM (Chebyshev) UCL: [illegible]

97.5% KM (Chebyshev) UCL: [illegible] | 99% KM (Chebyshev) UCL: [illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: [illegible] | **Anderson-Darling GOF Test**

5% A-D Critical Value: [illegible] | Detected Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic: [illegible] | **Kolmogrov-Smirnoff GOF**

5% K-S Critical Value: [illegible] | Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): [illegible] | k star (bias corrected MLE): [illegible]

Theta hat (MLE): [illegible] | Theta star (bias corrected MLE): [illegible]

nu hat (MLE): [illegible] | nu star (bias corrected): [illegible]

MLE Mean (bias corrected): [illegible] | MLE Sd (bias corrected): [illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): [illegible] | nu hat (KM): [illegible]

approximate Chi Square Value (.05, [illegible]): [illegible] | adjusted Chi Square Value (.05, [illegible]): [illegible]

95% Gamma approximate KM UCL (use when n>=50): [illegible] | 95% Gamma adjusted KM UCL (use when n<50): [illegible]

Gamma ROS Statistics using Imputed Non-Detects: [illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ET

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum: [illegible] | Mean: [illegible]

Maximum: [illegible] | Median: [illegible]

SD: [illegible] | CV: [illegible]

k hat (MLE): [illegible] | k star (bias corrected MLE): [illegible]

Theta hat (MLE): [illegible] | Theta star (bias corrected MLE): [illegible]

nu hat (MLE): [illegible] | nu star (bias corrected): [illegible]

MLE Mean (bias corrected): [illegible] | MLE Sd (bias corrected): [illegible]

Adjusted Level of Significance (alpha): [illegible]

approximate Chi Square Value (.05, [illegible]): [illegible] | adjusted Chi Square Value (.05, [illegible]): [illegible]

95% Gamma approximate UCL (use when n>=50): [illegible] | 95% Gamma adjusted UCL (use when n<50): [illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: [illegible] | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: [illegible] | Detected Data appear Lognormal at 5% Significance Level

Lilliefors Test Statistic: [illegible] | **Lilliefors GOF Test**

5% Lilliefors Critical Value: [illegible] | Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale: [illegible] | Mean in Log Scale: [illegible]

Dev in Original Scale: [illegible] | Dev in Log Scale: [illegible]

95% UCL (assumes normality of ROS data): [illegible] | 95% Percentile Bootstrap UCL: [illegible]

95% ET - Exponential UCL: [illegible] | 95% Bootstrap UCL: [illegible]

95% HOL (LN ROS): [illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged): [illegible] | 95% KM (UP) (KM of Log): [illegible]

KM (Dev of logged): [illegible] | 95% KM (Jackknife) (KM of Log): [illegible]

KM (Standard Error of Mean of logged): [illegible]

DL/2 Statistics

DL/2 Normal | **DL/2 Log-Transformed**

Mean in Original Scale: [illegible] | Mean in Log Scale: [illegible]

Dev in Original Scale: [illegible] | Dev in Log Scale: [illegible]

95% UCL (assumes normality): [illegible] | 95% Student's-t UCL: [illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Percentile Bootstrap) UCL: [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Maritz and Lee (2010)

However simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Summary

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	[illegible]
Number of Distinct Detects	5	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	1	Maximum Non-Detect	[illegible]
Average Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	1.	IQR Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detects is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (adj)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD of logged)	[illegible]	95% critical H value (KM-Log)	[illegible]
KM (standard error of mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Assets

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1
Number of Detects	1	Number of Non-Detects	3
Number of Distinct Detects	1	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	5
Maximum Detect	1	Maximum Non-Detect	100
Variance Detects	NA	Percent Non-Detects	100.00%
Mean Detects	1	DL/2 Detects	0.5
Median Detects	1	DL Detects	1.5
Skewness Detects	NA	Kurtosis Detects	NA
Mean of Logged Detects	0.0	DL/2 Logged Detects	-0.693

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.305	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.4	Standard Error of Mean	0.2
SD	0.5	95% KM (t) UCL	0.837
95% KM (z) UCL	0.8	95% KM (Percentile Bootstrap) UCL	0.8
95% KM (jackknife) UCL	0.91	95% KM (BCA Bootstrap) UCL	1.05
90% KM (Chebyshev) UCL	1.19	95% KM (Chebyshev) UCL	1.54
97.5% KM (Chebyshev) UCL	2.05	99% KM (Chebyshev) UCL	3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.43	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.3	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.305	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.63	k star (bias corrected MLE)	0.424
Theta hat (MLE)	1.6	Theta star (bias corrected MLE)	1.7
nu hat (MLE)	5.04	nu star (bias corrected)	3.4
MLE Mean (bias corrected)	1.07	MLE Sd (bias corrected)	1.37

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.667	nu hat (KM)	6.004
approximate Chi Square Value (0.05, df)	2.53	adjusted Chi Square Value (0.05, df)	2.31
95% Gamma approximate KM UCL (use when n>=50)	1.5	95% Gamma adjusted KM UCL (use when n<50)	1.6

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when total sample size is 3 or less

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	0.01	Mean	0.5
Maximum	1	Median	0.1
SD	1.15	CV	1.97
k hat (MLE)	0.2	k star (bias corrected MLE)	0.19
Theta hat (MLE)	2.4	Theta star (bias corrected MLE)	2.6
nu hat (MLE)	2.7	nu star (bias corrected)	2.3
MLE Mean (bias corrected)	0.5	MLE Sd (bias corrected)	1.14
		adjusted Level of significance (α)	0.0344
approximate Chi Square Value (2.3, α)	0.1	adjusted Chi Square Value (2.3, α)	0.01
95% Gamma approximate UCL (use when n>=50)	14.3	95% Gamma adjusted UCL (use when n<50)	14.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.305	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.5	Mean in Log scale	-1.44
SD in Original scale	1.5	SD in Log scale	0.5
95% KM (BCA) UCL (assumes normality of ROS data)	1.54	95% Percentile Bootstrap UCL	1.7
95% KM (t) UCL	1.44	95% Bootstrap UCL	1.7
95% KM (Log ROS) UCL	11.7		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	-1.51	95% KM (UCL of mean, logged)	0.1
KM (SD of logged)	0.94	95% KM (BCA UCL of mean, logged)	0.174
KM (Standard Error of Mean of logged)	0.14		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	1	Mean in Log scale	-0.11
SD in Original scale	1	SD in Log scale	0.41
95% UCL (assumes normality of DL/2 data)	1.64	95% H-stat UCL	1.11

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	1.4	95% KM (Bootstrap t) UCL	1.4

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Summary

General Statistics

Total Number of Observations	40	Number of Distinct Observations	15
Number of Detects	1[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	1[illegible]	Number of Distinct Non-Detects	4
Minimum Detect	0.04	Minimum Non-Detect	0.05
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	0.0[illegible]8	Percent Non-Detects	70%
Mean Detects	1.[illegible]4	DL Detects	0.[illegible]1
Median Detects	0.[illegible]5	UL Detects	0.[illegible]
Skewness Detects	0.[illegible]4	Kurtosis Detects	[illegible]
Mean of Logged Detects	0.0[illegible]5	SD of Logged Detects	0.[illegible]1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]4	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]4	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]1	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]5	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.[illegible]4	Standard Error of Mean	0.0[illegible]5
SD	0.[illegible]5	95% KM (BCA) UCL	0.[illegible]7
95% KM (t) UCL	0.[illegible]1	95% KM (Percentile Bootstrap) UCL	0.[illegible]4
95% KM (z) UCL	0.[illegible]1	95% KM (Bootstrap t) UCL	0.[illegible]4
90% KM (Chebyshev) UCL	0.[illegible]4	95% KM (Chebyshev) UCL	0.[illegible]4
97.5% KM (Chebyshev) UCL	0.[illegible]7	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.[illegible]4	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	1.[illegible]	MLE Sd (bias corrected)	0.[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	0.[illegible]	95% Gamma adjusted KM UCL (use when n>50)	0.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield artificially inflated UCL and ETs

For gamma distributed detected data, BTs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	0.05	Mean	0.[illegible]
Maximum	[illegible]	Median	0.[illegible]
SD	0.[illegible]	CV	0.[illegible]
k hat (MLE)	0.[illegible]	k star (bias corrected MLE)	0.[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	0.[illegible]	MLE Sd (bias corrected)	0.[illegible]
		adjusted Level (= significance level)	0.0484
approximate Chi Square Value (0.[illegible], df)	41.[illegible]	adjusted Chi Square Value (0.[illegible], df)	41.[illegible]
95% Gamma approximate UCL (use when n>=50)	0.[illegible]	95% Gamma adjusted UCL (use when n>50)	0.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.0[illegible]	SD in Log scale	0.[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	0.[illegible]	95% Percentile Bootstrap UCL	0.[illegible]
95% KM (Cheb) UCL	0.[illegible]	95% Bootstrap t UCL	0.[illegible]
95% HOM UCL (log ROS)	0.[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UPR1 of Log)	0.[illegible]
KM (SD of logged)	0.[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
KM (Standard Error of Mean of logged)	0.0[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	0.[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.[illegible]	SD in Log scale	0.[illegible]
95% DL/2 (t) UCL (assumes normality)	0.[illegible]	95% Hall's Bootstrap UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.[illegible]	95% KM (Percentile Bootstrap) UCL	0.[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Beryllium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	15
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	4	Number of Distinct Non-Detects	11
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	Date Detects	[illegible]
Median Detects	[illegible]	Date Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Date of Logged Detects	[illegible]

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	[illegible]		
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	[illegible]		
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (14, α)	[illegible]	adjusted Chi Square Value (14, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect values or at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values for UCLs and ETLs

For gamma distributed detected data, BTSs and BCAs UCLs may be improved by using gamma distribution in KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (14.014, α)	[illegible]	adjusted Chi Square Value (14.014, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (Log ROS) UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UCL of mean, logged)	[illegible]
KM (SD of logged)	[illegible]	95% KM (Chebyshev UCL, logged)	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Basic statistics

General Statistics

Total Number of Observations	40	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	5
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	1.4	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	5
Variance Detects	[illegible]	Percent Non-Detects	40%
Mean Detects	[illegible]	Standard Deviation Detects	[illegible]
Median Detects	[illegible]	Range of Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	1.544
Mean of Logged Detects	[illegible]	Standard Deviation of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has 50% NDs with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may produce unreliable adjusted gamma UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be impacted adversely when gamma distribution is not the estimate

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% Hall's UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	[illegible]	95% KM (Jackknife) UCL (log)	[illegible]
KM (SD of logged)	[illegible]	95% KM (all) UCL (log)	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cadmium

General Statistics

Total Number of Observations	4
Number of Distinct Observations	4
Number of Detects	4
Number of Non-Detects	0
Number of Distinct Detects	4
Number of Distinct Non-Detects	0
Minimum Detect	0.14
Minimum Non-Detect	[illegible]
Maximum Detect	14.00
Maximum Non-Detect	[illegible]
Average Detect	12.1 4
Pooled Average Non-Detects	[illegible]
Mean Detects	14.4
SD Detects	[illegible]
Median Detects	[illegible]
IQR Detects	[illegible]
Skewness Detects	[illegible]
Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]
SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]4
5% Shapiro Wilk Critical Value	0.[illegible]
Lilliefors Test Statistic	0.411
5% Lilliefors Critical Value	0.14

Shapiro Wilk GOF Test

Detected Data Not Normal at 5% Significance Level

Lilliefors GOF Test

Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]
Standard Error of Mean	[illegible]
SD	[illegible]
95% KM (t) UCL	[illegible]
95% KM (z) UCL	[illegible]
95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (BCA Bootstrap) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]
99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]
5% A-D Critical Value	[illegible]
K-S Test Statistic	[illegible]

Anderson-Darling GOF Test

Detected Data Not Gamma Distributed at 5% Significance Level

Kolmogrov-Smirnoff GOF

Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]
k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]
Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]
nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]
MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]
nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]
adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]
95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detects is small such as < 1.0

For such situations, GROS method may be unstable, with inflated values of UCLs and ETLs

For gamma distributed detected data, BTs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]
Mean	[illegible]
Maximum	[illegible]
Median	[illegible]
SD	[illegible]
CV	[illegible]
k hat (MLE)	[illegible]
k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]
Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]
nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]
MLE Sd (bias corrected)	[illegible]
Adjusted Level of Significance (0.05)	[illegible]
Adjusted Chi Square Value (1.[illegible], df)	[illegible]
approximate Chi Square Value (1.[illegible], df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]
95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]
5% Shapiro Wilk Critical Value	[illegible]
Lilliefors Test Statistic	[illegible]
5% Lilliefors Critical Value	[illegible]

Shapiro Wilk GOF Test

Detected Data appear Lognormal at 5% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]
Mean in Log scale	[illegible]
SD in Original scale	[illegible]
SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]
95% Percentile Bootstrap UCL	[illegible]
95% HW UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]
95% KM (BCA) UCL	[illegible]
KM SD (logged)	[illegible]
95% KM (Percentile Bootstrap) UCL	[illegible]
KM Standard Error of Mean (logged)	[illegible]

DL/2 Statistics

DL/2 Normal	DL/2 Log-Transformed
Mean in Original scale	[illegible]
Mean in Log scale	[illegible]
SD in Original scale	[illegible]
SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]
95% Hall's UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) Bootstrap UCL [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Chloroform

General Statistics

Total Number of Observations	40	Number of Distinct Observations	10
Number of Detects	4	Number of Non-Detects	1
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.5
Maximum Detect	0.4	Maximum Non-Detect	0.5
Mean Detects	0.2625	Percent Non-Detects	97.5%
Median Detects	0.2	Mean Non-Detects	0.5
Skewness Detects	0.0	Kurtosis Detects	1.75
Mean of Logged Detects	-1.61	Mean of Logged Non-Detects	-0.693

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.285	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.197	Standard Error of Mean	0.0425
SD	0.198	95% KM (BCA) UCL	0.244
95% KM (t) UCL	0.258	95% KM (Percentile Bootstrap) UCL	0.24
95% KM (z) UCL	0.277	95% KM (Bootstrap t) UCL	0.284
90% KM (Chebyshev) UCL	0.311	95% KM (Chebyshev) UCL	0.349
97.5% KM (Chebyshev) UCL	0.404	99% KM (Chebyshev) UCL	0.573

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.4	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.1	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.96	k star (bias corrected MLE)	0.435
Theta hat (MLE)	0.1	Theta star (bias corrected MLE)	0.605
nu hat (MLE)	15.5	nu star (bias corrected)	17.4
MLE Mean (bias corrected)	0.197	MLE Sd (bias corrected)	0.345

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.425	nu hat (KM)	34
approximate Chi Square Value (34, α)	21.8	adjusted Chi Square Value (34, β)	20.7
95% Gamma approximate KM UCL (use when n>=50)	0.41	95% Gamma adjusted KM UCL (use when n<50)	0.429

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or when all ND data are at a single DL

GROS may not be used when data set has only 2 distinct detected values or small sample size

Fitted Gamma distribution on GROS may not pass goodness of fit test

For gamma distributed detected data, BTs and 95% UCLs may be impacted using gamma distribution on KM estimates

Minimum	0.01	Mean	0.194
Maximum	0.4	Median	0.15
SD	0.107	CV	0.553
k hat (MLE)	0.783	k star (bias corrected MLE)	0.71
Theta hat (MLE)	0.248	Theta star (bias corrected MLE)	0.273
nu hat (MLE)	62.7	nu star (bias corrected)	56.8
MLE Mean (bias corrected)	0.194	MLE Sd (bias corrected)	0.231
		Adjusted Level of Significance (β)	0.0484
approximate Chi Square Value (56.8, α)	40.3	adjusted Chi Square Value (56.8, β)	38.7
95% Gamma approximate KM UCL (use when n>=50)	0.258	95% Gamma adjusted KM UCL (use when n<50)	0.271

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.285	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.156	Mean in Log scale	-2.14
SD in Original scale	0.195	SD in Log scale	1.14
95% KM (t) UCL (assumes normality of ROS data)	0.251	95% Percentile Bootstrap UCL	0.24
95% KM (BCA) UCL	0.27	95% Bootstrap t UCL	0.5
95% KM (Hall's bootstrap) UCL	0.28		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged Data)	-2	95% KM (BCA) UCL	0.18
KM (SD of logged Data)	1.18	95% KM (Bootstrap t) UCL	0.267
KM (Standard Error of Mean of logged Data)	0.54		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	0.17	Mean in Log scale	-2.14
SD in Original scale	0.198	SD in Log scale	1.11
95% UCL (assumes normality)	0.277	95% H-stat UCL	4.551

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.25	95% KM (Percentile Bootstrap) UCL	0.24

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nad'ar Maro, and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Chromium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	15
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	4
Minimum Detect	1	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	[illegible]	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Std. of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM Chebyshev UCL	[illegible]	95% KM Chebyshev UCL	[illegible]
97.5% KM Chebyshev UCL	[illegible]	99% KM Chebyshev UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (alpha)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nar Nile and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cobalt

General Statistics

Total Number of Observations	4	Number of Distinct Observations	2
Number of Detects	14	Number of Non-Detects	24
Number of Distinct Detects	1	Number of Distinct Non-Detects	10
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detects	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	[illegible] Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Std. of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, α)	[illegible]	adjusted Chi Square Value (1, N, α)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (1, α, β)	[illegible]	adjusted Chi Square Value (1, N, α, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged Data)	[illegible]	95% KM (UMVUE) UCL (Log)	[illegible]
KM (SD of logged Data)	[illegible]	95% KM (Approx Fiducial) UCL (Log)	[illegible]
KM (Standard Error of Mean of logged Data)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Bootstrap t) UCL [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Copper

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Mean Detects	[illegible]	Percent Non-Detects	[illegible]
Median Detects	[illegible]	Mode Detects	[illegible]
Standard Deviation Detects	[illegible]	Skewness Detects	[illegible]
Mean of Logged Detects	[illegible]	Standard Deviation of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (t) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (BCA) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level (= α/2)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n>50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% HM-UMVUE UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (Log ROS) UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UPR) UCL	[illegible]
KM (SD of logged)	[illegible]	95% KM (t-1) UCL	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cyanide

General Statistics

Total Number of Observations	4	Number of Distinct Observations	17
Number of Detects	1[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	10	Number of Distinct Non-Detects	7
Minimum Detect	[illegible].4	Minimum Non-Detect	10
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible].4	Percent Non-Detects	[illegible].%
Mean Detects	14.41	SD Detects	1.7
Median Detects	4	CV Detects	[illegible]
Kurtosis Detects	[illegible]4.1	Skewness Detects	1.[illegible]
Mean of Logged Detects	[illegible].7[illegible]	SD of Logged Detects	1.04

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0		
5% Shapiro Wilk Critical Value	0.[illegible]4	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.[illegible]1		
5% Lilliefors Critical Value	0.[illegible]7	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	10.[illegible]	KM Standard Error of Mean	1.[illegible]4
KM SD	4.1	95% KM (BCA) UCL	10.[illegible]
95% KM (t) UCL	10.[illegible]7	95% KM (Percentile Bootstrap) UCL	10.[illegible]
95% KM (z) UCL	10.[illegible]1	95% KM (Bootstrap t) UCL	11.14
90% KM (Chebyshev) UCL	1.[illegible]4	95% KM (Chebyshev) UCL	14
97.5% KM (Chebyshev) UCL	17.[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	0.[illegible]		
5% A-D Critical Value	0.7[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	0.[illegible]4		
5% K-S Critical Value	0.[illegible]1	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.[illegible]1	k star (bias corrected MLE)	1.07[illegible]
Theta hat (MLE)	11.[illegible]4	Theta star (bias corrected MLE)	14.[illegible]7
nu hat (MLE)	1[illegible]7.4	nu star (bias corrected)	[illegible].4[illegible]
MLE Mean (bias corrected)	14.41	MLE Sd (bias corrected)	14.7[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.[illegible]4[illegible]	nu hat (KM)	[illegible].4[illegible]
approximate Chi Square Value (34, α)	5.14	adjusted chi square value (34, β)	5.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	10.[illegible]5	95% Gamma adjusted KM UCL (use when n<50)	10.44

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.[illegible]	Mean	[illegible].[illegible]4
Maximum		Median	[illegible].4
SD	[illegible]	CV	1.01[illegible]
k hat (MLE)	0.41	k star (bias corrected MLE)	0.[illegible]4
Theta hat (MLE)	[illegible].44	Theta star (bias corrected MLE)	10.1
nu hat (MLE)	7.11	nu star (bias corrected)	[illegible].7[illegible]4
MLE Mean (bias corrected)	7.[illegible]4	MLE Sd (bias corrected)	4.[illegible]
		adjusted Level of significance (β)	0.0[illegible]7
approximate Chi Square Value (7.[illegible], α)	4.4[illegible]4	adjusted Chi Square Value (7.[illegible], β)	4.[illegible]4
95% Gamma approximate KM UCL (use when n>=50)	11.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	1.[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.[illegible]5		
5% Shapiro Wilk Critical Value	0.[illegible]4	Detected Data appear Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.[illegible]4		
5% Lilliefors Critical Value	0.[illegible]5[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	4.[illegible]1	Mean in Log scale	1.7[illegible]4
SD in Original scale	[illegible]5.[illegible]	SD in Log scale	0.[illegible]4
95% KM (BCA) UCL (assumes normality of ROS data)	10.[illegible]7	95% Percentile Bootstrap UCL	10.[illegible]
95% KM (Chebyshev) UCL	11.[illegible]	95% Bootstrap t UCL	11.[illegible]
95% HW UCL (Log ROS)	10.4[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	1.7[illegible]3	95% KM UCL (KM Log)	4.7[illegible]
KM SD (logged)	0.[illegible]54	95% Critical H Value (KM Log)	[illegible].144
KM Standard Error of Mean (logged)	0.11[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	4.11	Mean in Log scale	1.4[illegible]1
SD in Original scale	[illegible].1[illegible]	SD in Log scale	0.[illegible]44
95% UCL (assumes normality)	11.[illegible]	95% H-stat UCL	10.[illegible]7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	10.[illegible]7	95% GROS adjusted Gamma UCL	1.[illegible]
95% adjusted Gamma KM UCL	10.44		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all real world data sets; for additional insight, the user may want to consult a statistician.

Ethylbenzene

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	4	Number of Non-Detects	0
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.34	Minimum Non-Detect	0.5
Maximum Detect	1	Maximum Non-Detect	5
Mean Detects	0.8	Percent Non-Detects	74.4%
Median Detects	0.44	Detects	2.51
Skewness Detects	0.11	Kurtosis Detects	2.4
Mean of Logged Detects	-0.58	Dev of Logged Detects	1.5

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.74		
5% Shapiro Wilk Critical Value	0.24	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.2		
5% Lilliefors Critical Value	0.5	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.4	Standard Error of Mean	0.104
SD	0.4	95% KM (BCA) UCL	0.7
95% KM (t) UCL	0.4	95% KM (Percentile Bootstrap) UCL	0.4
95% KM (z) UCL	0.4	95% KM (Bootstrap t) UCL	0.54
90% KM (Chebyshev) UCL	0.6	95% KM (Chebyshev) UCL	0.2
97.5% KM (Chebyshev) UCL	0.4	99% KM (Chebyshev) UCL	5.1

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	0.4		
5% A-D Critical Value	0.44	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	0.2		
5% K-S Critical Value	0.24	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.2	k star (bias corrected MLE)	0.21
Theta hat (MLE)	4.71	Theta star (bias corrected MLE)	5.51
nu hat (MLE)	14.5	nu star (bias corrected)	11.7
MLE Mean (bias corrected)	0.4	MLE Sd (bias corrected)	0.4

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.4	nu hat (KM)	0.5
approximate Chi Square Value (0.05, df)	3.04	adjusted Chi Square Value (0.05, df)	1.7
95% Gamma approximate KM UCL (use when n>=50)	1.4	95% Gamma adjusted KM UCL (use when n<50)	2.08

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and/or multiple DLs

GROS may not be used when data set has only 2 detected data values or small sample size (< 10)

For such situations, GROS method may yield artificially inflated values UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.4
Maximum	1	Median	0.5
SD	0.48	CV	1.2
k hat (MLE)	0.42	k star (bias corrected MLE)	0.41
Theta hat (MLE)	2	Theta star (bias corrected MLE)	2
nu hat (MLE)	14	nu star (bias corrected)	14.7
MLE Mean (bias corrected)	0.4	MLE Sd (bias corrected)	0.94
		adjusted Level of Significance (0.05)	0.04
approximate Chi Square Value (14.7, alpha)	5.05	adjusted Chi Square Value (14.7, alpha)	4.4
95% Gamma approximate KM UCL (use when n>=50)	0.74	95% Gamma adjusted KM UCL (use when n<50)	0.81

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.8		
5% Shapiro Wilk Critical Value	0.24	Detected Data Not Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	0.4		
5% Lilliefors Critical Value	0.5	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.4	Mean in Log Scale	-0.8
SD in Original Scale	0.5	SD in Log Scale	0.5
95% KM (BCA) UCL (assumes normality of ROS data)	0.7	95% Percentile Bootstrap UCL	0.74
95% KM (Chebyshev) UCL	0.47	95% Bootstrap t UCL	0.4
95% KM (Log ROS) UCL	0.5		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Hero) Logged	-0.57	95% KM (UPH) UCL Log	0.74
KM (SD) Logged	0.74	95% Normal KM Value (UPH) Log	2.17
KM Standard Error of Mean Logged	0.4		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.51	Mean in Log Scale	-0.5
SD in Original Scale	0.4	SD in Log Scale	0.94
95% KM (t) UCL (assumes normality)	0.71	95% Hall's Bootstrap UCL	4.44

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.4	95% KM (Percentile Bootstrap) UCL	0.4

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nad'ie and Lee (2010).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride

General Statistics

Total Number of Observations: 4 | Number of Distinct Observations: 2

Number of Detects: 2 | Number of Non-Detects: 2

Number of Distinct Detects: 2 | Number of Distinct Non-Detects: 1

Minimum Detect: 7.5 | Minimum Non-Detect: 10.00

Maximum Detect: 10.00 | Maximum Non-Detect: 10.00

Variance Detects: 1.125E+00 | Percent Non-Detects: 50.00%

Mean Detects: 8.750 | Date Detects: 10/07/2008

Median Detects: 8.750 | Date Non-Detects: 11/04/2008

Skewness Detects: 0.000 | Kurtosis Detects: 0.000

Mean of Logged Detects: 0.000 | Date of Logged Detects: 04/05/2008

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: 0.750 | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: 0.767 | Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic: 0.244 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.374 | Detected Data Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: 8.750 | Standard Error of Mean: 0.433

SD: 0.612 | 95% KM (BCA) UCL: 9.424

95% KM (t) UCL: 9.534 | 95% KM (Percentile Bootstrap) UCL: 9.375

95% KM (z) UCL: 9.437 | 95% KM (BCA Bootstrap) UCL: 9.438

95% KM (Chebyshev) UCL: 10.437 | 95% KM (Chebyshev) UCL: 11.400

97.5% KM (Chebyshev) UCL: 12.104 | 99% KM (Chebyshev) UCL: 15.145

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: 0.375 | **Anderson-Darling GOF Test**

5% A-D Critical Value: 0.734 | Detected Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic: 0.250 | **Kolmogrov-Smirnoff GOF**

5% K-S Critical Value: 0.320 | Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): 0.243 | k star (bias corrected MLE): 0.188

Theta hat (MLE): 36.02 | Theta star (bias corrected MLE): 46.57

nu hat (MLE): 1.947 | nu star (bias corrected): 1.503

MLE Mean (bias corrected): 8.750 | MLE Sd (bias corrected): 20.17

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): 0.500 | nu hat (KM): 4.000

approximate Chi Square Value (4.00, α): 0.711 | adjusted Chi Square Value (4.00, β): 0.356

95% Gamma approximate KM UCL (use when n>=50): 12.104 | 95% Gamma adjusted KM UCL (use when n<50): 18.874

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and multiple DLs

GROS may not be used when data set has only 2 detected data values or small sample size

For such situations, GROS method may yield inflated values for UCL and ET's

For gamma distributed detected data, BTs and UCLs may be improved using gamma distribution in KM estimates

Minimum: 7.5 | Mean: 14.14

Maximum: 10.00 | Median: 8.750

SD: 1.414 | CV: 0.100

k hat (MLE): 195.2 | k star (bias corrected MLE): 195.2

Theta hat (MLE): 0.072 | Theta star (bias corrected MLE): 0.072

nu hat (MLE): 780 | nu star (bias corrected): 780

MLE Mean (bias corrected): 14.14 | MLE Sd (bias corrected): 1.020

Adjusted Level of Significance (β): 0.0481

approximate Chi Square Value (780.00, α): 735.7 | adjusted Chi Square Value (780.00, β): 735.1

95% Gamma approximate KM UCL (use when n>=50): 14.701 | 95% Gamma adjusted KM UCL (use when n<50): 14.744

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: 0.750 | **Shapiro Wilk GOF Test**

5% Shapiro Wilk Critical Value: 0.767 | Detected Data Not Lognormal at 5% Significance Level

Lilliefors Test Statistic: 0.244 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.374 | Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale: 8.750 | Mean in Log Scale: 2.150

SD in Original Scale: 0.642 | SD in Log Scale: 0.075

95% KM (BCA) UCL assumes normality of ROS data: 9.424 | 95% Percentile Bootstrap UCL: 9.375

95% KM (t) UCL: 9.534 | 95% Bootstrap UCL: 9.500

95% KM (Log ROS) UCL: 10.000

DL/2 Statistics

DL/2 Normal | **DL/2 Log-Transformed**

Mean in Original Scale: 8.750 | Mean in Log Scale: 2.150

SD in Original Scale: 0.642 | SD in Log Scale: 0.075

95% KM (t) UCL assumes normality: 9.534 | 95% Hall's Bootstrap UCL: 10.040

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL: 11.400

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon the results of the simulation studies summarized in Singh, Maritz and Lee (2010)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
1	Iron											
2												
3						**General Statistics**						
4				Total Number of Observations	4				Number of Distinct Observations	5		
5												
6				Number of Detects	5				Number of Non-Detects	1		
7				Number of Distinct Detects	4				Number of Distinct Non-Detects	1		
8				Minimum Detect	7.1				Minimum Non-Detect	10.0		
9				Maximum Detect	17.0				Maximum Non-Detect	10.0		
10				Variance Detects	15.4145				Percent Non-Detects	41.67%		
11				Mean Detects	12.74				SD Detects	4.1		
12				Median Detects	13.00				CV Detects	0.32		
13				Skewness Detects	0.477				Kurtosis Detects	2		
14				Mean of Logged Detects	2.515				SD of Logged Detects	0.441		
15												
16						**Normal GOF Test on Detects Only**						
17				Shapiro Wilk Test Statistic	0.94			**Shapiro Wilk GOF Test**				
18				5% Shapiro Wilk Critical Value	0.762			Detected Data Appear Normal at 5% Significance Level				
19				Lilliefors Test Statistic	0.207			**Lilliefors GOF Test**				
20				5% Lilliefors Critical Value	0.377			Detected Data Appear Normal at 5% Significance Level				
21						**Detected Data Not Normal at 5% Significance Level**						
22												
23						**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**						
24				Mean	12.2				Standard Error of Mean	2.424		
25				SD	3.41				95% KM (BCA) UCL	15.4		
26				95% KM (t) UCL	15.14				95% KM (Percentile Bootstrap) UCL	15.11		
27				95% KM (z) UCL	14.94				95% KM (Bootstrap t) UCL	19.4		
28				90% KM (Chebyshev) UCL	17.1				95% KM (Chebyshev) UCL	21		
29				97.5% KM (Chebyshev) UCL	23.7				99% KM (Chebyshev) UCL	29.5		
30												
31						**Gamma GOF Tests on Detected Observations Only**						
32				A-D Test Statistic	0.4			**Anderson-Darling GOF Test**				
33				5% A-D Critical Value	0.741			Detected data appear Gamma Distributed at 5% Significance Level				
34				K-S Test Statistic	0.33			**Kolmogrov-Smirnoff GOF**				
35				5% K-S Critical Value	0.3			Detected data appear Gamma Distributed at 5% Significance Level				
36						**Detected data appear Gamma Distributed at 5% Significance Level**						
37												
38						**Gamma Statistics on Detected Data Only**						
39				k hat (MLE)	10.55				k star (bias corrected MLE)	10.14		
40				Theta hat (MLE)	1.207				Theta star (bias corrected MLE)	1.255		
41				nu hat (MLE)	84				nu star (bias corrected)	81		
42				MLE Mean (bias corrected)	12.74				MLE Sd (bias corrected)	4.1		
43												
44						**Gamma Kaplan-Meier (KM) Statistics**						
45				k hat (KM)	11.25				nu hat (KM)	90		
46				approximate Chi Square Value (0.05, df)	71.54			adjusted Chi Square Value (0.05, df)		71.17		
47				95% Gamma approximate KM UCL (use when n>=50)	14.15			95% Gamma adjusted KM UCL (use when n<50)		14.7		
48												
49						**Gamma ROS Statistics using Imputed Non-Detects**						
50				GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs								
51				GROS may not be used when kstar of detected data is small such as < 0.1								
52				For such situations, GROS method may yield artifactual values of UCLs and BTVs								
53				For gamma distributed detected data, BTVs and UCLs may be improved by using gamma distribution in KM estimates								
54				Minimum	0.01				Mean	15.41		
55				Maximum	17.00				Median	17		
56				SD	5.7				CV	0.374		
57				k hat (MLE)	0.347				k star (bias corrected MLE)	0.315		
58				Theta hat (MLE)	44.45				Theta star (bias corrected MLE)	48.9		
59				nu hat (MLE)	1.4				nu star (bias corrected)	1.3		
60				MLE Mean (bias corrected)	15.41				MLE Sd (bias corrected)	8.84		
61								Adjusted Level of Significance (β)		0.0344		
62				approximate Chi Square Value (1.3, df)	5.43			adjusted Chi Square Value (1.3, df)		5.11		
63				95% Gamma approximate KM UCL (use when n>=50)	4.41			95% Gamma adjusted KM UCL (use when n<50)		5.4		
64												
65						**Lognormal GOF Test on Detected Observations Only**						
66				Shapiro Wilk Test Statistic	0.977			**Shapiro Wilk GOF Test**				
67				5% Shapiro Wilk Critical Value	0.762			Detected Data appear Lognormal at 5% Significance Level				
68				Lilliefors Test Statistic	0.181			**Lilliefors GOF Test**				
69				5% Lilliefors Critical Value	0.377			Detected Data appear Lognormal at 5% Significance Level				
70						**Detected Data appear Lognormal at 5% Significance Level**						
71												
72						**Lognormal ROS Statistics Using Imputed Non-Detects**						
73				Mean in Original scale	12.4				Mean in Log scale	2.47		
74				SD in Original scale	3.1				SD in Log scale	0.71		
75				95% KM (BCA) UCL (assumes normality of ROS data)	14.75				95% Percentile Bootstrap UCL	15.1		
76				95% KM (t) UCL (assumes normality of ROS data)	14.75				95% Bootstrap t UCL	19.4		
77				95% HW UCL (LN of ROS data)	14.1							
78												
79						**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**						
80				KM (Mean of logged data)	2.57				95% KM (UPR) UCL	19.4		
81				KM (SD of logged data)	0.75				95% KM (Chebyshev) UCL	31.2		
82				KM (standard Error of Mean of logged data)	0.27							
83												
84						**DL/2 Statistics**						
85				**DL/2 Normal**					**DL/2 Log-Transformed**			
86				Mean in Original scale	12.5				Mean in Log scale	2.34		
87				SD in Original scale	3.11				SD in Log scale	0.715		
88				95% UCL (assumes normality)	15.1				95% H-stat UCL	21.2		
89				DL/2 is not a recommended method, provided for comparisons and historical reasons								
90												
91						**Nonparametric Distribution Free UCL Statistics**						
92						**Detected Data appear Gamma Distributed at 5% Significance Level**						
93												
94						**Suggested UCL to Use**						
95				95% KM (BCA) UCL	15.4				95% GROS Adjusted Gamma UCL	14.7		
96				95% Adjusted Gamma KM UCL	14.7							
97												
98				Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL								
99				Recommendations are based upon data size, data distribution, and skewness								
100				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)								
101				However, simulation results will not cover all Real World data sets; for additional insight, the user may want to consult a statistician.								
102												

Level

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
Number of Detects	14	Number of Non-Detects	0
Number of Distinct Detects	14	Number of Distinct Non-Detects	0
Minimum Detect	[illegible]	Minimum Non-Detect	0
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Mean Detects	[illegible]	Percent Non-Detects	[illegible]
Median Detects	[illegible]	SD Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level (= alpha)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% critical H value (KM-log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight, the user may want to consult a statistician.

Manganese

General Statistics

Total Number of Observations: 4
Number of Distinct Observations: 4
Number of Detects: 2
Number of Non-Detects: 2
Number of Distinct Detects: 2
Number of Distinct Non-Detects: 2
Minimum Detect: [illegible]
Minimum Non-Detect: 1
Maximum Detect: [illegible]
Maximum Non-Detect: [illegible]
Percent Detects: 1.[illegible]E+[illegible]
Percent Non-Detects: [illegible]%
Mean Detects: 14.[illegible]
Standard Deviation Detects: [illegible]
Median Detects: [illegible]
Skewness Detects: [illegible]
Kurtosis Detects: [illegible]
Mean of Logged Detects: [illegible]
Standard Deviation of Logged Detects: [illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: [illegible]
Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value: [illegible]
Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic: [illegible]
Lilliefors GOF Test
5% Lilliefors Critical Value: [illegible]
Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: [illegible]
Standard Error of Mean: [illegible]
SD: [illegible]
95% KM (t) UCL: [illegible]
95% KM (percentile bootstrap) UCL: [illegible]
95% KM (z) UCL: [illegible]
95% KM (BCA bootstrap) UCL: [illegible]
95% KM (Chebyshev) UCL: [illegible]
95% KM (Chebyshev) UCL: [illegible]
97.5% KM (Chebyshev) UCL: [illegible]
99% KM (Chebyshev) UCL: [illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: [illegible]
Anderson-Darling GOF Test
5% A-D Critical Value: [illegible]
Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic: [illegible]
Kolmogrov-Smirnoff GOF
5% K-S Critical Value: [illegible]
Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): [illegible]
nu hat (KM): [illegible]
approximate Chi Square Value (.[illegible], [illegible]): [illegible]
adjusted Chi Square Value (.[illegible], [illegible]): [illegible]
95% Gamma approximate KM UCL (use when n>=50): [illegible]
95% Gamma adjusted KM UCL (use when n>50): [illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits or several different DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations GROS method may yield inflated values of UCLs and BTSs
For gamma distributed detected data, BTSs and UCLs may be improved using gamma distribution in KM estimates

Minimum: [illegible]
Mean: [illegible]
Maximum: [illegible]
Median: [illegible]
SD: [illegible]
CV: [illegible]
k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]
Adjusted Level of Significance (alpha): [illegible]
approximate Chi Square Value (.[illegible], [illegible]): [illegible]
adjusted Chi Square Value (.[illegible], [illegible]): [illegible]
95% Gamma approximate UCL (use when n>=50): [illegible]
95% Gamma adjusted UCL (use when n>50): [illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: [illegible]
Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value: [illegible]
Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic: [illegible]
Lilliefors GOF Test
5% Lilliefors Critical Value: [illegible]
Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale: [illegible]
Mean in Log scale: [illegible]
SD in Original scale: [illegible]
SD in Log scale: [illegible]
95% UCL (assumes normality of ROS data): [illegible]
95% Percentile Bootstrap UCL: [illegible]
95% BCA Bootstrap UCL: [illegible]
95% Hall's Bootstrap UCL: [illegible]
95% UCL (Log ROS): [illegible]

DL/2 Statistics

DL/2 Normal	DL/2 Log-Transformed
Mean in Original scale: [illegible]	Mean in Log scale: [illegible]
SD in Original scale: [illegible]	SD in Log scale: [illegible]
95% UCL (assumes normality): [illegible]	95% H-stat (UCL): [illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL: [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010).
However, simulation results will not cover all Real World data sets; in addition, advice regarding the use of maximum, mean, median, standard deviation, and other statistics

Mercury

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1[illegible]
Number of Detects	14	Number of Non-Detects	24
Number of Distinct Detects	14	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]44%
Mean Detects	[illegible]	DL/2 Detects	[illegible]
Median Detects	[illegible]	[illegible] Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	14.3
Mean of Logged Detects	[illegible]	DL/2 Logged Detects	[illegible]

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	[illegible]		
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	[illegible]		
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied observations at multiple DLs

GROS may not be used when k star of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (alpha)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM (UPR1 of Log)	[illegible]
KM (SD of logged)	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
KM (standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulation results will not cover all Real World data sets; for additional insight, the user may want to consult a statistician.

Kapitalizaro

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1[illegible]
Number of Detects	11	Number of Non-Detects	[illegible]
Number of Distinct Detects	11	Number of Distinct Non-Detects	[illegible]
Minimum Detect	0.74	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	5.11
Variance Detects	[illegible]	Percent Non-Detects	71.74%
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	[illegible] Detects	11.5[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	1.4[illegible]
Mean of Logged Detects	1.[illegible]	Std. Dev. of Logged Detects	0.7[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.1[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.[illegible]	KM Standard Error of Mean	0.[illegible]
KM SD	1.[illegible]	95% KM (BCA) UCL	1.[illegible]
95% KM (t) UCL	1.4	95% KM (Percentile Bootstrap) UCL	1.4
95% KM (z) UCL	1.[illegible]	95% KM (Bootstrap t) UCL	2.[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	4.[illegible]
97.5% KM (Chebyshev) UCL	5.[illegible]	99% KM (Chebyshev) UCL	6.[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.4[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.2[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.[illegible]	k star (bias corrected MLE)	2.[illegible]
Theta hat (MLE)	1.[illegible]	Theta star (bias corrected MLE)	1.[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	4[illegible].5
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	1[illegible]
approximate Chi Square Value (1[illegible], 0.05)	15[illegible]	adjusted Chi Square Value (1[illegible], 0.05)	154.1
95% Gamma approximate KM UCL (use when n>=50)	2.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	2.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and UCLs may be improved using gamma distribution in KM estimates

Minimum	0.[illegible]	Mean	2.444
Maximum	[illegible]	Median	2.1[illegible]
SD	1.[illegible]	CV	0.[illegible]
k hat (MLE)	.44	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	4.1
MLE Mean (bias corrected)	2.444	MLE Sd (bias corrected)	[illegible]
		adjusted Level (= significance level)	[illegible]
approximate Chi Square Value (4.[illegible], [illegible])	[illegible]	adjusted Chi Square Value (4.[illegible], [illegible])	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	2.[illegible]	95% Gamma adjusted KM UCL (use when n<50)	2.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.1[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	2.[illegible]	Mean in Log scale	[illegible]
SD in Original scale	1.4[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	2.[illegible]	95% Percentile Bootstrap UCL	2.[illegible]
95% KM (t) UCL (assumes normality of ROS data)	2.[illegible]	95% Bootstrap t UCL	2.[illegible]
95% HW UCL (Log ROS)	2.1		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged Data)	[illegible]	95% KM (BCA) UCL (KM Log)	[illegible]
KM (SD of logged Data)	[illegible]	95% KM (Chebyshev) UCL (KM Log)	2.[illegible]
KM (Standard Error of Mean of logged Data)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	4.2[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	4.[illegible]	95% H-stat UCL	4.[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	1.4	95% KM (Percentile Bootstrap) UCL	1.4

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations: 4 | Number of Distinct Observations: 7

Number of Detects: 1 | Number of Non-Detects: 1

Number of Distinct Detects: 1 | Number of Distinct Non-Detects: 1

Minimum Detect: 1 | Minimum Non-Detect: 40

Maximum Detect: 1 | Maximum Non-Detect: 100

Mean of Detects: 1.000 | Percent Non-Detects: 75.00%

Median of Detects: 1.000 | Standard Deviation of Detects: 0.000

Median of Detects: 1 | Skewness of Detects: 0.000

Kurtosis of Detects: 0.000

Mean of Logged Detects: 0.000 | Standard Deviation of Logged Detects: 0.000

Normal GOF Test on Detects Only

Shapiro-Wilk Test Statistic: 0.500 | **Shapiro-Wilk GOF Test**

5% Shapiro-Wilk Critical Value: 0.424 | Detected Data Not Normal at 5% Significance Level

Lilliefors Test Statistic: 0.707 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.354 | Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: 1.000 | Standard Error of Mean: 0.000

SD: 0.000 | 95% KM (BCA) UCL: 1.000

95% KM (t) UCL: 1.000 | 95% KM (Percentile Bootstrap) UCL: 1.000

95% KM (z) UCL: 1.000 | 95% KM (Bootstrap t) UCL: 1.000

90% KM (Chebyshev) UCL: 1.000 | 95% KM (Chebyshev) UCL: 1.000

97.5% KM (Chebyshev) UCL: 1.000 | 99% KM (Chebyshev) UCL: 1.000

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: 1.000 | **Anderson-Darling GOF Test**

5% A-D Critical Value: 0.757 | Detected Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic: 0.500 | **Kolmogrov-Smirnoff GOF**

5% K-S Critical Value: 0.364 | Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): 0.000 | k star (bias corrected MLE): 0.000

Theta hat (MLE): 0.000 | Theta star (bias corrected MLE): 0.000

nu hat (MLE): 0.000 | nu star (bias corrected): 0.000

MLE Mean (bias corrected): 0.000 | MLE Sd (bias corrected): 0.000

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): 0.000 | nu hat (KM): 0.000

approximate Chi Square Value (0.05, df): 0.000 | adjusted Chi Square Value (0.05, df): 0.000

95% Gamma approximate KM UCL (use when n>=50): 0 | 95% Gamma adjusted KM UCL (use when n<50): 0

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Minimum: 0.000 | Mean: 0.000

Maximum: 0.000 | Median: 0

SD: 0.000 | CV: 0.000

k hat (MLE): 0.000 | k star (bias corrected MLE): 0.000

Theta hat (MLE): 0.000 | Theta star (bias corrected MLE): 0.000

nu hat (MLE): 0.000 | nu star (bias corrected): 0.000

MLE Mean (bias corrected): 0.000 | MLE Sd (bias corrected): 0.000

adjusted Level of Significance (adj): 0.0444

approximate Chi Square Value (0.05, df): 0.000 | adjusted Chi Square Value (0.05, df): 0.000

95% Gamma approximate UCL (use when n>=50): 0 | 95% Gamma adjusted UCL (use when n<50): 0

Lognormal GOF Test on Detected Observations Only

Shapiro-Wilk Test Statistic: 0.500 | **Shapiro-Wilk GOF Test**

5% Shapiro-Wilk Critical Value: 0.424 | Detected Data appear Lognormal at 5% Significance Level

Lilliefors Test Statistic: 0.707 | **Lilliefors GOF Test**

5% Lilliefors Critical Value: 0.354 | Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale: 1.000 | Mean in Log Scale: 0.000

SD in Original Scale: 0.000 | SD in Log Scale: 0.000

95% KM (BCA) UCL (assumes normality of ROS data): 1.000 | 95% Percentile Bootstrap UCL: 1.000

95% KM (Cheb) UCL: 1.000 | 95% Bootstrap t UCL: 1.000

95% KM (Log ROS) UCL: 0.000

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of Logged): 0.000 | 95% KM (UPR) UCL: 0.000

KM (SD of Logged): 0.000 | 95% KM (Jackknife) UCL: 0.000

KM (Standard Error of Mean of Logged): 0.000

DL/2 Statistics

DL/2 Normal | **DL/2 Log-Transformed**

Mean in Original Scale: 1.000 | Mean in Log Scale: 0.000

SD in Original Scale: 0.000 | SD in Log Scale: 0.000

95% KM (t) UCL (assumes normality): 1.000 | 95% Hall's UCL: 1.000

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Bootstrap t) UCL: 1.000

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (1999).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nitrate as N

General Statistics

Total Number of Observations: [illegible]
Number of Distinct Observations: [illegible]
Number of Detects: [illegible]
Number of Non-Detects: [illegible]
Number of Distinct Detects: [illegible]
Number of Distinct Non-Detects: 1
Minimum Detect: [illegible]
Minimum Non-Detect: [illegible]
Maximum Detect: [illegible]
Maximum Non-Detect: [illegible]
Mean of Detects: [illegible]
Percent Non-Detects: [illegible]%
Median Detects: [illegible]
Standard Deviation of Detects: [illegible]
Skewness of Detects: [illegible]
Kurtosis of Detects: [illegible]
Mean of Logged Detects: [illegible]
Standard Deviation of Logged Detects: [illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic: [illegible]
5% Shapiro Wilk Critical Value: [illegible]
Data not Normal at 5% Significance Level

Shapiro Wilk GOF Test

Lilliefors Test Statistic: [illegible]
5% Lilliefors Critical Value: [illegible]
Data not Normal at 5% Significance Level

Lilliefors GOF Test

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean: [illegible]
Standard Error of Mean: [illegible]
SD: [illegible]
95% KM (t) UCL: [illegible]
95% KM (z) UCL: [illegible]
95% KM (jackknife) UCL: [illegible]
95% KM (bootstrap t) UCL: [illegible]
95% KM (BCA bootstrap) UCL: [illegible]
95% KM (percentile bootstrap) UCL: [illegible]
95% KM (bootstrap t) UCL: [illegible]
95% KM (percentile bootstrap) UCL: [illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic: [illegible]
5% A-D Critical Value: [illegible]
Detected data appear Gamma Distributed at 5% Significance Level

Anderson-Darling GOF Test

K-S Test Statistic: [illegible]
5% K-S Critical Value: [illegible]
Detected data appear Gamma Distributed at 5% Significance Level

Kolmogrov-Smirnoff GOF

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM): [illegible]
nu hat (KM): [illegible]
approximate Chi Square Value (.05): [illegible]
adjusted Chi Square Value (.05): [illegible]
95% Gamma approximate KM UCL (use when n>=50): [illegible]
95% Gamma adjusted KM UCL (use when n>50): [illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detect and multiple DLs
GROS may not be used when total # of detected data is small such as < 10
For such situations GROS method may yield artificially inflated UCL and ET s
For gamma distributed detected data ET s and UCLs may be improved using gamma distribution in KM estimates

Minimum: [illegible]
Mean: [illegible]
Maximum: [illegible]
Median: [illegible]
SD: [illegible]
CV: [illegible]
k hat (MLE): [illegible]
k star (bias corrected MLE): [illegible]
Theta hat (MLE): [illegible]
Theta star (bias corrected MLE): [illegible]
nu hat (MLE): [illegible]
nu star (bias corrected): [illegible]
MLE Mean (bias corrected): [illegible]
MLE Sd (bias corrected): [illegible]
Adjusted Level of Significance (adj): [illegible]
approximate Chi Square Value (.05): [illegible]
adjusted Chi Square Value (.05): [illegible]
95% Gamma approximate KM UCL (use when n>=50): [illegible]
95% Gamma adjusted KM UCL (use when n>50): [illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic: [illegible]
5% Shapiro Wilk Critical Value: [illegible]
Detected Data appear Lognormal at 5% Significance Level

Shapiro Wilk GOF Test

Lilliefors Test Statistic: [illegible]
5% Lilliefors Critical Value: [illegible]
Detected Data appear Lognormal at 5% Significance Level

Lilliefors GOF Test

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale: [illegible]
Mean in Log scale: [illegible]
SD in Original scale: [illegible]
SD in Log scale: [illegible]
95% KM (BCA) UCL (assumes normality of ROS data): [illegible]
95% Percentile Bootstrap UCL: [illegible]
95% KM (t) UCL: [illegible]
95% KM (Percentile Bootstrap) UCL: [illegible]
95% KM (Bootstrap t) UCL: [illegible]
95% KM (H-UCL) UCL: [illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged data): [illegible]
95% KM (H-UCL) UCL: [illegible]
KM (SD of logged data): [illegible]
95% KM (Chebyshev) UCL: [illegible]
KM (Standard Error of Mean of logged data): [illegible]

DL/2 Statistics

DL/2 Normal

Mean in Original scale: [illegible]
SD in Original scale: [illegible]
95% KM (t) UCL (assumes normality of ROS data): [illegible]

DL/2 Log-Transformed

Mean in Log scale: [illegible]
SD in Log scale: [illegible]
95% H-UCL (DL/2 log-transformed): [illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Percentile Bootstrap) UCL: [illegible]
95% GROS adjusted Gamma UCL: [illegible]
95% adjusted Gamma KM UCL: [illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL
Recommendations are based upon data size, data distribution, and skewness
These recommendations are based upon the results in the similar to studies summarized in Singh, Maichle and Lee (2006)
However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nitrite as N

General Statistics

Total Number of Observations	14
Number of Distinct Observations	12
Number of Detects	11
Number of Non-Detects	3
Number of Distinct Detects	10
Number of Distinct Non-Detects	2
Minimum Detect	1.00
Minimum Non-Detect	5.00
Maximum Detect	5.00
Maximum Non-Detect	5.00
Variance Detects	1.561E+
Percent Non-Detects	21.43%
Mean Detects	2.818
Standard Deviation Detects	1.250
Median Detects	2.00
Skewness Detects	0.774
Kurtosis Detects	0.5
Mean of Logged Detects	0.741
Standard Deviation of Logged Detects	0.468

Normal GOF Test on Detects Only

Shapiro Wilk Test	
Shapiro Wilk Test Statistic	0.848
5% Shapiro Wilk Critical Value	0.842
Detected Data Appear Normal at 5% Significance Level	
Lilliefors GOF Test	
Lilliefors Test Statistic	0.256
5% Lilliefors Critical Value	0.257
Detected Data Appear Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.2
Standard Error of Mean	0.218
SD	1.207
95% KM (BCA) UCL	4.500
95% KM (t) UCL	4.412
95% KM (Percentile Bootstrap) UCL	4.417
95% KM (z) UCL	4.4
95% KM (Bootstrap t) UCL	10.000
90% KM (Chebyshev) UCL	5.143
95% KM (Chebyshev) UCL	6.000
97.5% KM (Chebyshev) UCL	7.143
99% KM (Chebyshev) UCL	9.000

Gamma GOF Tests on Detected Observations Only

Anderson-Darling GOF Test	
A-D Test Statistic	0.596
5% A-D Critical Value	0.737
Detected Data Appear Gamma Distributed at 5% Significance Level	
Kolmogrov-Smirnoff GOF	
K-S Test Statistic	0.256
5% K-S Critical Value	0.264
Detected Data Appear Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.[illegible]
k star (bias corrected MLE)	1.[illegible]
Theta hat (MLE)	1.614
Theta star (bias corrected MLE)	1.844
nu hat (MLE)	34.[illegible]
nu star (bias corrected)	40.[illegible]
MLE Mean (bias corrected)	2.028
MLE Sd (bias corrected)	1.941

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	1.[illegible]
nu hat (KM)	46.[illegible]
approximate Chi Square Value (34, .05)	1.[illegible]
adjusted Chi Square Value (46, .05)	32.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	3.[illegible]
95% Gamma adjusted KM UCL (use when n<50)	3.[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or when many distinct detect and multiple DLs

GROS may not be used when k star of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be modeled using gamma distribution on KM estimates

Minimum	0.00
Mean	2.17
Maximum	5.00
Median	2.00
SD	1.47
CV	0.677
k hat (MLE)	0.918
k star (bias corrected MLE)	0.942
Theta hat (MLE)	2.367
Theta star (bias corrected MLE)	2.304
nu hat (MLE)	51.57
nu star (bias corrected)	52.93
MLE Mean (bias corrected)	2.17
MLE Sd (bias corrected)	2.11
Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (52.93, .α)	34.77
Adjusted Chi Square Value (52.93, .β)	32.44
95% Gamma approximate UCL (use when n>=50)	3.[illegible]
95% Gamma adjusted UCL (use when n<50)	3.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	0.877
5% Shapiro Wilk Critical Value	0.842
Detected Data Appear Lognormal at 5% Significance Level	
Lilliefors GOF Test	
Lilliefors Test Statistic	0.1[illegible]
5% Lilliefors Critical Value	0.256
Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	2.140
Mean in Log scale	-0.[illegible]
SD in Original scale	1.414
SD in Log scale	0.[illegible]
95% UCL (assumes normality of ROS data)	4.113
95% Percentile Bootstrap UCL	4.14
95% EPA - Exponential UCL	3.144
95% Bootstrap t UCL	4.4[illegible]
95% H-UCL (Log ROS)	3.1[illegible]

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	-0.[illegible]
95% KM (BCA) UCL	3.[illegible]
KM (SD of logged)	0.[illegible]
95% KM (Percentile Bootstrap) UCL	3.[illegible]
KM (standard Error of Mean of logged)	0.[illegible]

DL/2 Statistics

DL/2 Normal	**DL/2 Log-Transformed**
Mean in Original scale	2.[illegible]
Mean in Log scale	-0.[illegible]
SD in Original scale	1.414
SD in Log scale	0.[illegible]
95% UCL (assumes normality)	4.[illegible]
95% Hall's UCL	4.[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL 3.[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Perchloroethylene

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	7	Number of Non-Detects	4
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	1.1	Minimum Non-Detect	1.0
Maximum Detect	4	Maximum Non-Detect	10.0
Average Detects	1.444	Percent Non-Detects	36%
Mean Detects	2.71	Detects	1
Median Detects	2	Non-Detects	14.1
Skewness Detects	0.44	Kurtosis Detects	21.5
Mean of Logged Detects	0.72	Mean of Logged Non-Detects	0.44

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.71	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.35	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.71	Standard Error of Mean	0.72
SD	0.45	95% KM (BCA) UCL	0.4
95% KM (t) UCL	0.8	95% KM (Percentile Bootstrap) UCL	2.44
95% KM (z) UCL	2.44	95% KM (Bootstrap t) UCL	2.48
90% KM Chebyshev UCL	5.05	95% KM Chebyshev UCL	4.03
97.5% KM Chebyshev UCL	4.71	99% KM Chebyshev UCL	6.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.17	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.144	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.2	k star (bias corrected MLE)	1.94
Theta hat (MLE)	0.7	Theta star (bias corrected MLE)	0.444
nu hat (MLE)	7.4	nu star (bias corrected)	5.57
MLE Mean (bias corrected)	2.71	MLE Sd (bias corrected)	1.9

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.62	nu hat (KM)	5.2
approximate Chi Square Value (5, α)	1.48	adjusted Chi Square Value (5, α)	1.45
95% Gamma approximate KM UCL (use when n>=50)	2.8	95% Gamma adjusted KM UCL (use when n<50)	2.87

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% ND or with many tied detection limits or multiple DLs

GROS may not be used when data set has fewer than 5 detected data or small sample size (< 1)

For such situations, GROS method may yield artificially inflated values UCLs and ETLs

For gamma distributed detected data, BTSs and BCA UCLs may be more reliable than gamma distribution based KM estimates

Minimum	0.5	Mean	4
Maximum	10	Median	2.1
SD	3.04	CV	0.76
k hat (MLE)	0.98	k star (bias corrected MLE)	0.91
Theta hat (MLE)	4.7	Theta star (bias corrected MLE)	4.4
nu hat (MLE)	15	nu star (bias corrected)	14
MLE Mean (bias corrected)	4	MLE Sd (bias corrected)	4.11
		desired Level (α)	0.05
approximate Chi Square Value (14, α)	6.7	adjusted Chi Square Value (14, α)	6.1
95% Gamma approximate UCL (use when n>=50)	7.8	95% Gamma adjusted UCL (use when n<50)	8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.71	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.35	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	4.2	Mean in Log scale	0.7
SD in Original scale	3.18	SD in Log scale	0.84
95% KM (BCA) UCL (assumes normality of ROS data)	7.3	95% Percentile Bootstrap UCL	7.4
95% KM (Chebyshev) UCL	7.3	95% Bootstrap t UCL	7.77
95% KM (Log ROS) UCL	8		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged ND)	0.7	95% KM (UPR1 Log)	2.4
KM (SD of logged ND)	0.818	95% KM (Jackknife Log)	2.62
KM (standard Error of Mean of logged ND)	0.194		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	3.1	Mean in Log scale	-0.74
SD in Original scale	4.04	SD in Log scale	0.94
95% UCL (assumes normality)	4.41	95% Hall's UCL	9.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	4.8
95% KM (Percentile Bootstrap) UCL	2.44

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nad Maichle and Lee (2010).

However simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
Number of Detects	11	Number of Non-Detects	3
Number of Distinct Detects	11	Number of Distinct Non-Detects	3
Minimum Detect	0.2	Minimum Non-Detect	0.5
Maximum Detect	11.0	Maximum Non-Detect	0.5
Variance Detects	14.04	Percent Non-Detects	21.43%
Mean Detects	2.014	Detects	24%
Median Detects	0.7	Non-Detects	100%
Skewness Detects	2.055	Kurtosis Detects	7.04
Mean of Logged Detects	-0.44	Std Dev of Logged Detects	1.49

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data Not Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.42	Standard Error of Mean	0.77
SD	2.55	95% KM (BCA) UCL	3.54
95% KM (t) UCL	3.45	95% KM (Percentile Bootstrap) UCL	3.54
95% KM (z) UCL	3.5	95% KM (Bootstrap t) UCL	3.65
90% KM (Chebyshev) UCL	4.07	95% KM (Chebyshev) UCL	4.64
97.5% KM (Chebyshev) UCL	5.4	99% KM (Chebyshev) UCL	6.71

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.45	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.74	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.24	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.95	k star (bias corrected MLE)	0.85
Theta hat (MLE)	2.15	Theta star (bias corrected MLE)	2.37
nu hat (MLE)	26.4	nu star (bias corrected)	23.8
MLE Mean (bias corrected)	2.04	MLE Sd (bias corrected)	2.21

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.951	nu hat (KM)	26.4
approximate Chi Square Value (0.05)	16.79	adjusted Chi Square Value (0.05)	15.81
95% Gamma approximate KM UCL (use when n>=50)	3.23	95% Gamma adjusted KM UCL (use when n<50)	3.34

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detects is small such as < 1.0

For such situations, GROS method may yield inflated values of UCL and ET's

For gamma distributed detected data, BTA's and UCL may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.15
Maximum	11.0	Median	1.3
SD	2.85	CV	1.325
k hat (MLE)	0.577	k star (bias corrected MLE)	0.52
Theta hat (MLE)	3.73	Theta star (bias corrected MLE)	4.13
nu hat (MLE)	16.18	nu star (bias corrected)	14.56
MLE Mean (bias corrected)	2.15	MLE Sd (bias corrected)	2.94
		adjusted Level of significance (0)	0.0467
approximate Chi Square Value (14.56, 0.05)	5.23	adjusted Chi Square Value (14.56, 0.0467)	4.444
95% Gamma approximate UCL (use when n>=50)	4.56	95% Gamma adjusted UCL (use when n<50)	4.815

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.78	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.44	Mean in Log Scale	0.7
SD in Original Scale	2.84	SD in Log Scale	1.48
95% UCL (assumes normality of ROS data)	3.84	95% Percentile Bootstrap UCL	3.8
95% BCA Bootstrap UCL	3.93	95% Bootstrap t UCL	3.91
95% H-UCL (Log ROS)	3.8		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean of logged)	0.7	95% H-UCL (KM -Log)	3.2
KM (SD of logged)	1.02	95% critical H value (KM-Log)	2.4
KM (standard error of mean of logged)	0.3		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.74	Mean in Log Scale	0.41
SD in Original Scale	2.8	SD in Log Scale	1.48
95% UCL (assumes normality)	3.97	95% H-UCL	12.47

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3.45	95% KM (Percentile Bootstrap) UCL	3.54

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Selenium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	1
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects		Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	Detect	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Dev of Logged Detects	[illegible]

Normal GOF Test on Detects Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

		Anderson-Darling GOF Test	
A-D Test Statistic	[illegible]		
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
		Kolmogrov-Smirnoff GOF	
K-S Test Statistic	[illegible]		
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTSs

For gamma distributed detected data, BTSs and UCLs may be much higher when using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Adjusted Level of Significance (0.05)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

		Shapiro Wilk GOF Test	
Shapiro Wilk Test Statistic	[illegible]		
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
		Lilliefors GOF Test	
Lilliefors Test Statistic	[illegible]		
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM -log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Nar Nile and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Tetrachloroethene (Tetrachloroethylene)

General Statistics

Total Number of Observations	40	Number of Distinct Observations	14
Number of Detects	19	Number of Non-Detects	21
Number of Distinct Detects	12	Number of Distinct Non-Detects	2
Minimum Detect	0.1	Minimum Non-Detect	0.5
Maximum Detect	1	Maximum Non-Detect	5
Variance Detects	0.0[illegible]	Percent Non-Detects	52.5%
Mean Detects	0.5[illegible]	SD Detects	0.[illegible]
Median Detects	0.[illegible]	CV Detects	1.[illegible]
Kurtosis Detects	0.[illegible]	Skewness Detects	1.45[illegible]
Mean of Logged Detects	0.[illegible]	SD of Logged Detects	1.[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.41	Standard Error of Mean	0.[illegible]
SD	0.[illegible]	95% KM (BCA) UCL	1
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	0.[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	0.19[illegible]
90% KM (Chebyshev) UCL	0.[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	0.[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.14	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.[illegible]	k star (bias corrected MLE)	0.4[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.[illegible]
nu hat (MLE)	1.[illegible]	nu star (bias corrected)	14.[illegible]
MLE Mean (bias corrected)	0.[illegible]	MLE Sd (bias corrected)	0

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.4[illegible]	nu hat (KM)	14.[illegible]
approximate Chi Square Value (14, .05)	0.[illegible]	adjusted Chi Square Value (14, .05)	0.[illegible]
95% Gamma approximate KM UCL (use when n>=50)	0.4	95% Gamma adjusted KM UCL (use when n<50)	0.5[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection levels or several multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values for UCLs and ETLs

For gamma distributed detected data, BTSs and UCLs may be improved using gamma distribution in KM estimates

Minimum	0.0[illegible]	Mean	0.[illegible]
Maximum	1	Median	0.[illegible]
SD	0.4[illegible]	CV	1.[illegible]
k hat (MLE)	0.[illegible]	k star (bias corrected MLE)	0.[illegible]
Theta hat (MLE)	0.[illegible]	Theta star (bias corrected MLE)	0.44[illegible]
nu hat (MLE)	2.[illegible]	nu star (bias corrected)	2.1[illegible]
MLE Mean (bias corrected)	0.[illegible]	MLE Sd (bias corrected)	0.[illegible]
		Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (2.1[illegible], .05)	1.[illegible]	Adjusted Chi Square Value (2.1[illegible], .0[illegible])	1.14[illegible]
95% Gamma approximate UCL (use when n>=50)	0.4[illegible]	95% Gamma adjusted UCL (use when n<50)	0.[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.54	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.[illegible]	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.5[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.41	SD in Log scale	1.7[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	0.101	95% Bootstrap t UCL	0.5[illegible]
95% HW UCL (Log ROS)	0.[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	0.4[illegible]	SD in Log scale	1.[illegible]
95% KM (t) UCL (assumes normality)	0.5[illegible]	95% Hall's UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 0.[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon the results of the simulation studies summarized in Singh, Maritz and Lee (2010)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Thallium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	14
Number of Detects	4	Number of Non-Detects	0
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	[illegible]	Minimum Non-Detect	1
Maximum Detect	[illegible]	Maximum Non-Detect	120
Variance Detects	1[illegible]4	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	DL/2 Statistic	[illegible]
Median Detects	[illegible]	[illegible] Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	1[illegible]44
Mean of Logged Detects	[illegible]	Dev of Logged Detects	1[illegible]4

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 50% Non-Detects or less and multiple DLs

GROS may not be used when k star of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (.05, df)	[illegible]	adjusted Chi Square Value (.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (Chebyshev) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% KM UCL (KM Log)	[illegible]
KM (SD of logged)	[illegible]	95% Critical H Value (KM Log)	[illegible]
KM (Standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Trichloroethene (Trichloroethylene)

General Statistics

Total Number of Observations	40	Number of Distinct Observations	11
Number of Detects	11	Number of Non-Detects	11
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.24	Minimum Non-Detect	0.5
Maximum Detect	4	Maximum Non-Detect	5
Variance Detects	1.1	Percent Non-Detects	75%
Mean Detects	1.05	Percent Detects	25%
Median Detects	1.45	Total Detects	11.4
Skewness Detects	0.971	Kurtosis Detects	1.01
Mean of Logged Detects	-0.21	Std Dev of Logged Detects	1.34

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.74	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.14	Standard Error of Mean	0.34
SD	1.51	95% KM (BCA) UCL	2.04
95% KM (t) UCL	1.94	95% KM (Percentile Bootstrap) UCL	1.84
95% KM (z) UCL	1.94	95% KM (Bootstrap t) UCL	2.41
90% KM (Chebyshev) UCL	2.41	95% KM (Chebyshev) UCL	2.89
97.5% KM (Chebyshev) UCL	3.4	99% KM (Chebyshev) UCL	4.37

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.41	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.74	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.34	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.11	k star (bias corrected MLE)	0.9
Theta hat (MLE)	1.19	Theta star (bias corrected MLE)	1.3
nu hat (MLE)	22.7	nu star (bias corrected)	17.7
MLE Mean (bias corrected)	1.35	MLE Sd (bias corrected)	1.3

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.747	nu hat (KM)	59.7
approximate Chi Square Value (59.7, α)	44	adjusted Chi Square Value (59.7, β)	42.49
95% Gamma approximate KM UCL (use when n>=50)	1.7	95% Gamma adjusted KM UCL (use when n>50)	1.8

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when k star of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be incorrect when using gamma distribution on ROS estimates

Minimum	0.001	Mean	1.1
Maximum	5.04	Median	0.94
SD	1.24	CV	1.13
k hat (MLE)	0.79	k star (bias corrected MLE)	0.748
Theta hat (MLE)	1.44	Theta star (bias corrected MLE)	1.47
nu hat (MLE)	63.2	nu star (bias corrected)	60
MLE Mean (bias corrected)	1.1	MLE Sd (bias corrected)	1.27
		Adjusted Level of Significance (β)	0.0484
Approximate Chi Square Value (60, α)	41	Adjusted Chi Square Value (60, β)	39.14
95% Gamma approximate UCL (use when n>=50)	1.45	95% Gamma adjusted UCL (use when n>50)	1.57

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.1	Mean in Log Scale	-0.041
SD in Original Scale	1.14	SD in Log Scale	1.74
95% UCL (assumes normality of ROS data)	1.91	95% Percentile Bootstrap UCL	1.74
95% BCA Bootstrap UCL	1.97	95% Bootstrap t UCL	1.98
95% H-UCL (Log ROS)	2.41		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.46	Mean in Log Scale	0.4
SD in Original Scale	1.19	SD in Log Scale	1.04
95% UCL (assumes normality)	2.18	95% H-UCL (LN)	5.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.94	95% KM (Percentile Bootstrap) UCL	1.84

Note: Suggestion is regarding the selection of a 95% UCL except when data has inadequate sample size or sample size is very small (such as < 10), or two or more DLs, or a high DL/CV value (> 2).

For recommendations based on data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile, and Lee (2010)

However simulations results will not cover all real world data sets; for additional insight the user may want to consult a statistician.

Zinc

General Statistics

Total Number of Observations	4	Number of Distinct Observations	11
Number of Detects	11	Number of Non-Detects	0
Number of Distinct Detects	11	Number of Distinct Non-Detects	0
Minimum Detect	1.1	Minimum Non-Detect	5.0
Maximum Detect	1100	Maximum Non-Detect	5.0
Variance Detects	5.4E+5	Percent Non-Detects	0.00%
Mean Detects	99.1	Detects to Non-Detects Ratio	1.0e+7
Median Detects	5.0	Total Detects	2.0E+4
Skewness Detects	11.4	Kurtosis Detects	4.17
Mean of Logged Detects	5.144	Dev of Logged Detects	2.4

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.412	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.48	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.43	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.4	Standard Error of Mean	2.100
SD	6.5	95% KM (BCA) UCL	7.300
95% KM (t) UCL	6.44	95% KM (Percentile Bootstrap) UCL	6.74
95% KM (z) UCL	6.7	95% KM (Bootstrap t) UCL	14.10
90% KM (Chebyshev) UCL	8.0	95% KM (Chebyshev) UCL	10.5
97.5% KM (Chebyshev) UCL	15.6	99% KM (Chebyshev) UCL	25.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.14	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.3	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.1	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.201	k star (bias corrected MLE)	0.14
Theta hat (MLE)	4.74	Theta star (bias corrected MLE)	4.014
nu hat (MLE)	4.1	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	0.9	MLE Sd (bias corrected)	14.48

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0[illegible]	nu hat (KM)	1.4[illegible]
approximate Theta (scale) (KM)	1.54	adjusted Theta (scale) (KM)	1.4
95% Gamma approximate KM UCL (use when n>=50)	1.100	95% Gamma adjusted KM UCL (use when n<50)	1.14

Gamma KM Mean (derived from k hat (KM)) 0.1

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as 0.1

For such situations GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be affected significantly when using gamma distribution for imputed estimates

Minimum	0.01	Mean	2.4
Maximum	1100	Median	0.01
SD	9.1	CV	3.947
k hat (MLE)	0.0[illegible]	k star (bias corrected MLE)	0.111
Theta hat (MLE)	1.4	Theta star (bias corrected MLE)	2.42
nu hat (MLE)	2.4	nu star (bias corrected)	2.614
MLE Mean (bias corrected)	2.4	MLE Sd (bias corrected)	47.01
		adjusted Level of significance (0.)	0.0144
approximate Theta (scale) (MLE)	[illegible]	adjusted Theta (scale) (MLE)	0.11
95% Gamma approximate UCL (use when n>=50)	4.01	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.48	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	2.4[illegible]	Mean in Log scale	-4.1
Dev in Original scale	1.0[illegible]	Dev in Log scale	2.4
95% UCL (assumes normality of ROS data)	7.[illegible]	95% Percentile Bootstrap UCL	7.411
95% BTS-Bootstrap UCL	8	95% Bootstrap UCL	[illegible]

95% H-UCL (Log ROS) [illegible]

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	2	Mean in Log scale	4.E-1
Dev in Original scale	1.0[illegible]	Dev in Log scale	2.1
95% UCL (assumes normality)	7.[illegible]	95% H-Stat UCL	4.[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a discernible distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 25.4

Note: Suggestions regarding the selection of a 95% UCL are based upon data set characteristics such as skewness, GOF test results, and the number of detected and non-detect observations

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maro Nile and Lee (2010)

However simulations results will not cover all real world data sets; for additional insight the user may want to consult a statistician

APPENDIX B-6
DEEP GROUNDWATER

Appendix B-6
ProUCL Output - Deep Groundwater
Smokey Mountain Smelters
Knoxville, Tennessee

UCL Statistics for Data Sets with Non-Detects

User Selected Options
Date/Time of Computation [illegible]
From File [illegible]
Full Precision OFF
Confidence Coefficient [illegible]%
Number of Bootstrap Operations [illegible]

2,4-Dinitrotoluene

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	14
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15.6% NDs with many tied detect values at multiple DLs
GROS may not be used when kstar of detected data is small such as 0.1
For such situations, GROS method may yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0.01)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (BCA) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (t) UCL (assumes normality)	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
95% HW UCL (LN of ROS data)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% HW UCL (KM Log)	[illegible]
KM SD (logged)	[illegible]	95% Chebyshev (KM Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% HW UCL (assumes normality)	[illegible]	95% Chebyshev UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL
Recommendations are based upon data size, data distribution, and skewness
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Lee (2006)
However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

2,8-Dinitrotoluene

General Statistics

Total Number of Observations	24	Number of Distinct Observations	4
Number of Detects	[illegible]	Number of Non-Detects	1
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	
Minimum Detect		Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible]% Non-Detects or more than 25% Non-Detects

GROS may not be used when kstar of detected data is small such as <0.1

For such situations, GROS method may yield inflated values of UCL and ETL

For gamma distributed detected data, BTSP and BCA UCL may be more accurate when using gamma distribution to impute Non-Detects

Mean	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0.05)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD of logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM (Standard Error of Mean of logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, insight from the graphical and numerical diagnostics on the data may yield additional insight for the best UCL to use

For small sample sizes (n<15), use the 95% Chebyshev UCL

For moderate sample sizes (15<=n<50), use the 97.5% Chebyshev UCL

For large sample sizes (n>=50), use the 99% Chebyshev UCL

For data sets with > 50% NDs and small sample sizes, use 95% Chebyshev UCL

For data sets with > 50% NDs and large sample sizes, use 97.5% Chebyshev UCL

For data sets with > 50% NDs and very large sample sizes, use 99% Chebyshev UCL

Aluminum

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	Detects	[illegible]
Median Detects	[illegible]	Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	Detects Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, α)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% Non-Detects or less and no single DL

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations GROS method may yield inflated values of UCL and ETL

For gamma distributed detected data, BTSA and BCA UCLs may be improved using gamma distribution in KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, α)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (mean) of logged Data	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD) of logged Data	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean of logged Data	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However simulation results will not cover all Real World data sets; in addition, although the gamma and lognormal models are good statistical models

Arsenic

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or all Non-Detects

GROS may not be used when kstar of detected data is small such as [illegible]

For such situations GROS method may yield inflated values of UCL and ETs

For gamma distributed detected data BTSs and UCLs may be improved using gamma distribution in KM estimates

Mean	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nar Nie, and Lee (2006)

However simulation results will not cover all real world data sets; in addition, insight into the gamma, lognormal, and normal distributions results in statistical

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation [illegible]

From File [illegible]

Full Precision OFF

Confidence Coefficient 95%

Number of Bootstrap Operations [illegible]

Benzene

General Statistics

Total Number of Observations	24	Number of Distinct Observations	10
Number of Detects		Number of Non-Detects	14
Number of Distinct Detects	9	Number of Distinct Non-Detects	5
Minimum Detect	0.24	Minimum Non-Detect	0.5
Maximum Detect	1.2	Maximum Non-Detect	5
Variance Detects	0.0114	Percent Non-Detects	58.33%
Mean Detects	0.443	SD Detects	0.374
Median Detects	0.35	CV Detects	0.84
Skewness Detects	1.04	Kurtosis Detects	1.104
Mean of Logged Detects	-0.82	SD of Logged Detects	0.701

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.237	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.374	KM Standard Error of Mean	0.0704
KM SD	0.243	95% KM (BCA) UCL	0.5
95% KM (t) UCL	0.51	95% KM (Percentile Bootstrap) UCL	0.5
95% KM (z) UCL	0.5	95% KM (Bootstrap t) UCL	0.52
90% KM (Chebyshev) UCL	0.62	95% KM (Chebyshev) UCL	0.74
97.5% KM (Chebyshev) UCL	0.9	99% KM (Chebyshev) UCL	1.245

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.503	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.243	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.244	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.67	k star (bias corrected MLE)	1.42
Theta hat (MLE)	0.265	Theta star (bias corrected MLE)	0.312
nu hat (MLE)	40.1	nu star (bias corrected)	34.1
MLE Mean (bias corrected)	0.443	MLE Sd (bias corrected)	0.372

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.42	nu hat (KM)	116
approximate Chi Square Value (0.05, DF)	93.4	adjusted Chi Square Value (0.05, DF)	90.1
95% Gamma approximate KM UCL (use when n>=50)	0.4	95% Gamma adjusted KM UCL (use when n<50)	0.47

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% Non-Detects but has more than 10 distinct values

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Mean	0.408	Median	0.374
Maximum	1.2	Minimum	0.0001
SD	0.2	CV	0.49
k hat (MLE)	3.75	k star (bias corrected MLE)	3.1
Theta hat (MLE)	0.109	Theta star (bias corrected MLE)	0.132
nu hat (MLE)	90.4	nu star (bias corrected)	74.4
MLE Mean (bias corrected)	0.414	MLE Sd (bias corrected)	0.234
		Adjusted Level of Significance (β)	0.0214
approximate Chi Square Value (74.4, α)	54.2	adjusted Chi Square Value (74.4, β)	48.04
95% Gamma approximate UCL (use when n>=50)	0.6	95% Gamma adjusted UCL (use when n<50)	0.74

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.237	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	0.407	Mean in Log scale	-0.77
SD in Original scale	0.2	SD in Log scale	0.67
95% KM (BCA) UCL (assumes normality of ROS data)	0.54	95% Percentile Bootstrap UCL	0.54
95% KM (t) UCL (assumes normality)	0.51	95% Bootstrap t UCL	0.6
95% HW UCL (LN of ROS data)	0.74		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.87	95% KM UCL (KM-Log)	0.4
KM SD (logged)	0.56	95% KM Chebyshev UCL (KM-Log)	1.05
KM Standard Error of Mean (logged)	0.0944		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	0.373	Mean in Log scale	-0.94
SD in Original scale	0.4	SD in Log scale	0.62
95% UCL (assumes normality)	0.49	95% Hall's UCL	1.46

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	0.54	95% KM (Percentile Bootstrap) UCL	0.5

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all real world data sets; in addition, insight from the graphical and numerical goodness of fit results should also be used

Cadmium

General Statistics

Total Number of Observations	24	Number of Distinct Observations	13
Number of Detects	7	Number of Non-Detects	14
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	0.4	Minimum Non-Detect	0.5
Maximum Detect	8.8	Maximum Non-Detect	2.50
Average Detect	4.5	Percent Non-Detects	58.33%
Geomean Detect	2.7	SD Detects	3.4
Median Detect	3.4	CV Detects	0.73
Skewness Detects	1.414	Kurtosis Detects	1.475
Mean of Logged Detects	0.73	SD of Logged Detects	0.714

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.751	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.81	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.25	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.43	KM Standard Error of Mean	0.45
KM SD	3.45	95% KM (BCA) UCL	4.555
95% KM (t) UCL	4.75	95% KM (Percentile Bootstrap) UCL	4.74
95% KM (z) UCL	4.74	95% KM (Bootstrap t) UCL	5.014
90% KM (Chebyshev) UCL	5.4	95% KM (Chebyshev) UCL	6.44
97.5% KM (Chebyshev) UCL	7.34	99% KM (Chebyshev) UCL	9.461

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.42	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.245	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.34	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.42	k star (bias corrected MLE)	1.914
Theta hat (MLE)	1.89	Theta star (bias corrected MLE)	1.741
nu hat (MLE)	34	nu star (bias corrected)	26.7
MLE Mean (bias corrected)	4.7	MLE Sd (bias corrected)	2.97

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	2.43	nu hat (KM)	100.4
approximate Chi Square Value (100.4, α)	79.1	adjusted Chi Square Value (100.4, β)	77.6
95% Gamma approximate KM-UCL (use when n>=50)	5.431	95% Gamma adjusted KM-UCL (use when n<50)	5.5

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ET's

For gamma distributed detected data, BTs and UCLs may be improved by using gamma distribution for KM estimates

Minimum	0.001	Mean	3.3
Maximum	8.8	Median	1.15
SD	3.45	CV	1.047
k hat (MLE)	1.08	k star (bias corrected MLE)	0.97
Theta hat (MLE)	3.061	Theta star (bias corrected MLE)	3.4
nu hat (MLE)	51.9	nu star (bias corrected)	46.84
MLE Mean (bias corrected)	3.3	MLE Sd (bias corrected)	3.414
		Adjusted Level of Significance (β)	0.044
approximate Chi Square Value (46.84, α)	31.5	adjusted Chi Square Value (46.84, β)	30
95% Gamma approximate UCL (use when n>=50)	5.7	95% Gamma adjusted UCL (use when n<50)	5.97

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.81	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.25	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	3.4	Mean in Log scale	0.445
SD in Original scale	3.4	SD in Log scale	0.9
95% UCL (assumes normality of ROS data)	4.44	95% Percentile Bootstrap UCL	4.7
95% BCA Bootstrap UCL	4.45	95% Bootstrap t UCL	5.5
95% Hall's Bootstrap UCL	4		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	0.444	95% H-UCL (KM-Log)	4.44
KM SD (logged)	0.91	95% Critical H Value (KM-Log)	3.55
KM Standard Error of Mean (logged)	0.55		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	3.4	Mean in Log scale	0.54
SD in Original scale	3.17	SD in Log scale	1.08
95% UCL (assumes normality)	4.4	95% H-stat UCL	6.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	4.75	95% KM (Percentile Bootstrap) UCL	4.74

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

CHloroform

General Statistics

Total Number of Observations	28	Number of Distinct Observations	7
Number of Detects	5	Number of Non-Detects	14
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.35	Minimum Non-Detect	0.5
Maximum Detect	5.4	Maximum Non-Detect	5
Average Detect	2.04	Percent Non-Detects	74.07%
Geomean Detect	1.77	SD Detects	2.44
Median Detect	1.7	CV Detects	0.44
Skewness Detects	0.405	Kurtosis Detects	-2.441
Mean of Logged Detects	0.42	SD of Logged Detects	1.07

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.34	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1.144	Standard Error of Mean	0.15
SD	1.72	95% KM (BCA) UCL	2.07
95% KM (t) UCL	2.037	95% KM (Percentile Bootstrap) UCL	2.036
95% KM (z) UCL	1.974	95% KM (Bootstrap t) UCL	2.1
90% KM (Chebyshev) UCL	2.51	95% KM (Chebyshev) UCL	3.4
97.5% KM (Chebyshev) UCL	4.245	99% KM (Chebyshev) UCL	5.44

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.2	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.224	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.254	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.441	k star (bias corrected MLE)	0.35
Theta hat (MLE)	2.594	Theta star (bias corrected MLE)	3.29
nu hat (MLE)	24.14	nu star (bias corrected)	19.44
MLE Mean (bias corrected)	1.27	MLE Sd (bias corrected)	0.6

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.401	nu hat (KM)	14.5
approximate Chi Square Value (14.5, α)	6.1	adjusted Chi Square Value (14.5, β)	5
95% Gamma approximate KM UCL (use when n>=50)	2.05	95% Gamma adjusted KM UCL (use when n<50)	2.14

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be overestimated when gamma distribution is not used for KM estimates

Minimum	0.001	Mean	1.124
Maximum	5.4	Median	0.525
SD	1.35	CV	1.2
k hat (MLE)	0.429	k star (bias corrected MLE)	0.401
Theta hat (MLE)	2.674	Theta star (bias corrected MLE)	2.8
nu hat (MLE)	24.07	nu star (bias corrected)	22.4
MLE Mean (bias corrected)	1.14	MLE Sd (bias corrected)	1.78
		adjusted Level of Significance (β)	0.0224
approximate Chi Square Value (22.4, α)	10.2	adjusted Chi Square Value (22.4, β)	9.4
95% Gamma approximate UCL (use when n>=50)	2.15	95% Gamma adjusted UCL (use when n<50)	2.35

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.1	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.34	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.44	Mean in Log Scale	-0.484
SD in Original Scale	1.514	SD in Log Scale	1.41
95% UCL (assumes normality of ROS data)	1.67	95% Percentile Bootstrap UCL	1.65
95% BCA Bootstrap UCL	1.64	95% Bootstrap t UCL	1.66
95% H-UCL (Log ROS)	2.2		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.47	95% H-UCL (KM-Log)	2.1
KM SD (logged)	1.24	95% Critical H Value (KM-Log)	1.65
KM Standard Error of Mean (logged)	0.44		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	1.44	Mean in Log Scale	-0.41
SD in Original Scale	1.45	SD in Log Scale	1.54
95% UCL (assumes normality)	2.07	95% H-UCL	4.05

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.07	95% KM (Percentile Bootstrap) UCL	2.06

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, various other factors such as the presence of outliers, number of distinct values, number of detects, and nature of the distribution (multimodal, skewed, etc.) may also impact the performance of the various UCL statistics

Chromium

General Statistics

Total Number of Observations	24	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	21
Number of Distinct Detects	5	Number of Distinct Non-Detects	6
Minimum Detect	1.1	Minimum Non-Detect	10
Maximum Detect	4	Maximum Non-Detect	5000
Average Detect	1.74	Percent Non-Detects	87.5%
Geometric Mean of Detects	1.5	Percent Distinct Detects	5.2%
Median Detect	1	Percent Detects	12.5%
Skewness Detects	1.514	Kurtosis Detects	2.52
Mean of Logged Detects	0.16	Coefficient of Variation Detects	0.907

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.55	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.5	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.4	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.17	Standard Error of Mean	0.047
SD	0.464	95% KM (BCA) UCL	0.2
95% KM (t) UCL	0.23	95% KM (Percentile Bootstrap) UCL	0.25
95% KM (z) UCL	0.21	95% KM (Bootstrap t) UCL	0.25
90% KM (Chebyshev) UCL	0.311	95% KM (Chebyshev) UCL	0.4
97.5% KM (Chebyshev) UCL	0.5	99% KM (Chebyshev) UCL	0.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.6	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.8	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.184	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.4	k star (bias corrected MLE)	0.97
Theta hat (MLE)	2.317	Theta star (bias corrected MLE)	0.448
nu hat (MLE)	1.4	nu star (bias corrected)	7.5
MLE Mean (bias corrected)	0.32	MLE Sd (bias corrected)	0.488

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.444	nu hat (KM)	2.7
approximate Chi Square Value (0.05)	1.7	adjusted Chi Square Value (0.05)	1.2
95% Gamma approximate KM UCL (use when n>=50)	2.01	95% Gamma adjusted KM UCL (use when n<50)	2.4

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute MLE estimates

Minimum	0.001	Mean	0.3
Maximum	5	Median	0.001
SD	0.9	CV	2.4
k hat (MLE)	0.18	k star (bias corrected MLE)	0.14
Theta hat (MLE)	1.8	Theta star (bias corrected MLE)	2.5
nu hat (MLE)	8.7	nu star (bias corrected)	6.5
MLE Mean (bias corrected)	0.3	MLE Sd (bias corrected)	0.9
		adjusted Level of significance (0.01)	0.01
approximate Chi Square Value (4.01, 0.01)	0.7	adjusted Chi Square Value (4.01, 0.01)	0.4
95% Gamma approximate KM UCL (use when n>=50)	2.2	95% Gamma adjusted KM UCL (use when n<50)	2.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.134	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.4	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.04	Mean in Log Scale	1.411
SD in Original Scale	1.1	SD in Log Scale	1.08
95% UCL (assumes normality of ROS data)	1.4	95% Percentile Bootstrap UCL	1.54
95% BCA Bootstrap UCL	1.65	95% Bootstrap t UCL	2.45
95% H-UCL (Log ROS)	1.54		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean of logged)	1.6	95% H-UCL (KM-Log)	1.54
KM (SD of logged)	0.74	95% Critical H Value (KM-Log)	1.6
KM (Standard Error of Mean of logged)	0.174		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.54	Mean in Log Scale	-1.4
SD in Original Scale	0.1	SD in Log Scale	1.08
95% UCL (assumes normality)	0.7	95% H-stat UCL	2.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.23	95% KM (Percentile Bootstrap) UCL	0.25

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However, simulation results will not cover all Real World data sets; in addition, advice from the project team, knowledge of the site, and other relevant statistical

Cebuk

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible] %
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk GOF Test

Shapiro Wilk Test Statistic	[illegible]	Detected Data Not Normal at 5% Significance Level
5% Shapiro Wilk Critical Value	[illegible]	

Lilliefors GOF Test

Lilliefors Test Statistic	[illegible]	Detected Data appear Normal at 5% Significance Level
5% Lilliefors Critical Value	[illegible]	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

Anderson-Darling GOF Test

A-D Test Statistic	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level
5% A-D Critical Value	[illegible]	

Kolmogrov-Smirnoff GOF

K-S Test Statistic	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level
5% K-S Critical Value	[illegible]	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, α)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or all or almost all Detects

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ETL

For gamma distributed detected data, BTSP and BCA UCL may be improved using gamma distribution for KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk GOF Test

Shapiro Wilk Test Statistic	[illegible]	Detected Data appear Lognormal at 5% Significance Level
5% Shapiro Wilk Critical Value	[illegible]	

Lilliefors GOF Test

Lilliefors Test Statistic	[illegible]	Detected Data appear Lognormal at 5% Significance Level
5% Lilliefors Critical Value	[illegible]	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (BCA) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (H) UCL (LN of ROS data)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% KM (U) UCL (KM Log)	[illegible]
KM SD (logged)	[illegible]	95% KM (A) UCL (KM Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% Percentile Bootstrap UCL	[illegible]

:

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all real world data sets; in addition, insight into the gamma, lognormal, and normal distributions, results statistician

Copper

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be much higher when using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (0.05)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (z) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% KM (jackknife) UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean) of logged data	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD) of logged data	[illegible]	95% critical H value (KM-Log)	[illegible]
KM (Standard Error) of Mean of logged data	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (2006)

However, simulation results will not cover all Real World data sets; in addition, advice from the site statistician

Cyanide

General Statistics

Total Number of Observations	2	Number of Distinct Observations	4
Number of Detects	7	Number of Non-Detects	15
Number of Distinct Detects	5	Number of Distinct Non-Detects	
Minimum Detect	[illegible]	Minimum Non-Detect	10
Maximum Detect	14	Maximum Non-Detect	1
Average Detect	7.[illegible]	Percent Non-Detects	[illegible]
Geometric Mean of Detects	[illegible]	SD of Detects	4.15
Median Detect	4	CV of Detects	0.4[illegible]
Skewness Detects	1.11	Kurtosis Detects	1.47
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	[illegible]	KM Standard Error of Mean	[illegible]
KM SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	11	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	1.47	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	1.47	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or no more than 50% Non-Detects

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and ETSs

For gamma distributed detected data, BTSs and BCAs UCLs may be improved using gamma distribution to impute Non-Detects

Minimum	[illegible]	Mean	[illegible]
Maximum	14	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (β)	[illegible]
approximate Chi Square Value (34, α)	[illegible]	adjusted Chi Square Value (34, β)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	4	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	11	95% KM (Percentile Bootstrap) UCL	[illegible]

;

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will vary greatly for other data sets. In addition, visualizing the data, histogram, probability plot, etc. along with the above statistics

Iron

General Statistics

Total Number of Observations	24	Number of Distinct Observations	24
Number of Detects	1	Number of Non-Detects	1
Number of Distinct Detects	1	Number of Distinct Non-Detects	1
Minimum Detect	1	Minimum Non-Detect	1000
Maximum Detect	1000	Maximum Non-Detect	1000
Variance Detects	40,441	Percent Non-Detects	50%
Mean Detects	1,441	Detects	12
Median Detects	400	Distinct Detects	11
Skewness Detects		Non-detects	11
Mean of Logged Detects	6.307	Distinct Logged Detects	11

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.441	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.249	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	1561	Standard Error of Mean	1306
SD	1420	95% KM (BCA) UCL	N/A
95% KM (t) UCL	4,144	95% KM (Percentile Bootstrap) UCL	5210
95% KM (z) UCL	4,154	95% KM (Bootstrap t) UCL	14,251
90% KM (Chebyshev) UCL	6,455	95% KM (Chebyshev) UCL	8,756
97.5% KM (Chebyshev) UCL	11,450	99% KM (Chebyshev) UCL	17,154

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.424	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.377	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.254	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.857	k star (bias corrected MLE)	0.792
Theta hat (MLE)	2,444	Theta star (bias corrected MLE)	2,645
nu hat (MLE)	41.74	nu star (bias corrected)	38.07
MLE Mean (bias corrected)	2,082	MLE Sd (bias corrected)	2,352

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.882	nu hat (KM)	42.74
approximate Chi Square Value (34, α)	24.77	adjusted Chi Square Value (34, β)	24.741
95% Gamma approximate KM UCL (use when n>=50)	3,425	95% Gamma adjusted KM UCL (use when n<50)	3,487
Gamma ROS Statistics using Imputed Non-Detects			

GROS may not be used when data set has only 15% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and ET's

For gamma distributed detected data, BTs and UCLs may be inflated when using gamma distribution on KM estimates

Minimum	0.001	Mean	147.1
Maximum	1000	Median	15.51
SD	223.0	CV	1.516
k hat (MLE)	0.123	k star (bias corrected MLE)	0.1
Theta hat (MLE)	1,195	Theta star (bias corrected MLE)	1,190
nu hat (MLE)	9.852	nu star (bias corrected)	8.401
MLE Mean (bias corrected)	147.1	MLE Sd (bias corrected)	420
		adjusted Level of significance (β)	0.0214
approximate Chi Square Value (8.401, α)	2.117	adjusted Chi Square Value (8.401, β)	1.487
95% Gamma approximate UCL (use when n>=50)	450.7	95% Gamma adjusted UCL (use when n<50)	542.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.249	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	1561	Mean in Log scale	5.219
SD in Original scale	5551	SD in Log scale	1.9
95% KM (t) UCL (assumes normality of ROS data)	4	95% Percentile Bootstrap UCL	5257
95% EPA (Land) Bootstrap UCL	4,714	95% Bootstrap UCL	2,4
95% H-UCL UCL (ROS)	1,1		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (Logged)	5.45	95% H-UCL (KM-Log)	2,174
KM SD (Logged)	1.9	95% Critical H Value (KM-Log)	4.1
KM Standard Error of Mean (Logged)	0.374		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	1,245	Mean in Log scale	5.1
SD in Original scale	5550	SD in Log scale	1.977
95% UCL (assumes normality)	7,014	95% H-stat UCL	44,4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 1,254

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the simulation studies summarized in Singh, Nar Nile, and Lee (2006)

However simulation results will not cover all Real World data sets; in addition, although the gamma and lognormal distributions

...results statistics can

Level

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
Number of Detects	[illegible]	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (34, 0.05)	[illegible]	adjusted Chi Square Value (34, 0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only [illegible] Non-Detects or only one or two unique DLs

GROS may not be used when kstar of detected data is small such as [illegible]

For such situations GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and BCAs UCLs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of significance (0.05)	[illegible]
approximate Chi Square Value (0.05, [illegible])	[illegible]	adjusted Chi Square Value (0.05, [illegible])	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% H-UCL (Log ROS)	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM (Mean) of logged Data	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM (SD) of logged Data	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean of logged Data	[illegible]		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-Stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Warning: One or more Recommended UCL(s) not available!

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (2006)

However simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Manganese

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	[illegible]
		Number of Missing Observations	0
Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	Standard Error of Mean	[illegible]
Coefficient of Variation	[illegible]	Skewness	[illegible]

Normal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL	**95% UCLs (Adjusted for Skewness)**
95% Student's-t UCL [illegible]	95% Adjusted-CLT UCL (Chen-1995) [illegible]
	95% Modified-Johnson UCL (Johnson-1978) [illegible]

Gamma GOF Test

A-D Test Statistic	[illegible]	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	[illegible]	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff Gamma GOF Test**	
5% K-S Critical Value	[illegible]	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Approximate Chi Square Value (0.05)	[illegible]
Adjusted Level of Significance	[illegible]	Adjusted Chi Square Value	[illegible]

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	[illegible]
95% Adjusted Gamma UCL (use when n<50)	[illegible]

Lognormal GOF Test

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	[illegible]	Data Not Lognormal at 5% Significance Level	

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	[illegible]	Mean of Logged Data	[illegible]
Maximum of Logged Data	[illegible]	Sd of Logged Data	[illegible]

Assuming Lognormal Distribution

95% H-UCL	[illegible]
95% Chebyshev (MVUE) UCL	[illegible]
97.5% Chebyshev (MVUE) UCL	[illegible]
99% Chebyshev (MVUE) UCL	[illegible]

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	[illegible]
95% Jackknife UCL	[illegible]
95% Standard Bootstrap UCL	[illegible]
95% Bootstrap-t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]
95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]
95% Chebyshev (Mean, Sd) UCL	[illegible]
97.5% Chebyshev (Mean, Sd) UCL	[illegible]
99% Chebyshev (Mean, Sd) UCL	[illegible]

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	[illegible]

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002).
However, simulation results will not cover all Real World data sets;
For additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	26	Number of Distinct Observations	
Number of Detects	6	Number of Non-Detects	20
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.0016	Minimum Non-Detect	0.1
Maximum Detect	0.41	Maximum Non-Detect	0.2
Variance Detects	0.0137	Percent Non-Detects	76.92%
Mean Detects	0.1	SD Detects	0.14
Median Detects	0.0645	CV Detects	1.41
Skewness Detects	1.14	Kurtosis Detects	4.27
Mean of Logged Detects	-2.5	SD of Logged Detects	1.24

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.7	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.0645	Standard Error of Mean	0.0174
SD	0.137	95% KM (BCA) UCL	0.137
95% KM (t) UCL	0.154	95% KM (Percentile Bootstrap) UCL	0.16
95% KM (z) UCL	0.152	95% KM (Bootstrap t) UCL	0.256
90% KM (Chebyshev) UCL	0.19	95% KM (Chebyshev) UCL	0.229
97.5% KM (Chebyshev) UCL	0.27	99% KM (Chebyshev) UCL	0.387

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.46	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.247	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.4	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.761	k star (bias corrected MLE)	0.641
Theta hat (MLE)	0.1	Theta star (bias corrected MLE)	0.126
nu hat (MLE)	41.7	nu star (bias corrected)	34.7
MLE Mean (bias corrected)	0.1	MLE Sd (bias corrected)	0.1

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.76	nu hat (KM)	41.5
approximate Chi Square Value (34.57, α)	24.1	adjusted Chi Square Value (34.57, β)	24.4
95% Gamma approximate KM-UCL (use when n>=50)	0.134	95% Gamma adjusted KM-UCL (use when n<50)	0.144

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Minimum	0.001	Mean	0.0647
Maximum	0.41	Median	0.0645
SD	0.1	CV	1.55
k hat (MLE)	0.614	k star (bias corrected MLE)	0.564
Theta hat (MLE)	0.154	Theta star (bias corrected MLE)	0.172
nu hat (MLE)	34.4	nu star (bias corrected)	29.57
MLE Mean (bias corrected)	0.0947	MLE Sd (bias corrected)	0.1
		adjusted Level of Significance (β)	0.0414
approximate Chi Square Value (29.57, α)	17.1	adjusted Chi Square Value (29.57, β)	17.56
95% Gamma approximate UCL (use when n>=50)	0.154	95% Gamma adjusted UCL (use when n<50)	0.165

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.7	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0464	Mean in Log Scale	-3.47
SD in Original Scale	0.175	SD in Log Scale	1.12
95% UCL (assumes normality of ROS data)	0.155	95% Percentile Bootstrap UCL	0.15
95% BCA Bootstrap UCL	0.147	95% Bootstrap t UCL	0.171
95% H-UCL (Log ROS)	0.147		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.43	95% H-UCL (KM-Log)	0.16
KM SD (logged)	0.98	95% Critical H Value (KM-Log)	2.75
KM Standard Error of Mean (logged)	0.425		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.126	Mean in Log Scale	-2.4
SD in Original Scale	0.165	SD in Log Scale	0.844
95% UCL (assumes normality)	0.17	95% H-stat UCL	0.147

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	95% KM (Percentile Bootstrap) UCL 0.16

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nai Ma, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, advantages of the other methods, such as robustness, may not be shown in simulations

Nickel

General Statistics

Total Number of Observations	24	Number of Distinct Observations	22
Number of Detects	15	Number of Non-Detects	11
Number of Distinct Detects	15	Number of Distinct Non-Detects	7
Minimum Detect	1	Minimum Non-Detect	10
Maximum Detect	240	Maximum Non-Detect	2000
Average Detects	52.07	Percent Non-Detects	45.83%
Median Detects	8.5	Detects	0.0417
Mean Detects	1	Distinct Detects	15.04
Skewness Detects	0.01	Kurtosis Detects	0.03
Mean of Logged Detects	2.75	Distinct Logged Detects	1.44

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.224	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	24.04	Standard Error of Mean	10.1
SD	44.2	95% KM (BCA) UCL	44.4
95% KM (t) UCL	47.5	95% KM (Percentile Bootstrap) UCL	46.6
95% KM (z) UCL	46.2	95% KM (Bootstrap t) UCL	67.6
90% KM (Chebyshev) UCL	54.7	95% KM (Chebyshev) UCL	76.9
97.5% KM (Chebyshev) UCL	86.54	99% KM (Chebyshev) UCL	130.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.40	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.154	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.95	k star (bias corrected MLE)	0.871
Theta hat (MLE)	56	Theta star (bias corrected MLE)	27.6
nu hat (MLE)	34.74	nu star (bias corrected)	27.2
MLE Mean (bias corrected)	52.5	MLE Sd (bias corrected)	50.77

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.87	nu hat (KM)	34.8
approximate Chi Square Value (34, α)	24.04	adjusted Chi Square Value (34, β)	23.4
95% Gamma approximate KM UCL (use when n>=50)	65.2	95% Gamma adjusted KM UCL (use when n>50)	65.37

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield artificially inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute MLE estimates

Minimum	10.01	Mean	25.2
Maximum	240	Median	14.44
SD	47.37	CV	1.881
k hat (MLE)	0.414	k star (bias corrected MLE)	0.4
Theta hat (MLE)	61.1	Theta star (bias corrected MLE)	64.66
nu hat (MLE)	19.66	nu star (bias corrected)	20.4
MLE Mean (bias corrected)	25.2	MLE Sd (bias corrected)	40.4
		adjusted Level of Significance (β)	0.04
approximate Chi Square Value (20.4, α)	11.14	adjusted Chi Square Value (20.4, β)	10.04
95% Gamma approximate KM UCL (use when n>=50)	46.4	95% Gamma adjusted KM UCL (use when n>50)	4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.165	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.224	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	25.4	Mean in Log scale	2.42
SD in Original scale	47.44	SD in Log scale	1.44
95% UCL (assumes normality of ROS data)	41.4	95% Percentile Bootstrap UCL	42.4
95% BCA Bootstrap UCL	50.61	95% Bootstrap t UCL	55.4
95% Hall's Bootstrap UCL	50.2		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.415	95% H-UCL (KM-Log)	70.47
KM SD (logged)	1.401	95% Critical H Value (KM-Log)	1.99
KM Standard Error of Mean (logged)	0.44		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	24.87	Mean in Log scale	2.5
SD in Original scale	48.54	SD in Log scale	1.25
95% UCL (assumes normality)	50.5	95% H-stat UCL	2.77

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	44.4	95% GROS adjusted Gamma UCL	4
95% adjusted Gamma KM UCL	64.37		

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar examples summarized through Hanley and Lee (2000)

However, simulation results will not cover all Real World data sets; in addition, although the gamma and lognormal distributions are frequently used to model positive environmental data, these two parametric distributions

Selenium

General Statistics

Total Number of Observations	24	Number of Distinct Observations	15
Number of Detects	10	Number of Non-Detects	14
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	4.4	Minimum Non-Detect	2
Maximum Detect	14	Maximum Non-Detect	100
Average Detect	57.1	Percent Non-Detects	58.3%
Geometric Mean of Detects	4	Total No. of Detects	24
Median Detect	54.5	Total No. of Non-Detects	35.5
Skewness Detects	0.75	Kurtosis Detects	0.7
Mean of Logged Detects	4.47	Std. Dev. of Logged Detects	1.06

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.84	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	27.7	Standard Error of Mean	5.21
SD	25.2	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	37.7	95% KM (Percentile Bootstrap) UCL	44
95% KM (z) UCL	37.44	95% KM (BCA) UCL	44
90% KM (Chebyshev) UCL	41.5	95% KM (Chebyshev) UCL	44.5
97.5% KM (Chebyshev) UCL	50.7	99% KM (Chebyshev) UCL	67.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.02	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.77	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.21	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.271	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.714	k star (bias corrected MLE)	1.54
Theta hat (MLE)	32.41	Theta star (bias corrected MLE)	34
nu hat (MLE)	34.1	nu star (bias corrected)	30.14
MLE Mean (bias corrected)	58	MLE Sd (bias corrected)	45

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.44	nu hat (KM)	17.6
approximate Chi Square Value (17, α)	8.14	adjusted Chi Square Value (17, β)	5
95% Gamma approximate KM UCL (use when n>=50)	63.44	95% Gamma adjusted KM UCL (use when n<50)	67.6

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15.1% NDs (with many unique detection limits)

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTV

For gamma distributed detected data, BTVs and UCLs may be overestimated when gamma ROS estimates

Minimum	0.1	Mean	25.6
Maximum	100	Median	20.4
SD	27.57	CV	0.4
k hat (MLE)	1.04	k star (bias corrected MLE)	0.94
Theta hat (MLE)	24.4	Theta star (bias corrected MLE)	27.1
nu hat (MLE)	50.1	nu star (bias corrected)	51.5
MLE Mean (bias corrected)	25.6	MLE Sd (bias corrected)	26.7
		Adjusted Level of Significance (β)	0.0104
approximate Chi Square Value (51.5, α)	34.14	adjusted Chi Square Value (51.5, β)	32
95% Gamma approximate KM UCL (use when n>=50)	84.54	95% Gamma adjusted KM UCL (use when n<50)	87.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.7	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.84	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.2	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	22.7	Mean in Log scale	2.51
SD in Original scale	22.77	SD in Log scale	1.15
95% KM (t) UCL (assumes normality of ROS data)	34	95% Percentile Bootstrap UCL	34.4
95% KM (BCA) UCL	38.14	95% KM (bootstrap t) UCL	35.1
95% KM (Chebyshev) UCL	44.4		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	16.76	Mean in Log scale	1.2
SD in Original scale	17.4	SD in Log scale	1.27
95% KM (t) UCL (assumes normality)	31.15	95% H-stat (Land) UCL	104.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	37	95% KM (Percentile Bootstrap) UCL	44

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Thallium

General Statistics

Total Number of Observations	28	Number of Distinct Observations	
Number of Detects	4	Number of Non-Detects	20
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	0.1	Minimum Non-Detect	1
Maximum Detect	4	Maximum Non-Detect	1.0
Average Detects	1.401	Percent Non-Detects	[illegible] %
Mean Detects	1.4	SD Detects	1.4014
Median Detects	0.74	CV Detects	1.1
Skewness Detects	1.100	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	1.7[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.44	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.74	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.5	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.74	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.07	95% KM (Bootstrap t) UCL	N/A
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.4	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogov-Smirnoff GOF**	
5% K-S Critical Value	0.405	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.7[illegible]	k star (bias corrected MLE)	0.44
Theta hat (MLE)	5.5	Theta star (bias corrected MLE)	111.7
nu hat (MLE)	[illegible]	nu star (bias corrected)	2.74
MLE Mean (bias corrected)	1.4	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.1[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detect values.

GROS may not be used when kstar of detected data is small such as 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute MLE estimates

Mean	0.0[illegible]	Median	[illegible]
Maximum	4	Median	0.0[illegible]
SD	0.1[illegible]	CV	[illegible]
k hat (MLE)	0.1[illegible]	k star (bias corrected MLE)	0.1[illegible]
Theta hat (MLE)	44.[illegible]	Theta star (bias corrected MLE)	4[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	1.1
		adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (0.05)	[illegible]	adjusted Chi Square Value (0.05)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	N/A

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.74	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.44	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	7.7[illegible]	Mean in Log scale	[illegible]
SD in Original scale	1.5[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	0.44	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	0.411		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.74	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002).

However, simulation results will not cover all real world data sets; in addition, insight from the graphical and numerical goodness of fit results should also be used.

Zinc

General Statistics

Total Number of Observations	24	Number of Distinct Observations	19
Number of Detects	20	Number of Non-Detects	4
Number of Distinct Detects	20	Number of Distinct Non-Detects	1
Minimum Detect	1.8	Minimum Non-Detect	5.0
Maximum Detect	1100	Maximum Non-Detect	5.0
Average of Detects	114	Percent Non-Detects	16.67%
Mean of Detects	120.4	Total of Detects	2408
Median of Detects	56.5	SD of Detects	246.4
Skewness of Detects	3.8	Kurtosis of Detects	14.04
Mean of Logged Detects	4.4	SD of Logged Detects	1.48

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.567	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.173	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	80.22	Standard Error of Mean	25.56
SD	117.7	95% KM (BCA) UCL	127.1
95% KM (t) UCL	125.4	95% KM (Percentile Bootstrap) UCL	124.8
95% KM (z) UCL	122.5	95% KM (Bootstrap t) UCL	137.4
90% KM (Chebyshev) UCL	158.4	95% KM (Chebyshev) UCL	193.8
97.5% KM (Chebyshev) UCL	232.4	99% KM (Chebyshev) UCL	345

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.204	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.784	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.431	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.207	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.104	k star (bias corrected MLE)	0.924
Theta hat (MLE)	109	Theta star (bias corrected MLE)	130.4
nu hat (MLE)	43.9	nu star (bias corrected)	36.94
MLE Mean (bias corrected)	120.4	MLE Sd (bias corrected)	125.9

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.965	nu hat (KM)	46.37
approximate Chi Square Value (46.37, α)	31.47	adjusted Chi Square Value (46.37, β)	31.46
95% Gamma approximate KM UCL (use when n>=50)	137.7	95% Gamma adjusted KM UCL (use when n<50)	144

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and ET

For gamma distributed detected data, BTs and UCLs may be improved by using gamma distribution in KM estimates

Mean	110.1	Median	70.74
Maximum	1100	Minimum	1.8
SD	120.4	Total	2640
k hat (MLE)	0.9	k star (bias corrected MLE)	0.924
Theta hat (MLE)	122.5	Theta star (bias corrected MLE)	119.4
nu hat (MLE)	43.2	nu star (bias corrected)	44.31
MLE Mean (bias corrected)	107.4	MLE Sd (bias corrected)	113.5
		adjusted Level of significance (β)	0.0483
approximate Chi Square Value (44.31, α)	30.4	adjusted Chi Square Value (44.31, β)	29.97
95% Gamma approximate KM UCL (use when n>=50)	124	95% Gamma adjusted KM UCL (use when n<50)	135

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.173	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	114	Mean in Log Scale	4.11
SD in Original Scale	119.2	SD in Log Scale	0.798
95% KM (t) UCL (assumes normality of ROS data)	134.3	95% Percentile Bootstrap UCL	132.5
95% KM (BCA) UCL	135	95% Bootstrap t UCL	142
95% KM (Hall's bootstrap) UCL	147.4		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	115.3	Mean in Log Scale	4.17
SD in Original Scale	119.4	SD in Log Scale	1.101
95% KM (t) UCL (assumes normality)	154.4	95% H-stat UCL	213

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL 124	95% KM (Percentile Bootstrap) UCL 124

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Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Nelson, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Fluoride

General Statistics

Total Number of Observations	2	Number of Distinct Observations	17
Number of Detects	14	Number of Non-Detects	[illegible]
Number of Distinct Detects	14	Number of Distinct Non-Detects	[illegible]
Minimum Detect	1	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Variance Detects	[illegible]	Percent Non-Detects	[illegible]
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Skewness Detects	[illegible]	Kurtosis Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many unique detection limits

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCL and BTSs

For gamma distributed detected data, BTSs and UCLs may be improved by using gamma distribution to impute NDs

Mean	[illegible]	Median	[illegible]
Maximum	[illegible]	Minimum	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		adjusted Level of Significance (0.05)	[illegible]
approximate Chi Square Value (1, alpha)	[illegible]	adjusted Chi Square Value (1, alpha)	[illegible]
95% Gamma approximate UCL (use when n>=50)	[illegible]	95% Gamma adjusted UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% KM (t) UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% KM (z) UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% HW UCL in Log ROS	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM -log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM -log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	[illegible]	Mean in Log scale	[illegible]
SD in Original scale	[illegible]	SD in Log scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-stat UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	[illegible]	95% GROS adjusted Gamma UCL	[illegible]
95% adjusted Gamma KM UCL	[illegible]		

Note: suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar studies summarized in Singh, Nar Nie, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, insight from the graphical and numerical statistics

Nitrate as N

General Statistics

Total Number of Observations	25	Number of Distinct Observations	20
Number of Detects	20	Number of Non-Detects	5
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	5.00	Minimum Non-Detect	1.00
Maximum Detect	41.00	Maximum Non-Detect	1.00
Variance Detects	50.16E+	Percent Non-Detects	20.00%
Mean Detects	14.55	Detects	25.00
Median Detects	7.400	Non-Detects	75.00
Skewness Detects	[illegible]	Kaplan-Meier Detects	14.4
Mean of Logged Detects	2.641	Distinct Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.174	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	11.74	Standard Error of Mean	1.481
SD	14.01	95% KM (BCA) UCL	30.76
95% KM (t) UCL	31.34	95% KM (Percentile Bootstrap) UCL	29.24
95% KM (z) UCL	30.74	95% KM (Bootstrap t) UCL	55.02
90% KM (Chebyshev) UCL	37.12	95% KM (Chebyshev) UCL	43.4
97.5% KM (Chebyshev) UCL	49.13	99% KM (Chebyshev) UCL	59.56

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.724	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.195	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.205	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.724	k star (bias corrected MLE)	0.647
Theta hat (MLE)	19.44	Theta star (bias corrected MLE)	22.05
nu hat (MLE)	29.4	nu star (bias corrected)	25.84
MLE Mean (bias corrected)	14.25	MLE Sd (bias corrected)	17.57

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.7	nu hat (KM)	34.4
approximate Chi Square Value (34, α)	22.4	adjusted Chi Square Value (34, β)	21.1
95% Gamma approximate KM-UCL (use when n>=50)	25.44	95% Gamma adjusted KM-UCL (use when n<50)	24.3

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has only 15% NDs with many tied non-detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield artificially inflated values of UCL and ET's

For gamma distributed detected data, BTA's and UCL may be improved by using gamma distribution to impute NDs

Mean	11.01	Median	11.01
Maximum	41.00	Minimum	1.00
SD	14.01	Variance	196.2
k hat (MLE)	0.45	k star (bias corrected MLE)	0.424
Theta hat (MLE)	24.4	Theta star (bias corrected MLE)	25.94
nu hat (MLE)	22.5	nu star (bias corrected)	21.22
MLE Mean (bias corrected)	11.01	MLE Sd (bias corrected)	17.04
		adjusted Level of significance (β)	0.0[illegible]
approximate Chi Square Value (21.22, α)	12.4[illegible]	adjusted Chi Square Value (21.22, β)	9.444
95% Gamma approximate UCL (use when n>=50)	27.44	95% Gamma adjusted UCL (use when n<50)	24.97

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.11	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.174	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original scale	11.05	Mean in Log scale	2.05
SD in Original scale	14.4	SD in Log scale	1.071
95% UCL (assumes normality of ROS data)	31.7	95% Percentile Bootstrap UCL	29.4
95% BCA Bootstrap UCL	34.41	95% Bootstrap t UCL	[illegible]
95% Hall's bootstrap UCL	50.[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.5	95% H-UCL (KM-Log)	34
KM SD (logged)	1.71	95% Critical H Value (KM-Log)	2
KM Standard Error of Mean (logged)	0.75		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original scale	11.74	Mean in Log scale	0.[illegible]
SD in Original scale	14.07	SD in Log scale	1.414
95% UCL (assumes normality)	31.11	95% H-stat UCL	1.0[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 43.4	95% GROS adjusted Gamma UCL 24.97
95% adjusted Gamma KM UCL 24.3	

Note: suggestions regarding the selection of a 95% UCL are provided to help the user select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results in the similar examples presented in Singh, Maichle, and Lee (2006)

However, simulation results will not cover all Real World data sets; in addition, insight from the graphical analysis and other statistical

APPENDIX B-7
FISH TISSUE - ALL SPECIES

Appendix B-7
ProUCL Output - Fish Tissue - All Species
Smokey Mountain Smelters
Knoxville, Tennessee

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File: all_species_v1
Full Precision: OFF
Confidence Coefficient: 95
Number of Bootstrap Operations: 2000

Chromium

General Statistics

Number of Valid Data	10	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	5
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.26	Minimum Detected	-1.347
Maximum Detected	0.95	Maximum Detected	-0.0513
Mean of Detected	0.51	Mean of Detected	-0.815
SD of Detected	0.298	SD of Detected	0.506
Minimum Non-Detect	0.014	Minimum Non-Detect	-4.204
Maximum Non-Detect	0.12	Maximum Non-Detect	-2.12

Note: Data have a mixture of Detects and Non-Detects - For all methods, use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Large MDLs are treated as ND

Number treated as Non-Detect: 5
Number treated as Detected: 5
Single DL Non-Detect Percentage: 50.00%

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro-Wilk Test Statistic	0.877	Shapiro-Wilk Test Statistic	0.901
5% Shapiro-Wilk Critical Value	0.762	5% Shapiro-Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.242	Mean	-2.07
SD	0.298	SD	1.17
95% DL/2 Student's-t UCL	0.398	95% H-Stat DL/2 UCL	0.702
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0625	Mean in Log Scale	-1.79
SD	0.51	SD in Log Scale	1.051
95% MLE Student's-t UCL	0.[illegible]	Mean in Original Scale	0.254
95% MLE Tiku UCL	0.[illegible]	SD in Original Scale	0.[illegible]
		95% H-UCL	0.404
		95% Percentile Bootstrap UCL	0.406
		95% BCA Bootstrap UCL	0.407
		95% H-UCL	0.674

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k hat (bias corrected)	1.717	**Data appear Normal at 5% Significance Level**
Theta Hat	0.297	
nu hat	17.17	
A-D Test Statistic	0.[illegible]	**Nonparametric Statistics**
5% A-D Critical Value	0.[illegible]	Kaplan-Meier (KM) Method
K-S Test Statistic	0.[illegible]	Mean
5% K-S Critical Value	0.[illegible]	SD
Data appear Gamma Distributed at 5% Significance Level		SE of Mean
		95% KM (t) UCL
Assuming Gamma Distribution		95% KM (z) UCL
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL
Minimum	0.000001	95% KM (bootstrap t) UCL
Maximum	0.95	95% KM (BCA) UCL
Mean	0.[illegible]	95% KM (Percentile Bootstrap) UCL
Median	0.000001	95% KM (Chebyshev) UCL
SD	0.[illegible]	97.5% KM (Chebyshev) UCL
k hat	0.14[illegible]	99% KM (Chebyshev) UCL
Theta hat	1.4[illegible]	
nu hat	[illegible].7	**Potential UCLs to Use**
apo/Ba	0.5[illegible]	95% KM (t) UCL
95% Gamma Approximate UCL (use when n >= 40)	1.4[illegible]	95% KM (Percentile Bootstrap) UCL
95% Adjusted Gamma UCL (use when n < 40)	1.95[illegible]	

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Appendix B-7
ProUCL Output - Fish Tissue - All Species
Smokey Mountain Smelters
Knoxville, Tennessee

Mercury

General Statistics

Number of Valid Data	12	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	7
		Percent Non-Detect	58.33

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	0.29	Maximum Detected	-1.238
Mean of Detected	0.166	Mean of Detected	-1.862
SD of Detected	0.0779	SD of Detected	0.432
Minimum Non-Detect	0.096	Minimum Non-Detect	-2.323
Maximum Non-Detect	0.23	Maximum Non-Detect	-1.47

Note: Data have multiple DL - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods)
Observations < Large ND are treated as ND

Number treated as Non-Detect	11
Number treated as Detected	1
Single DL Non-Detect Percentage	91.67

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro-Wilk Test Statistic	0.876	Shapiro-Wilk Test Statistic	0.926
5% Shapiro-Wilk Critical Value	0.762	5% Shapiro-Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.115	Mean	-2.293
SD	0.0666	SD	0.522
95% DL/2 (t) UCL	0.151	95% H-Stat (DL/2) UCL	0.163
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.25
		SD in Log Scale	0.46
		Mean in Original Scale	0.116
		SD in Original Scale	0.0656
		95% t UCL	0.152
		95% Percentile Bootstrap UCL	0.149
		95% BCA Bootstrap UCL	0.16
		95% H-UCL	0.157

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k-star (bias corrected)	2.753	**Data appear Normal at 5% Significance Level**	
Theta Star	0.061		
nu star	27.53		
A-D Test Statistic	0.361	**Nonparametric Statistics**	
5% A-D Critical Value	0.66	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.66	Mean	0.132
5% K-S Critical Value	0.356	SD	0.0556
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0164
		95% KM (t) UCL	0.165
Assuming Gamma Distribution		95% KM (z) UCL	0.162
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.161
Minimum	0.000001	95% KM (bootstrap) UCL	0.21
Maximum	0.29	95% KM (BCA) UCL	0.206
Mean	0.096	95% KM (Percentile Bootstrap) UCL	0.176
Median	0.076	95% KM (Chebyshev) UCL	0.212
SD	0.0617	97.5% KM (Chebyshev) UCL	0.247
k star	0.322	99% KM (Chebyshev) UCL	0.315
Theta star	0.304		
Nu star	7.732	**Potential UCLs to Use**	
AppChi2	2.561	95% KM (t) UCL	0.165
95% Gamma Approximate UCL (Use when n >= 40)	0.294	95% KM (Percentile Bootstrap) UCL	0.176
95% Adjusted Gamma UCL (Use when n < 40)	0.352		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Appendix B-7
ProUCL Output - Fish Tissue - All Species
Smokey Mountain Smelters
Knoxville, Tennessee

Selenium

General Statistics

Number of Valid Observation [illegible]

Number of Distinct Observation [illegible]

Raw Statistics

Minimum [illegible]

Maximum [illegible]

Mean [illegible]

Geometric Mean [illegible]

Median [illegible]

SD [illegible]

Std. Error of Mean [illegible]

Coefficient of Variation [illegible]

Skewness [illegible]

Log-transformed Statistics

Minimum of Log Data [illegible]

Maximum of Log Data [illegible]

Mean of log Data [illegible]

SD of log Data [illegible]

Relevant UCL Statistics

Normal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro-Wilk Test Statistic [illegible]

Shapiro-Wilk Critical Value [illegible]

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL [illegible]

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) [illegible]

95% Modified-t UCL (Johnson-1978) [illegible]

Assuming Lognormal Distribution

95% H-UCL [illegible]

95% Chebyshev (MVUE) UCL [illegible]

97.5% Chebyshev (MVUE) UCL [illegible]

99% Chebyshev (MVUE) UCL [illegible]

Gamma Distribution Test

k star (bias corrected) [illegible]

Theta Star [illegible]

MLE of Mean [illegible]

MLE of Standard Deviation [illegible]

nu star [illegible]

Approximate Chi Square Value (.05) [illegible]

Adjusted Level of Significance [illegible]

Adjusted Chi Square Value [illegible]

Anderson-Darling Test Statistic [illegible]

Anderson-Darling 5% Critical Value [illegible]

Kolmogorov-Smirnov Test Statistic [illegible]

Kolmogorov-Smirnov 5% Critical Value [illegible]

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n >= 40) [illegible]

95% Adjusted Gamma UCL (use when n < 40) [illegible]

Nonparametric Statistics

95% CLT UCL [illegible]

95% Jackknife UCL [illegible]

95% Standard Bootstrap UCL [illegible]

95% Bootstrap-t UCL [illegible]

95% Hall's Bootstrap UCL [illegible]

95% Percentile Bootstrap UCL [illegible]

95% BCa Bootstrap UCL [illegible]

95% Chebyshev(Mean, Sd) UCL [illegible]

97.5% Chebyshev(Mean, Sd) UCL [illegible]

99% Chebyshev(Mean, Sd) UCL [illegible]

Potential UCL to Use

Use 95% Approximate Gamma UCL [illegible]

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX B-8
SOIL GAS

Appendix B-8
ProUCL Output - Soil Gas
Smokey Mountain Smelters
Knoxville, Tennessee

UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation [illegible]

From File [illegible]

Full Precision OFF

Confidence Coefficient [illegible]%

Number of Bootstrap Operations [illegible]

1,2,4-Trimethylbenzene

General Statistics

Total Number of Observations	[illegible]	Number of Distinct Observations	11
Number of Detects	1	Number of Non-Detects	[illegible]
Number of Distinct Detects	[illegible]	Number of Distinct Non-Detects	[illegible]
Minimum Detect	[illegible]	Minimum Non-Detect	[illegible]
Maximum Detect	[illegible]	Maximum Non-Detect	[illegible]
Average Detects	[illegible]	Percent Non-Detects	[illegible]%
Mean Detects	[illegible]	SD Detects	[illegible]
Median Detects	[illegible]	CV Detects	[illegible]
Kurtosis Detects	[illegible]	Skewness Detects	[illegible]
Mean of Logged Detects	[illegible]	SD of Logged Detects	[illegible]

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	[illegible]	Standard Error of Mean	[illegible]
SD	[illegible]	95% KM (BCA) UCL	[illegible]
95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]
95% KM (z) UCL	[illegible]	95% KM (Bootstrap t) UCL	[illegible]
90% KM (Chebyshev) UCL	[illegible]	95% KM (Chebyshev) UCL	[illegible]
97.5% KM (Chebyshev) UCL	[illegible]	99% KM (Chebyshev) UCL	[illegible]

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	[illegible]	**Anderson-Darling GOF Test**	
5% A-D Critical Value	[illegible]	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	[illegible]	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	[illegible]	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	[illegible]	nu hat (KM)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detect values at multiple DLs

GROS may not be used when kstar of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and ETLs

For gamma distributed detected data, BTSs and BCAs may be computed using gamma distribution on KM estimates

Minimum	[illegible]	Mean	[illegible]
Maximum	[illegible]	Median	[illegible]
SD	[illegible]	CV	[illegible]
k hat (MLE)	[illegible]	k star (bias corrected MLE)	[illegible]
Theta hat (MLE)	[illegible]	Theta star (bias corrected MLE)	[illegible]
nu hat (MLE)	[illegible]	nu star (bias corrected)	[illegible]
MLE Mean (bias corrected)	[illegible]	MLE Sd (bias corrected)	[illegible]
		Adjusted Level of Significance (β)	[illegible]
approximate Chi Square Value (0.05, df)	[illegible]	adjusted Chi Square Value (0.05, df)	[illegible]
95% Gamma approximate KM UCL (use when n>=50)	[illegible]	95% Gamma adjusted KM UCL (use when n<50)	[illegible]

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	[illegible]	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	[illegible]	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	[illegible]	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality of ROS data)	[illegible]	95% Percentile Bootstrap UCL	[illegible]
95% BCA Bootstrap UCL	[illegible]	95% Bootstrap t UCL	[illegible]
95% Hall's Bootstrap UCL	[illegible]		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	[illegible]	95% H-UCL (KM-Log)	[illegible]
KM SD (logged)	[illegible]	95% Critical H Value (KM-Log)	[illegible]
KM Standard Error of Mean (logged)	[illegible]		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	[illegible]	Mean in Log Scale	[illegible]
SD in Original Scale	[illegible]	SD in Log Scale	[illegible]
95% UCL (assumes normality)	[illegible]	95% H-UCL	[illegible]

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	[illegible]	95% KM (Percentile Bootstrap) UCL	[illegible]

Note: Suggestions regarding the selected 95% UCL are provided to help the user select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006).

However, simulation results will not cover all Real World data sets; in addition, relying on the recommended UCL alone may not be adequate in some cases.

Statistics

General Statistics

Total Number of Observations	25	Number of Distinct Observations	14
Number of Detects	4	Number of Distinct Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	1	Minimum Non-Detect	5
Maximum Detect	56	Maximum Non-Detect	300
Variance Detect	218.5	Percent Non-Detects	54.16%
Mean Detect	27	All Detects	14.44
Median Detect	24	All Non-Detects	115.5
Skewness Detect	1.155	Kurtosis Detect	0.741
Mean of Logged Detects	3.2	All Logged Detects	3.04

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	15.4	Standard Error of Mean	3.4
SD	16.5	95% KM (t) UCL	21.1
95% KM (z) UCL	20.1	95% KM (Percentile Bootstrap) UCL	21.3
95% KM (BCA) UCL	20.7	95% KM (Bootstrap t) UCL	22.1
90% KM (Chebyshev) UCL	25.2	95% KM (Chebyshev) UCL	29.7
97.5% KM (Chebyshev) UCL	35	99% KM (Chebyshev) UCL	46.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.245	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.166	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.3	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.444	k star (bias corrected MLE)	3.04
Theta hat (MLE)	6.184	Theta star (bias corrected MLE)	8.9
nu hat (MLE)	355.7	nu star (bias corrected)	243.2
MLE Mean (bias corrected)	27	MLE Sd (bias corrected)	15.44

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	3.304	nu hat (KM)	5.2
approximate Chi Square Value (5, α)	2.01	adjusted Chi Square Value (5, α)	1.45
95% Gamma approximate KM-UCL (use when n>=50)	23	95% Gamma adjusted KM-UCL (use when n<50)	32.4

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied detection limits at multiple DLs

GROS may not be used when kstar of detected data is small such as < 1.0

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.001	Mean	11.77
Maximum	56	Median	4.231
SD	16.71	CV	1.42
k hat (MLE)	0.525	k star (bias corrected MLE)	0.48
Theta hat (MLE)	22.43	Theta star (bias corrected MLE)	24.4
nu hat (MLE)	26.24	nu star (bias corrected)	23.52
MLE Mean (bias corrected)	11.77	MLE Sd (bias corrected)	17.54
		Adjusted Level of Significance (β)	0.0167
Approximate Chi Square Value (0.01, df)	4.517	Adjusted Chi Square Value (0.01, df)	4.21
95% Gamma approximate UCL (use when n>=50)	23.4	95% Gamma adjusted UCL (use when n<50)	31.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.246	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.75	Mean in Log Scale	2.5
Sd in Original Scale	17.1	Sd in Log Scale	1.115
95% UCL (assumes normality of ROS data)	14.4	95% Percentile Bootstrap UCL	14
95% BCA Bootstrap UCL	21.5	95% Bootstrap t UCL	23.16
95% H-UCL (Log ROS)	24.01		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.67	95% H-UCL (KM -Log)	23.4
KM SD (logged)	0.7756	95% Critical H Value (KM-Log)	2.241
KM Standard Error of Mean (logged)	0.134		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	14	Mean in Log Scale	2.47
SD in Original Scale	16.16	SD in Log Scale	1.591
95% UCL (assumes normality)	13.7	95% H-Stat UCL	16.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	21.1	95% KM (Percentile Bootstrap) UCL	21.3

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Engelhardt (1997)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician

Dilutions

General Statistics

Total Number of Observations	22	Number of Distinct Observations	11
Number of Detects	8	Number of Non-Detects	14
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	1.00	Minimum Non-Detect	2.00
Maximum Detect	1.00	Maximum Non-Detect	40.0
Average Detects	1.40	Percent Non-Detects	63.6%
Mean Detects	47.7	SD Detects	4.46
Median Detects	7	IQR Detects	11.41
Skewness Detects	1.76	Kurtosis Detects	1.85
Mean of Logged Detects	0.81	SD of Logged Detects	0.934

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.315	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	14.4	Standard Error of Mean	4.44
SD	21.8	95% KM (BCA) UCL	35.7
95% KM (t) UCL	37.4	95% KM (Percentile Bootstrap) UCL	37
95% KM (z) UCL	37.7	95% KM (Bootstrap t) UCL	41.4
90% KM (Chebyshev) UCL	46.6	95% KM (Chebyshev) UCL	56.1
97.5% KM (Chebyshev) UCL	67.2	99% KM (Chebyshev) UCL	87.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.251	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.1	**Kolmogorov-Smirnoff GOF**	
5% K-S Critical Value	0.2	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.96E	k star (bias corrected MLE)	0.8E
Theta hat (MLE)	2.1	Theta star (bias corrected MLE)	4.7
nu hat (MLE)	31.4	nu star (bias corrected)	13.5
MLE Mean (bias corrected)	47.7	MLE Sd (bias corrected)	4.94

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.42	nu hat (KM)	21.5
approximate Chi Square Value (0.05, df)	11.4	adjusted Chi Square Value (0.05, df)	11.45
95% Gamma approximate KM UCL (use when n>=50)	8.94	95% Gamma adjusted KM UCL (use when n<50)	9.24

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method may yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be overestimated when using gamma distribution on KM estimates

Minimum	0.001	Mean	1.01
Maximum	1.0	Median	0.001
SD	0.8	CV	2.4
k hat (MLE)	0.56E	k star (bias corrected MLE)	0.584
Theta hat (MLE)	4.1	Theta star (bias corrected MLE)	7.34
nu hat (MLE)	5.8	nu star (bias corrected)	6.14
MLE Mean (bias corrected)	1.01	MLE Sd (bias corrected)	2.74
		Adjusted Level of Significance (β)	0.0115
Approximate Chi Square Value (.01, df)	2.26	Adjusted Chi Square Value (.01, df)	2.014
95% Gamma approximate KM UCL (use when n>=50)	4.115	95% Gamma adjusted KM UCL (use when n<50)	4.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.315	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.4	Mean in Log Scale	1.11
SD in Original Scale	24.4	SD in Log Scale	1.14
95% UCL (assumes normality of ROS data)	35.5	95% Percentile Bootstrap UCL	35.5
95% BCA Bootstrap UCL	41.4	95% Bootstrap t UCL	81.4
95% H-UCL (Log ROS)	11.24		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	2.61	95% H-UCL (KM -Log)	25.4
KM SD (logged)	0.81	95% Critical H Value (KM-Log)	2.1
KM Standard Error of Mean (logged)	0.14		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	54.2	Mean in Log Scale	2.46
SD in Original Scale	11.4	SD in Log Scale	1.67
95% UCL (assumes normality)	130.1	95% H-UCL (KM -Log)	1.2E+

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	37.4	95% KM (Percentile Bootstrap) UCL	37

Note: suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL

Recommendations are based upon data size, data distribution, and skewness

These recommendations are based upon the results of the simulation studies summarized in Singh, Maslia, and Lee (2006)

However, simulation results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

APPENDIX C
VAPOR INTRUSION CALCULATIONS

Table C-1
Vapor Intrusion Calculations - On-Site Worker - RME
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71432	Benzene	2.1E+01	2.10E+00	**1.3E-06**	1.6E-02	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	**2.3E-06**	2.8E-03	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**2.5E+00**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**2.3E-05**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**8.1E-04**	**1.2E+01**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	6.5E-07	7.3E-04	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	7.1E-02			7.00E-03	P	
			Total	8.3E-04	1.5E+01					

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	25
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	250
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	8

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table C-2
Vapor Intrusion Calculations - On-Site Worker - CTE
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Commercial	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration	Calculated Indoor Air Concentration	VI Carcinogenic Risk	VI Hazard	Inhalation Unit Risk	IUR Source*	Reference Concentration	RFC Source*	Mutagenic Indicator
		Csg	Cia	CR	HQ	IUR		RfC		
		(ug/m^3)	(ug/m^3)			(ug/m^3)$^{-1}$		(mg/m^3)		i
71432	Benzene	2.1E+01	2.10E+00	1.6E-07	1.9E-03	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	2.7E-07	3.4E-04	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**3.0E-01**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**2.8E-06**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**9.7E-05**	**1.5E+00**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	7.8E-08	8.7E-05	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	8.6E-03			7.00E-03	P	
			Total	1.0E-04	1.8E+00					

Notes:

(1) **Inhalation Pathway Exposure Parameters (CTE):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	25
Exposure duration	(yrs)	ED_R_SG	13	ED_C_SG	12	ED_SG	12
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	125	EF_SG	125
Exposure time	(hr/day)	ET_R_SG	16	ET_C_SG	4	ET_SG	4

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table C-3
Vapor IntrusionCalculations - Residential - RME
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71432	Benzene	2.1E+01	2.10E+00	**5.8E-06**	6.7E-02	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	**9.8E-06**	1.2E-02	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**1.1E+01**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**1.0E-04**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**3.5E-03**	**5.2E+01**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	**2.8E-06**	3.0E-03	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	**3.0E-01**			7.00E-03	P	
			Total	3.6E-03	6.3E+01					

Notes:

(1) **Inhalation Pathway Exposure Parameters (RME):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	26
Exposure duration	(yrs)	ED_R_SG	26	ED_C_SG	25	ED_SG	26
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	250	EF_SG	350
Exposure time	(hr/day)	ET_R_SG	24	ET_C_SG	8	ET_SG	24

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

Table C-4
Vapor Intrusion Calculations - Residential - CTE
Smokey Mountain Smelters
Knoxville, Tennessee

OSWER VAPOR INTRUSION ASSESSMENT
Sub-slab or Exterior Soil Gas Concentration to Indoor Air Concentration (SGC-IAC) Calculator Version 3.3.1, January 2015 RSLs

Parameter	Symbol	Value	Instructions
Exposure Scenario	Scenario	Residential	Select residential or commercial scenario from pull down list
Target Risk for Carcinogens	TCR_SG	1.00E-06	Enter target risk for carcinogens (for comparison to the calculated VI carcinogenic risk in column F)
Target Hazard Quotient for Non-Carcinogens	THQ_SG	0.1	Enter target hazard quotient for non-carcinogens (for comparison to the calculated VI hazard in column G)

CAS	Chemical Name	Site Sub-slab or Exterior Soil Gas Concentration Csg (ug/m^3)	Calculated Indoor Air Concentration Cia (ug/m^3)	VI Carcinogenic Risk CR	VI Hazard HQ	Inhalation Unit Risk IUR (ug/m^3)$^{-1}$	IUR Source*	Reference Concentration RfC (mg/m^3)	RFC Source*	Mutagenic Indicator i
71432	Benzene	2.1E+01	2.10E+00	**2.2E-06**	2.6E-02	7.80E-06	I	3.00E-02	I	
67663	Chloroform	1.2E+01	1.20E+00	**3.8E-06**	4.5E-03	2.30E-05	I	9.80E-02	A	
74873	Chloromethane	1.0E+04	1.00E+03	No IUR	**4.1E+00**			9.00E-02	I	
75343	Dichloroethane, 1,1-	1.8E+03	1.80E+02	**3.9E-05**	No RfC	1.60E-06	CA			
107062	Dichloroethane, 1,2-	3.8E+03	3.80E+02	**1.4E-03**	**2.0E+01**	2.60E-05	I	7.00E-03	P	
100414	Ethylbenzene	3.2E+01	3.18E+00	**1.1E-06**	1.2E-03	2.50E-06	CA	1.00E+00	I	
95636	Trimethylbenzene, 1,2,4-	2.2E+01	2.19E+00	No IUR	**1.2E-01**			7.00E-03	P	
				1.4E-03	2.4E+01					

Notes:

(1) **Inhalation Pathway Exposure Parameters (CTE):**

Exposure Scenario	Units	Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Averaging time for carcinogens	(yrs)	ATc_R_SG	70	ATc_C_SG	70	ATc_SG	70
Averaging time for non-carcinogens	(yrs)	ATnc_R_SG	26	ATnc_C_SG	25	ATnc_SG	26
Exposure duration	(yrs)	ED_R_SG	15	ED_C_SG	12	ED_SG	15
Exposure frequency	(days/yr)	EF_R_SG	350	EF_C_SG	125	EF_SG	350
Exposure time	(hr/day)	ET_R_SG	16	ET_C_SG	4	ET_SG	16

(2) **Generic Attenuation Factors:**

Source Medium of Vapors		Residential Symbol	Residential Value	Commercial Symbol	Commercial Value	Selected (based on scenario) Symbol	Selected (based on scenario) Value
Groundwater	(-)	AFgw_R_SG	0.001	AFgw_C_SG	0.001	AFgw_SG	0.001
Sub-Slab and Exterior Soil Gas	(-)	AFss_R_SG	0.1	AFss_C_SG	0.1	AFss_SG	0.1

(3) **Formulas**

Cia, target = MIN(Cia,c; Cia,nc)
Cia,c (ug/m3) = TCR x ATc x (365 days/yr) x (24 hrs/day) / (ED x EF x ET x IUR)
Cia,nc (ug/m3) = THQ x ATnc x (365 days/yr) x (24 hrs/day) x RfC x (1000 ug/mg) / (ED x EF x ET)

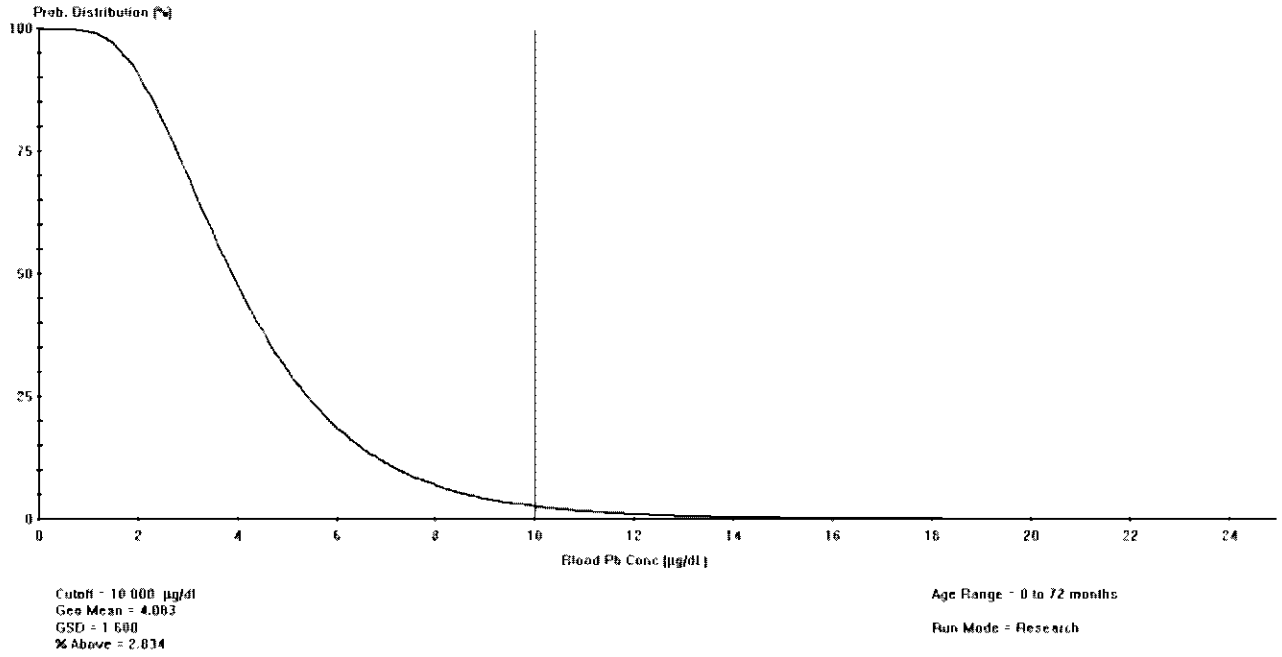
Notation:

I = IRIS: EPA Integrated Risk Information System (IRIS). Available online at: http://www.epa.gov/iris/subst/index.html
P = PPRTV. EPA Provisional Peer Reviewed Toxicity Values (PPRTVs). Available online at: http://hhpprtv.ornl.gov/pprtv.shtml
A = Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs). Available online at: http://www.atsdr.cdc.gov/mrls/index.html
CA = California Environmental Protection Agency/Office of Environmental Health Hazard Assessment assessments. Available online at: http://www.oehha.ca.gov/risk/ChemicalDB/index.asp
H = HEAST. EPA Superfund Health Effects Assessment Summary Tables (HEAST) database. Available online at: http://epa-heast.ornl.gov/heast.shtml
S = See RSL User Guide, Section 5
X = PPRTV Appendix
Mut = Chemical acts according to the mutagenic-mode-of-action, special exposure parameters apply (see footnote (4) above).
VC = Special exposure equation for vinyl chloride applies (see Navigation Guide for equation).
TCE = Special mutagenic and non-mutagenic IURs for trichloroethylene apply (see footnote (4) above).
Yellow highlighting indicates site-specific parameters that may be edited by the user.
Blue highlighting indicates exposure factors that are based on Risk Assessment Guidance for Superfund (RAGS) or EPA vapor intrusion guidance, which generally should not be changed.
Pink highlighting indicates VI carcinogenic risk greater than the target risk for carcinogens (TCR) or VI Hazard greater than or equal to the target hazard quotient for non-carcinogens (THQ).

APPENDIX D
IEUBK LEAD MODEL OUTPUTS

Appendix D
IEUBK Lead Results
Smokey Mountain Smelters
Knoxville, Tennessee

Shallow Groundwater



LEAD MODEL FOR WINDOWS Version 1.1

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Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

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****** Air ******

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors	Ventilation Rate	Lung Absorption	Outdoor Air Pb Conc

	(hours)	(m^3/day)	(%)	(µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100
4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 20.600 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000
2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

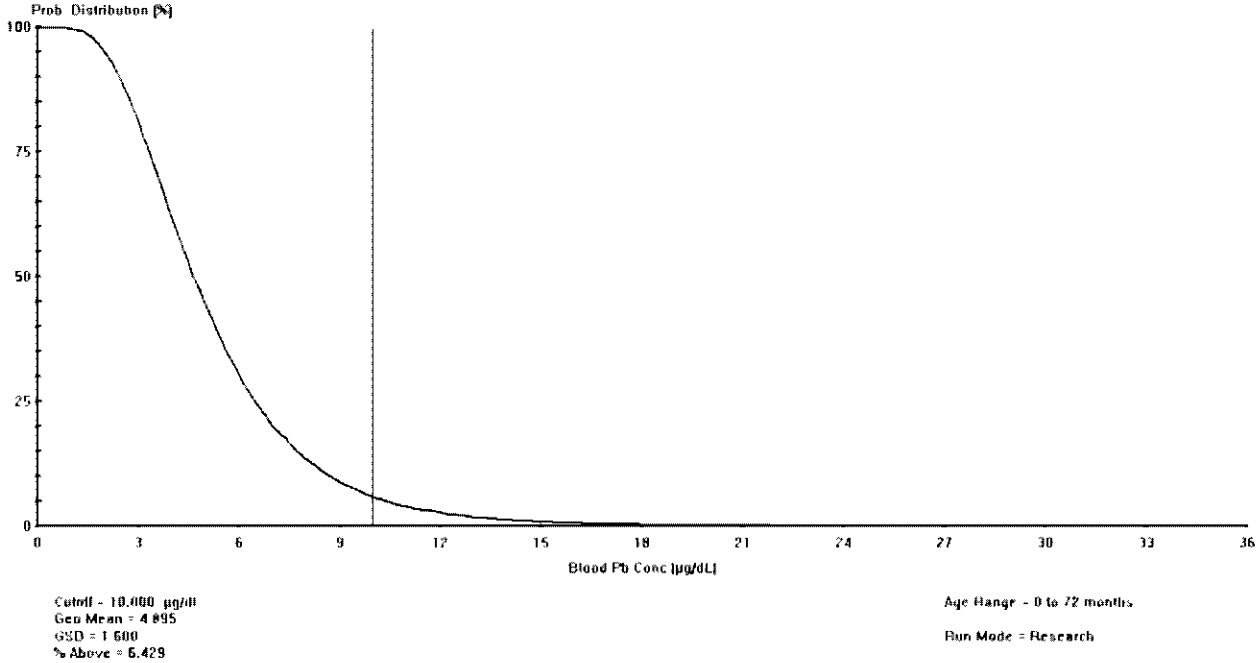
Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.043	0.000	1.901
1-2	0.034	0.883	0.000	4.639
2-3	0.062	0.972	0.000	4.887
3-4	0.067	0.942	0.000	5.042
4-5	0.067	0.917	0.000	5.329
5-6	0.093	0.971	0.000	5.661
6-7	0.093	1.057	0.000	5.785

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.060	7.026	3.8
1-2	6.293	11.850	4.8
2-3	6.374	12.294	4.6
3-4	6.452	12.503	4.4
4-5	4.868	11.181	3.9
5-6	4.414	11.139	3.5
6-7	4.187	11.122	3.2

Deep Groundwater



LEAD MODEL FOR WINDOWS Version 1.1

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Model Version: 1.1 Build11
User Name:
Date:
Site Name:
Operable Unit:
Run Mode: Research

==========

******** Air ********

Indoor Air Pb Concentration: 30.000 percent of outdoor.
Other Air Parameters:

Age	Time Outdoors (hours)	Ventilation Rate (m^3/day)	Lung Absorption (%)	Outdoor Air Pb Conc (µg Pb/m^3)
.5-1	1.000	2.000	32.000	0.100
1-2	2.000	3.000	32.000	0.100
2-3	3.000	5.000	32.000	0.100
3-4	4.000	5.000	32.000	0.100

4-5	4.000	5.000	32.000	0.100
5-6	4.000	7.000	32.000	0.100
6-7	4.000	7.000	32.000	0.100

****** Diet ******

Age	Diet Intake(µg/day)
.5-1	2.260
1-2	1.960
2-3	2.130
3-4	2.040
4-5	1.950
5-6	2.050
6-7	2.220

****** Drinking Water ******

Water Consumption:

Age	Water (L/day)
.5-1	0.200
1-2	0.500
2-3	0.520
3-4	0.530
4-5	0.550
5-6	0.580
6-7	0.590

Drinking Water Concentration: 32.200 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 150.000 µg/g

Mass fraction of outdoor soil to indoor dust conversion factor: 0.700
Outdoor airborne lead to indoor household dust lead concentration: 100.000
Use alternate indoor dust Pb sources? No

Age	Soil (µg Pb/g)	House Dust (µg Pb/g)
.5-1	200.000	150.000
1-2	200.000	150.000
2-3	200.000	150.000
3-4	200.000	150.000
4-5	200.000	150.000
5-6	200.000	150.000
6-7	200.000	150.000

****** Alternate Intake ******

Age	Alternate (µg Pb/day)
.5-1	0.000
1-2	0.000

2-3	0.000
3-4	0.000
4-5	0.000
5-6	0.000
6-7	0.000

****** Maternal Contribution: Infant Model ******

Maternal Blood Concentration: 1.000 µg Pb/dL

****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.031	0.000	2.938
1-2	0.034	0.864	0.000	7.101
2-3	0.062	0.953	0.000	7.495
3-4	0.067	0.926	0.000	7.749
4-5	0.067	0.903	0.000	8.202
5-6	0.093	0.957	0.000	8.719
6-7	0.093	1.042	0.000	8.918

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.014	8.005	4.3
1-2	6.163	14.163	5.7
2-3	6.254	14.765	5.5
3-4	6.345	15.087	5.2
4-5	4.793	13.965	4.7
5-6	4.349	14.119	4.4
6-7	4.130	14.183	4.0

Table E-1R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potentially Ingested	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDI Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD Ref		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
On Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.9E-12	mg/kg-day	1.5E+05	(mg/kg-day)^-1	1.2E-06	2.5E-11	mg/kg-day	7.0E-10	mg/kg-day	0.04
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	3.7E-02	mg/kg-day	1.0E+00	mg/kg-day	0.04
				Arsenic	1.75E+01	mg/kg	3.2E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	4.8E-06	9.0E-06	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Chromium	3.66E+01	mg/kg	1.1E-05	mg/kg-day	5.0E-01	(mg/kg-day)^-1	5.6E-06	3.1E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.05
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	3.2E-04	mg/kg-day	4.0E-02	mg/kg-day	0.008
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	3.3E-02	mg/kg-day	7.0E-01	mg/kg-day	0.05
				Magnesium	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-03	mg/kg-day	2.4E-02	mg/kg-day	0.05
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	5.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.05
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	5.0E-03	mg/kg-day	0.01
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	5.8E-04	mg/kg-day	3.0E-01	mg/kg-day	0.002
			Ingestion Total								1.2E-05					0.3
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-12	mg/kg-day	1.5E+05	(mg/kg-day)^-1	1.4E-07	3.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0004
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.0E+00	mg/kg-day	NA
				Arsenic	1.75E+01	mg/kg	6.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	1.0E-06	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	0.006
				Chromium	3.66E+01	mg/kg	NA	NA	2.0E+01	(mg/kg-day)^-1	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	mg/kg-day	7.0E-04	mg/kg-day	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.1E-06					0.01
	Total On-Site Surface Soil										1.3E-05					0.3
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.2E-13	pg/m3	3.3E+01	(pg/m3)^-1	1.6E-11	1.2E-12	mg/m3	4.0E-08	mg/m3	0.00000003
				Aluminum	4.33E+04	mg/kg	6.3E-04	µg/m3	NA	NA	NA	1.8E-03	mg/m3	5.0E-03	mg/m3	0.0004
				Arsenic	1.75E+01	mg/kg	2.5E-07	µg/m3	4.3E-03	(µg/m3)^-1	1.1E-09	7.1E-07	mg/m3	1.5E-05	mg/m3	0.000005
				Chromium	3.66E+01	mg/kg	5.3E-07	µg/m3	8.4E-02	(µg/m3)^-1	4.5E-08	1.5E-06	mg/m3	1.0E-04	mg/m3	0.000001
				Cobalt	1.73E+01	mg/kg	2.5E-07	µg/m3	9.0E-03	(µg/m3)^-1	2.3E-09	7.0E-07	mg/m3	6.0E-06	mg/m3	0.00001
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.39E+03	mg/kg	NA	NA	NA	NA	NA	5.6E-05	mg/m3	5.0E-05	mg/m3	0.001
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	5.6E-07	µg/m3	NA	µg/m3	NA	1.6E-09	mg/m3	1.0E-04	mg/m3	0.0000016
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								4.8E-08					0.002
	Total On-Site Air										4.8E-08					0.002
Total On-Site Surface Soil											1.3E-05					0.3

Table E-1R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Current Future
Receptor Population: On Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non Cancer Hazard Calculations				
							Intake Exposure Concentration		CDI Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD Ref		
					ulge	Unit	ulge	Unit	ulge	Unit		ulge	Unit	ulge	Unit	Hazard Quotient
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	1.6E-08	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.1E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	3.1E-08	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.2E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	3.4E-08	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.5E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	3.1E-08	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.2E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	2.9E-08	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.1E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.0E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	3.9E-07	8.5E-12	mg/kg-day	7.0E-10	mg/kg-day	0.01
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.01
				Arsenic	1.02E+01	mg/kg	1.9E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	4.7E-06	5.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	2.61E+01	mg/kg	8.0E-06	mg/kg-day	4.2E-02	(mg/kg-day)^-1	4.3E-06	2.4E-05	mg/kg-day	3.0E-03	mg/kg-day	0.008
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.1E-06	mg/kg-day	6.0E-04	mg/kg-day	0.003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	2.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.04
				Magnesium	1.14E+03	mg/kg	NA	NA	NA	NA	NA	9.8E-04	mg/kg-day	1.4E-01	mg/kg-day	0.007
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	9.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.09
			Ingestion Total								9.0E-06					0.2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	8.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	6.2E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.7E-08	mg/kg-day	7.3E+00	(mg/kg-day)^-1	1.2E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.8E-08	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.3E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.7E-08	mg/kg-day	7.3E-02	(mg/kg-day)^-1	1.2E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.6E-08	mg/kg-day	7.3E-03	(mg/kg-day)^-1	1.2E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.6E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	4.9E-08	1.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	3.9E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	5.8E-07	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.004
				Chromium	2.61E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								7.7E-07					0.005
	Total Flenniken Branch Surface Soil										1.0E-05					0.2

Table E-1R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Equation/Calculation		CF Unit Risk		Cancer Risk	Intake Equation/Calculation		RfD/RfC		
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	Hazard Quotient
	Air	Fugitive Emissions	Inhalation	Benzo[a]anthracene	5.10E-02	mg/kg	7.4E-10	µg/m^3	1.1E-04	(µg/m^3)^-1	8.1E-14	NA	NA	NA	NA	NA
				Benzo[a]pyrene	1.00E-01	mg/kg	1.5E-09	µg/m^3	1.1E-03	(µg/m^3)^-1	1.6E-12	NA	NA	NA	NA	NA
				Benzo[b]fluoranthene	1.10E-01	mg/kg	1.6E-09	µg/m^3	1.1E-04	(µg/m^3)^-1	1.8E-13	NA	NA	NA	NA	NA
				Benzo[k]fluoranthene	1.00E-01	mg/kg	1.5E-09	µg/m^3	1.1E-04	(µg/m^3)^-1	1.6E-13	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.4E-09	µg/m^3	1.1E-05	(µg/m^3)^-1	1.5E-14	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.4E-13	µg/m^3	3.8E+01	(µg/m^3)^-1	5.5E-12	4.0E-16	mg/m^3	4.0E-08	mg/m^3	0.000000001
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	5.6E-07	mg/m^3	5.0E-03	mg/m^3	0.00001
				Arsenic	1.02E+01	mg/kg	1.5E-07	µg/m^3	4.3E-03	(µg/m^3)^-1	6.4E-10	4.1E-10	mg/m^3	1.5E-05	mg/m^3	0.000003
				Chromium	2.81E+01	mg/kg	4.0E-07	µg/m^3	8.4E-02	(µg/m^3)^-1	3.4E-08	1.1E-09	mg/m^3	1.0E-04	mg/m^3	0.000001
				Cobalt	1.22E+01	mg/kg	1.8E-07	µg/m^3	9.0E-03	(µg/m^3)^-1	1.6E-09	4.9E-10	mg/m^3	6.0E-06	mg/m^3	0.000083
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	9.7E-11	mg/m^3	8.0E-04	mg/m^3	0.00000001
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	4.6E-08	mg/m^3	5.0E-05	mg/m^3	0.00009
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.0E-08					0.001
	Total Fugitive Emissions in Air										3.0E-08					0.001
Total Fugitive Emissions in Ambient Air											1.0E-05					0.2

Table E-2R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Current Future
Receptor Population: On Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	1.4E-07	6.2E-12	mg/kg-day	7.0E-10	mg/kg-day	0.009
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	9.2E-03	mg/kg-day	1.0E+00	mg/kg-day	0.009
				Arsenic	1.75E+01	mg/kg	3.8E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	5.8E-07	2.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	3.66E+01	mg/kg	1.3E-06	mg/kg-day	5.0E-01	(mg/kg-day)^-1	6.7E-07	7.8E-06	mg/kg-day	3.0E-03	mg/kg-day	0.003
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	3.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	8.0E-05	mg/kg-day	4.0E-02	mg/kg-day	0.002
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	8.2E-03	mg/kg-day	7.0E-01	mg/kg-day	0.01
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	2.4E-02	mg/kg-day	0.01
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/kg-day	1.0E-05	mg/kg-day	0.01
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	8.4E-06	mg/kg-day	5.0E-03	mg/kg-day	0.002
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	1.4E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0005
			Ingestion Total								1.4E-06					0.06
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.4E-14	mg/kg-day	1.3E+05	(mg/kg-day)^-1	5.8E-09	2.6E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00004
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	2.7E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	4.0E-06	1.6E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0005
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								4.6E-06					0.00009
	Total On Site Surface Soil										1.4E-06					0.06
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.1E-14	pg/m^3	3.3E+01	(pg/m^3)^-1	1.9E-12	2.9E-13	mg/m^3	4.0E-08	mg/m^3	0.000000007
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-04	mg/m^3	5.0E-03	mg/m^3	0.00009
				Arsenic	1.75E+01	mg/kg	3.0E-06	pg/m^3	4.3E-03	(pg/m^3)^-1	1.3E-10	1.8E-07	mg/m^3	1.5E-05	mg/m^3	0.000001
				Chromium	3.66E+01	mg/kg	6.4E-06	pg/m^3	8.4E-02	(pg/m^3)^-1	5.4E-09	3.7E-07	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Cobalt	1.73E+01	mg/kg	3.0E-06	pg/m^3	9.0E-03	(pg/m^3)^-1	2.7E-10	1.8E-07	mg/m^3	6.0E-06	mg/m^3	0.000003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.4E-05	mg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.0E-10	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								5.8E-09					0.00004
	Total On Site Air										5.8E-09					0.00004
Total On Site Surface Soil											1.4E-06					0.06

Table E-2R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Weighted Average
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	1.9E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	3.7E-09	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.7E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.9E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	3.7E-09	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.7E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	3.5E-09	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.6E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.6E-13	mg/kg-day	1.3E+05	(mg/kg-day)^-1	4.7E-08	2.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	3.0E-03	mg/kg-day	1.0E+00	mg/kg-day	0.003
				Arsenic	1.02E+01	mg/kg	3.7E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	5.6E-07	2.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	2.31E+01	mg/kg	1.0E-06	mg/kg-day	5.0E-01	(mg/kg-day)^-1	5.1E-07	6.0E-06	mg/kg-day	3.0E-03	mg/kg-day	0.002
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	2.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.1E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0009
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	6.5E-03	mg/kg-day	7.0E-01	mg/kg-day	0.009
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-04	mg/kg-day	1.4E-01	mg/kg-day	0.002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.02
			Ingestion Total								1.2E-06					0.06
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	3.4E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.5E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	6.6E-10	mg/kg-day	7.3E+00	(mg/kg-day)^-1	4.8E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	7.3E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	5.3E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	6.6E-10	mg/kg-day	7.3E-02	(mg/kg-day)^-1	4.8E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	6.4E-10	mg/kg-day	7.3E-03	(mg/kg-day)^-1	4.6E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.5E-14	mg/kg-day	1.3E+05	(mg/kg-day)^-1	2.0E-09	8.8E-14	mg/kg-day	7.0E-10	mg/kg-day	0.00001
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	1.6E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	2.3E-06	4.4E-06	mg/kg-day	3.0E-04	mg/kg-day	0.00001
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.1E-08					0.00003
	Total Flenniken Branch Surface Soil										1.2E-06					0.06

Table E-2R
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	8.9E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	9.8E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.7E-10	µg/m^3	1.1E-03	(µg/m^3)^-1	1.9E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.9E-10	µg/m^3	1.1E-04	(µg/m^3)^-1	2.1E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.7E-10	µg/m^3	1.1E-04	(µg/m^3)^-1	1.9E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.7E-10	µg/m^3	1.1E-05	(µg/m^3)^-1	1.8E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.7E-14	µg/m^3	3.8E+01	(µg/m^3)^-1	6.6E-13	1.0E-16	mg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.4E-07	mg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.02E+01	mg/kg	1.8E-08	µg/m^3	4.3E-03	(µg/m^3)^-1	7.6E-11	1.0E-10	mg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	2.81E+01	mg/kg	4.9E-08	µg/m^3	8.4E-02	(µg/m^3)^-1	4.1E-09	2.8E-10	mg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.22E+01	mg/kg	2.1E-08	µg/m^3	9.0E-03	(µg/m^3)^-1	1.9E-10	1.2E-10	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.4E-11	mg/m^3	8.0E-04	mg/m^3	0.00000003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-08	mg/m^3	5.0E-05	mg/m^3	0.0002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								4.3E-09					0.0003
	Total Flenniken Branch Air										4.3E-09					0.0003
Total Flenniken Branch Surface Soil											1.2E-06					0.06

Table E-3
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	1.3E-05	(mg/kg-day)	NA	--	NA	3.6E-05	(mg/kg-day)	NA	--	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	3.9E-05	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	1.2E-05	1.1E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.054
				4,4'-DDD	3.20E-02	µg/L	2.4E-07	(mg/kg-day)	2.4E-01	(mg/kg-day)^-1	5.9E-08	6.8E-07	(mg/kg-day)	NA	--	NA
				Benzene	1.12E+00	µg/L	8.5E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	4.7E-07	2.4E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0060
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	1.8E-04	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	2.5E-06	4.9E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.025
				Bromodichloromethane	3.20E-01	µg/L	2.4E-06	(mg/kg-day)	6.2E-02	(mg/kg-day)^-1	1.5E-07	6.8E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00034
				Bromomethane	1.45E+00	µg/L	1.1E-05	(mg/kg-day)	NA	--	NA	3.1E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.022
				Chloroform	9.10E+00	µg/L	7.0E-05	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	2.2E-06	1.9E-04	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.019
				Dibenzofuran	1.60E+00	µg/L	1.2E-05	(mg/kg-day)	NA	--	NA	3.4E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.034
				Dieldrin	3.40E-02	µg/L	2.6E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	4.2E-06	7.3E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.015
				Ethylbenzene	1.90E+00	µg/L	1.5E-05	(mg/kg-day)	1.1E-02	(mg/kg-day)^-1	1.6E-07	4.1E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00041
				Naphthalene	3.14E+00	µg/L	2.4E-05	(mg/kg-day)	NA	--	NA	6.7E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0034
				Pentachlorophenol	3.01E+00	µg/L	2.3E-05	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	9.2E-06	6.4E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.013
				Phenol	1.57E+02	µg/L	1.2E-03	(mg/kg-day)	NA	--	NA	3.4E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.011
				Tetrachloroethene	5.89E+00	µg/L	4.5E-05	(mg/kg-day)	2.1E-03	(mg/kg-day)^-1	9.5E-08	1.3E-04	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.021
				Trichloroethene	1.99E+00	µg/L	1.5E-05	(mg/kg-day)	4.6E-02	(mg/kg-day)^-1	7.0E-07	4.3E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.085
				1,1-Dichloroethylene	8.94E+00	µg/L	6.8E-05	(mg/kg-day)	NA	--	NA	1.9E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.0010
				Aluminum	5.62E+04	µg/L	4.3E-01	(mg/kg-day)	NA	--	NA	1.2E+00	(mg/kg-day)	1.0E+00	(mg/kg-day)	1.2
				Antimony	7.94E+00	µg/L	6.1E-05	(mg/kg-day)	NA	--	NA	1.7E-04	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.42
				Arsenic	1.40E+01	µg/L	1.1E-04	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.6E-04	3.0E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.0
				Barium	1.03E+01	µg/L	7.9E-05	(mg/kg-day)	NA	--	NA	2.2E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.11
				Cadmium	2.34E+00	µg/L	1.8E-05	(mg/kg-day)	NA	--	NA	5.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0
				Chromium	3.14E+01	µg/L	2.4E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.2E-04	6.7E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.22
				Cobalt	1.14E+03	µg/L	8.7E-03	(mg/kg-day)	NA	--	NA	2.4E-02	(mg/kg-day)	3.0E-04	(mg/kg-day)	82
				Copper	2.80E+02	µg/L	2.1E-03	(mg/kg-day)	NA	--	NA	6.0E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.15
				Cyanide	1.07E+01	µg/L	8.2E-05	(mg/kg-day)	NA	--	NA	2.3E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.4
				Iron	2.54E+03	µg/L	1.9E-02	(mg/kg-day)	NA	--	NA	5.4E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.08
				Lead	1.49E+01	µg/L	1.1E-04	(mg/kg-day)	NA	--	NA	3.2E-04	(mg/kg-day)	NA	--	NA
				Manganese	6.91E+04	µg/L	5.3E-01	(mg/kg-day)	NA	--	NA	1.5E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	62
				Mercury	6.99E+00	µg/L	5.3E-05	(mg/kg-day)	NA	--	NA	1.5E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.50
				Molybdenum	1.20E+02	µg/L	9.2E-04	(mg/kg-day)	NA	--	NA	2.6E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.51
				Nickel	7.56E+02	µg/L	5.8E-03	(mg/kg-day)	NA	--	NA	1.6E-02	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.81
				Selenium	1.75E+01	µg/L	1.3E-04	(mg/kg-day)	NA	--	NA	3.7E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.075
				Strontium	1.80E+03	µg/L	1.4E-02	(mg/kg-day)	NA	--	NA	3.9E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.064
				Thallium	2.27E+01	µg/L	1.7E-04	(mg/kg-day)	NA	--	NA	4.9E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	49
				Vanadium	2.30E+01	µg/L	1.8E-04	(mg/kg-day)	NA	--	NA	4.9E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.098
				Zinc	2.33E+04	µg/L	1.8E-01	(mg/kg-day)	NA	--	NA	5.0E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.7
			Ingestion Total								3.1E-04					199
Total Shallow Groundwater											3.1E-04					199

Table E-3
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	9.2E-06	mg/kg-day	9.1E-02	(mg/kg-day)-1	8.3E-07	2.6E-05	mg/kg-day	6.0E-03	mg/kg-day	0.0043
				2,4-Dinitrotoluene	1.29E+01	µg/L	9.8E-05	mg/kg-day	3.1E-01	(mg/kg-day)-1	3.0E-05	2.8E-04	mg/kg-day	2.0E-03	mg/kg-day	0.14
				2,6-Dinitrotoluene	4.66E+00	µg/L	3.6E-05	mg/kg-day	1.5E+00	(mg/kg-day)-1	5.3E-05	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.33
				Benzene	8.61E-01	µg/L	6.6E-06	mg/kg-day	5.5E-02	(mg/kg-day)-1	3.6E-07	1.8E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0046
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	5.1E-04	mg/kg-day	1.4E-02	(mg/kg-day)-1	7.2E-06	1.4E-03	mg/kg-day	2.0E-02	mg/kg-day	0.072
				Bromomethane	2.90E+00	µg/L	2.2E-05	mg/kg-day	NA	--	NA	6.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.044
				Chloroform	2.02E+00	µg/L	1.5E-05	mg/kg-day	3.1E-02	(mg/kg-day)-1	4.8E-07	4.3E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0043
				Dieldrin	3.50E-02	µg/L	2.7E-07	mg/kg-day	1.6E+01	(mg/kg-day)-1	4.3E-06	7.5E-07	mg/kg-day	5.0E-05	mg/kg-day	0.0150
				Heptachlor epoxide	5.40E-02	µg/L	4.1E-07	mg/kg-day	9.1E+00	(mg/kg-day)-1	3.8E-06	1.2E-06	mg/kg-day	1.3E-05	mg/kg-day	0.089
				Naphthalene	1.66E+00	µg/L	1.2E-05	mg/kg-day	NA	--	NA	3.4E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0017
				Pentachlorophenol	2.50E+00	µg/L	1.9E-05	mg/kg-day	4.0E-01	(mg/kg-day)-1	7.6E-06	5.4E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0107
				Tetrachloroethene	5.80E-01	µg/L	4.4E-06	mg/kg-day	4.6E-02	(mg/kg-day)-1	2.0E-07	1.2E-05	mg/kg-day	5.0E-04	mg/kg-day	0.025
				Aluminum	3.86E+03	µg/L	3.0E-02	mg/kg-day	NA	--	NA	8.3E-02	mg/kg-day	1.0E+00	mg/kg-day	0.083
				Arsenic	6.67E+00	µg/L	5.1E-05	mg/kg-day	1.5E+00	(mg/kg-day)-1	7.7E-05	1.4E-04	mg/kg-day	3.0E-04	mg/kg-day	0.48
				Barium	4.80E+00	µg/L	3.7E-05	mg/kg-day	NA	--	NA	1.0E-04	mg/kg-day	2.0E-03	mg/kg-day	0.051
				Cadmium	2.75E+00	µg/L	2.1E-05	mg/kg-day	NA	--	NA	5.9E-05	mg/kg-day	5.0E-04	mg/kg-day	0.12
				Chromium	2.11E+01	µg/L	1.6E-04	mg/kg-day	5.0E-01	(mg/kg-day)-1	8.1E-05	4.5E-04	mg/kg-day	3.0E-03	mg/kg-day	0.15
				Cobalt	1.52E+01	µg/L	1.2E-04	mg/kg-day	NA	--	NA	3.2E-04	mg/kg-day	3.0E-04	mg/kg-day	1.1
				Copper	3.48E+01	µg/L	2.7E-04	mg/kg-day	NA	--	NA	7.4E-04	mg/kg-day	4.0E-02	mg/kg-day	0.019
				Cyanide	1.10E+01	µg/L	8.4E-05	mg/kg-day	NA	--	NA	2.4E-04	mg/kg-day	6.0E-04	mg/kg-day	0.39
				Iron	1.25E+04	µg/L	9.6E-02	mg/kg-day	NA	--	NA	2.7E-01	mg/kg-day	7.0E-01	mg/kg-day	0.38
				Lead	4.66E+00	µg/L	3.6E-05	mg/kg-day	NA	--	NA	1.0E-04	mg/kg-day	NA	--	NA
				Magnesium	1.00E+05	µg/L	7.7E-01	mg/kg-day	NA	--	NA	2.1E+00	mg/kg-day	2.4E-02	mg/kg-day	90
				Mercury	1.54E-01	µg/L	1.2E-06	mg/kg-day	NA	--	NA	3.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.011
				Molybdenum	2.00E+02	µg/L	1.5E-03	mg/kg-day	NA	--	NA	4.3E-03	mg/kg-day	5.0E-03	mg/kg-day	0.86
				Nickel	4.83E+01	µg/L	3.7E-04	mg/kg-day	NA	--	NA	1.0E-03	mg/kg-day	2.0E-02	mg/kg-day	0.052
				Selenium	3.44E+01	µg/L	2.6E-04	mg/kg-day	NA	--	NA	7.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.15
				Strontium	8.60E+03	µg/L	6.6E-02	mg/kg-day	NA	--	NA	1.8E-01	mg/kg-day	6.0E-01	mg/kg-day	0.307
				Thallium	1.74E+01	µg/L	1.3E-04	mg/kg-day	NA	--	NA	3.7E-04	mg/kg-day	1.0E-05	mg/kg-day	37
				Vanadium	2.80E+01	µg/L	2.1E-04	mg/kg-day	NA	--	NA	6.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.12
				Zinc	1.24E+02	µg/L	9.5E-04	mg/kg-day	NA	--	NA	2.7E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0088
			Ingestion Total								2.7E-04					132
Total Deep Groundwater											2.7E-04					132

Table E-4
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	1.6E-06	(mg/kg-day)	NA	--	NA	9.1E-06	(mg/kg-day)	NA	--	NA
				2,4-Dinitrotoluene	5.00E+00	µg/L	4.6E-06	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	1.4E-06	2.7E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.014
				4,4'-DDD	3.20E-02	µg/L	2.9E-08	(mg/kg-day)	2.4E-01	(mg/kg-day)^-1	7.0E-09	1.7E-07	(mg/kg-day)	NA	--	NA
				Benzene	1.12E+00	µg/L	1.0E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	5.6E-08	6.0E-06	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0015
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	2.1E-05	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	3.0E-07	1.2E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00062
				Bromodichloromethane	3.20E-01	µg/L	2.9E-07	(mg/kg-day)	6.2E-02	(mg/kg-day)^-1	1.8E-08	1.7E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.000086
				Bromomethane	1.45E+00	µg/L	1.3E-06	(mg/kg-day)	NA	--	NA	7.8E-06	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.0055
				Chloroform	9.10E+00	µg/L	8.3E-06	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	2.6E-07	4.9E-05	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.0049
				Dichlorodifluoromethane	1.60E+00	µg/L	1.5E-06	(mg/kg-day)	NA	--	NA	8.6E-06	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.0086
				Dieldrin	3.40E-02	µg/L	3.1E-08	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	5.0E-07	1.8E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.0036
				Ethylbenzene	1.93E+00	µg/L	1.8E-06	(mg/kg-day)	1.1E-02	(mg/kg-day)^-1	1.9E-08	1.0E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00010
				Naphthalene	3.14E+00	µg/L	2.9E-06	(mg/kg-day)	NA	--	NA	1.7E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00084
				Pentachlorophenol	3.01E+00	µg/L	2.8E-06	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	1.1E-06	1.6E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.0032
				Phenol	1.57E+02	µg/L	1.4E-04	(mg/kg-day)	NA	--	NA	8.4E-04	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.0028
				Tetrachloroethene	5.82E+00	µg/L	5.4E-06	(mg/kg-day)	2.1E-03	(mg/kg-day)^-1	1.1E-08	3.2E-05	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.0053
				Trichloroethene	1.99E+00	µg/L	1.8E-06	(mg/kg-day)	4.6E-02	(mg/kg-day)^-1	8.4E-08	1.1E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.021
				1,2,3-trichloropropane	8.94E+00	µg/L	8.2E-06	(mg/kg-day)	NA	--	NA	4.8E-05	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.00024
				Aluminum	5.62E+04	µg/L	5.2E-02	(mg/kg-day)	NA	--	NA	3.0E-01	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.30
				Antimony	7.94E+00	µg/L	7.3E-06	(mg/kg-day)	NA	--	NA	4.2E-05	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.11
				Arsenic	1.40E+01	µg/L	1.3E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.9E-05	7.5E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.25
				Barium	1.03E+01	µg/L	9.5E-06	(mg/kg-day)	NA	--	NA	5.5E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.028
				Cadmium	2.34E+00	µg/L	2.1E-06	(mg/kg-day)	NA	--	NA	1.2E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.025
				Chromium	3.14E+01	µg/L	2.9E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.4E-05	1.7E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.056
				Cobalt	1.14E+03	µg/L	1.0E-03	(mg/kg-day)	NA	--	NA	6.1E-03	(mg/kg-day)	3.0E-04	(mg/kg-day)	20
				Copper	2.60E+02	µg/L	2.6E-04	(mg/kg-day)	NA	--	NA	1.5E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.037
				Cyanide	1.07E+01	µg/L	9.8E-06	(mg/kg-day)	NA	--	NA	5.7E-05	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.095
				Iron	2.54E+03	µg/L	2.3E-03	(mg/kg-day)	NA	--	NA	1.4E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.019
				Lead	1.49E+01	µg/L	1.4E-05	(mg/kg-day)	NA	--	NA	8.0E-05	(mg/kg-day)	NA	--	NA
				Manganese	6.91E+04	µg/L	6.3E-02	(mg/kg-day)	NA	--	NA	3.7E-01	(mg/kg-day)	2.4E-02	(mg/kg-day)	15
				Mercury	6.99E+00	µg/L	6.4E-06	(mg/kg-day)	NA	--	NA	3.7E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Molybdenum	1.20E+02	µg/L	1.1E-04	(mg/kg-day)	NA	--	NA	6.4E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.13
				Nickel	7.56E+02	µg/L	6.9E-04	(mg/kg-day)	NA	--	NA	4.0E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.202
				Selenium	1.75E+01	µg/L	1.6E-05	(mg/kg-day)	NA	--	NA	9.3E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.019
				Strontium	1.80E+03	µg/L	1.7E-03	(mg/kg-day)	NA	--	NA	9.6E-03	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.016
				Thallium	2.27E+01	µg/L	2.1E-05	(mg/kg-day)	NA	--	NA	1.2E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	12
				Vanadium	2.30E+01	µg/L	2.1E-05	(mg/kg-day)	NA	--	NA	1.2E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.025
				Zinc	2.33E+04	µg/L	2.1E-02	(mg/kg-day)	NA	--	NA	1.2E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.42
			Ingestion Total								3.7E-05					50
Total Shallow Groundwater											3.7E-05					50

Table E-4
Calculation of COPC Cancer Risks and Noncancer Hazards -On-Site Worker - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					size	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							size	Unit	size	Unit		size	Unit	size	Unit	
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	1.1E-06	(mg/kg-day)	9.1E-02	(mg/kg-day)^-1	1.0E-07	6.4E-06	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.00107
				2,4-Dinitrotoluene	1.29E+01	µg/L	1.2E-05	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	3.7E-06	6.9E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.034
				2,6-Dinitrotoluene	4.66E+00	µg/L	4.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	6.4E-06	2.5E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.083
				Benzene	8.61E-01	µg/L	7.9E-07	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	4.3E-08	4.6E-06	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0012
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	6.1E-05	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	8.6E-07	3.6E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.018
				Bromomethane	2.90E+00	µg/L	2.7E-06	(mg/kg-day)	NA	--	NA	1.6E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.011
				Chloroform	2.02E+00	µg/L	1.8E-06	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	5.7E-08	1.1E-05	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.0011
				Dieldrin	3.50E-02	µg/L	3.2E-08	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	5.1E-07	1.9E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.0037
				Heptachlor epoxide	5.40E-02	µg/L	5.0E-08	(mg/kg-day)	9.1E+00	(mg/kg-day)^-1	4.5E-07	2.9E-07	(mg/kg-day)	1.3E-05	(mg/kg-day)	0.022
				Naphthalene	1.60E+00	µg/L	1.5E-06	(mg/kg-day)	NA	--	NA	8.6E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.000043
				Pentachlorophenol	2.50E+00	µg/L	2.3E-06	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	9.2E-07	1.3E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.0027
				Tetrachloroethene	5.80E-01	µg/L	5.3E-07	(mg/kg-day)	4.6E-02	(mg/kg-day)^-1	2.4E-08	3.1E-06	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.0062
				Aluminum	3.86E+03	µg/L	3.5E-03	(mg/kg-day)	NA	--	NA	2.1E-02	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.021
				Arsenic	6.67E+00	µg/L	6.1E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	9.2E-06	3.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Barium	4.80E+00	µg/L	4.4E-06	(mg/kg-day)	NA	--	NA	2.6E-05	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.013
				Cadmium	2.75E+00	µg/L	2.5E-06	(mg/kg-day)	NA	--	NA	1.5E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.029
				Chromium	2.11E+01	µg/L	1.9E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	9.7E-06	1.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.038
				Cobalt	1.52E+01	µg/L	1.4E-05	(mg/kg-day)	NA	--	NA	8.1E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.27
				Copper	3.48E+01	µg/L	3.2E-05	(mg/kg-day)	NA	--	NA	1.9E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.0047
				Cyanide	1.10E+01	µg/L	1.0E-05	(mg/kg-day)	NA	--	NA	5.9E-05	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.098
				Iron	1.25E+04	µg/L	1.2E-02	(mg/kg-day)	NA	--	NA	6.7E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.096
				Lead	4.66E+00	µg/L	4.3E-06	(mg/kg-day)	NA	--	NA	2.5E-05	(mg/kg-day)	NA	--	NA
				Magnesium	1.00E+05	µg/L	9.2E-02	(mg/kg-day)	NA	--	NA	5.4E-01	(mg/kg-day)	2.4E-02	(mg/kg-day)	22
				Mercury	1.54E-01	µg/L	1.4E-07	(mg/kg-day)	NA	--	NA	8.2E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.003
				Molybdenum	2.00E+02	µg/L	1.8E-04	(mg/kg-day)	NA	--	NA	1.1E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.21
				Nickel	4.83E+01	µg/L	4.4E-05	(mg/kg-day)	NA	--	NA	2.6E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.013
				Selenium	3.44E+01	µg/L	3.2E-05	(mg/kg-day)	NA	--	NA	1.8E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.037
				Strontium	8.60E+03	µg/L	7.9E-03	(mg/kg-day)	NA	--	NA	4.6E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.077
				Thallium	1.74E+01	µg/L	1.6E-05	(mg/kg-day)	NA	--	NA	9.3E-05	(mg/kg-day)	1.0E-05	(mg/kg-day)	9.3
				Vanadium	2.80E+01	µg/L	2.6E-05	(mg/kg-day)	NA	--	NA	1.5E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.030
				Zinc	1.24E+02	µg/L	1.1E-04	(mg/kg-day)	NA	--	NA	6.6E-04	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.0022
			Ingestion Total								3.2E-05					33
Total Deep Groundwater											3.2E-05					33

Table E-5
Calculation of COPC Cancer Risks and Noncancer Hazards - On-Site Worker - Soil Gas Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					slope	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Units	slope	Units		slope	Units	slope	Units	
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	µg/m	See "1" Calculations: Table C-1				2.3E-05	See "1" Calculations: Table C-1				---
				1,2,4-Trimethylbenzene	2.19E+00	µg/m					---					0.071
				1,2-Dichloroethane	3.80E+02	µg/m					8.1E-04					12
				Benzene	2.10E+00	µg/m					1.3E-06					0.016
				Chloroform	1.20E+00	µg/m					2.3E-06					0.0028
				Chloromethane	1.00E+03	µg/m					---					2.5
				Ethylbenzene	3.18E+00	µg/m					6.5E-07					0.00073
			Inhalation Total								8.3E-04					15
Total Site Indoor Air											8.3E-04					15

Table E-6
Calculation of COPC Cancer Risks and Noncancer Hazards - On-SiteWorker - Soil Gas Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					slope	Unit	Intake-Exposure Concentration		CSF-Unit Risk		Cancer Risk	Intake-Exposure Concentration		RfD-RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	µg/m	See 1-Calculations Table C-2				2.8E-06	See 1-Calculations Table C-2				...
				1,2,4-Trimethylbenzene	2.19E+00	µg/m					...					0.0036
				1,2-Dichloroethane	3.80E+02	µg/m					9.7E-05					1.5
				Benzene	2.10E+00	µg/m					1.6E-07					0.0019
				Chloroform	1.20E+00	µg/m					2.7E-07					0.00034
				Chloromethane	1.00E+03	µg/m					...					0.30
				Ethylbenzene	3.18E+00	µg/m					7.8E-08					0.000087
			Inhalation Total								1.0E-04					1.8
Total Site Indoor Air											1.0E-04					1.8

Table E-7R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * Slope Factor
Reference Dose = Intake / RfD
Reference Conc = Intake * Unit Risk

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potentially Ingested	EPC Value	EPC Unit	Cancer Risk Calculation Intake/Exposure Concentration Value	Intake/Exposure Concentration Unit	CSF/Unit Risk Value	CSF/Unit Risk Unit	Cancer Risk	Non-Cancer Hazard Calculation Intake/Exposure Concentration Value	Intake/Exposure Concentration Unit	RfD/RfC Value	RfD/RfC Unit	Hazard Quotient
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	3E-12	mg/kg-day	1.3E+05	mg/kg-day-1	3.4E-07	1.3E-11	mg/kg-day	7.0E-10	mg/kg-day	0.03
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.7E-02	mg/kg-day	1.0E+00	mg/kg-day	0.03
				Arsenic	1.75E+01	mg/kg	2E-07	mg/kg-day	1.5E+00	mg/kg-day-1	1.4E-06	6.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	3.66E+01	mg/kg	Multimedia Model not Action See Table 27				5.0E-06	2.3E-05	mg/kg-day	3.0E-03	mg/kg-day	0.0008
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.04
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	2.4E-04	mg/kg-day	4.0E-02	mg/kg-day	0.006
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	8.3E-04	mg/kg-day	2.4E-02	mg/kg-day	0.04
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	4.0E-07	mg/kg-day	1.0E-05	mg/kg-day	0.04
				Vanadium	3.92E+01	mg/kg	4E-06	mg/kg-day	NA	mg/kg-day-1	NA	2.5E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0005
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	4.3E-04	mg/kg-day	3.0E-01	mg/kg-day	0.001
			Ingestion Total								6.7E-06					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	3E-12	mg/kg-day	1.3E+05	mg/kg-day-1	4.2E-06	2.2E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	2E-07	mg/kg-day	1.5E+00	mg/kg-day-1	2.9E-07	1.4E-06	mg/kg-day	3.0E-04	mg/kg-day	0.005
				Chromium	3.66E+01	mg/kg	Multimedia Model not Action See Table 27				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.4E-07					0.008
	Total On Site Surface Soil										7.1E-06					0.2
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4E-14	µg/m^3	3.3E+01	(µg/m^3)^-1	1.3E-12	2.5E-13	µg/m^3	4.0E-08	mg/m^3	0.0000000006
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	3.7E-04	µg/m^3	5.0E-03	mg/m^3	0.000007
				Arsenic	1.75E+01	mg/kg	2E-03	µg/m^3	4.3E-03	(µg/m^3)^-1	9.1E-11	1.5E-07	µg/m^3	1.5E-05	mg/m^3	0.000001
				Chromium	3.66E+01	mg/kg	Multimedia Model not Action See Table 27				1.1E-03	3.1E-07	µg/m^3	1.0E-04	mg/m^3	0.0000003
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-07	µg/m^3	6.0E-06	mg/m^3	0.000002
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-05	µg/m^3	5.0E-05	mg/m^3	0.00002
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	3.3E-10	mg/m^3	1.0E-04	mg/m^3	0.0000003
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.1E-03					0.0000
	Total On Site Air										1.1E-03					0.0000
Total On Site Surface Soil											7.1E-06					0.2

Table E-7R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * CSF
Noncancer Hazard = Intake / RfD
Intake = Exposure Concentration * Intake Factor / Body Weight * Averaging Time

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potentially Ingested	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
					value	Unit	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							value	Unit	value	Unit		value	Unit	value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 27				1.0E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				2.0E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 27				2.2E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				2.0E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 27				1.9E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	9E-12	mg/kg-day	1.5E+05	mg/kg-day)^-1	1.2E-07	6.3E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0009
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	8.8E-03	mg/kg-day	1.0E+00	mg/kg-day	0.0009
				Arsenic	1.02E+01	mg/kg	9E-07	mg/kg-day	1.5E+00	mg/kg-day)^-1	1.4E-06	6.4E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	2.31E+01	mg/kg	Multiple Modes of Action, See Table 27				2.8E-06	1.8E-05	mg/kg-day	3.0E-03	mg/kg-day	0.006
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	7.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.5E-06	mg/kg-day	6.0E-04	mg/kg-day	0.003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	1.9E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	7.2E-04	mg/kg-day	1.4E-01	mg/kg-day	0.005
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	7.0E-07	mg/kg-day	1.0E-05	mg/kg-day	0.07
			Ingestion Total								5.5E-06					0.2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 27				5.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				1.1E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 27				1.2E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 27				1.1E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 27				1.0E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1E-12	mg/kg-day	1.5E+05	mg/kg-day)^-1	1.4E-08	7.8E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0001
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	1E-07	mg/kg-day	1.5E+00	mg/kg-day)^-1	1.7E-07	8.0E-07	mg/kg-day	3.0E-04	mg/kg-day	0.003
				Chromium	2.31E+01	mg/kg	Multiple Modes of Action, See Table 27				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	1.5E-03	µg/m3	9.0E-03	µg/m3	1.3E-10	1.0E-10	mg/m3	6.0E-06	mg/m3	0.000002
				Copper	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.1E-07					0.004
	Total Flenniken Branch Surface Soil										5.8E-06					0.2

Table E-7R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoranthracene	5.10E-02	mg/kg	Mutagenic Mode of Action: See Table 37				2.0E-14	NA	NA	NA	NA	NA
				Benzoraxpyrene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 37				4.0E-13	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	Mutagenic Mode of Action: See Table 37				4.4E-14	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 37				4.0E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mutagenic Mode of Action: See Table 37				3.8E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1E-14	µg/m^3	3.8E+01	(µg/m^3)^-1	4.5E-13	8.3E-17	mg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.2E-07	mg/m^3	5.0E-03	mg/m^3	0.00002
				Arsenic	1.02E+01	mg/kg	1E-08	µg/m^3	4.3E-03	(µg/m^3)^-1	5.3E-11	8.5E-11	mg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	2.81E+01	mg/kg	Mutagenic Mode of Action: See Table 37				8.5E-09	2.4E-10	mg/m^3	1.0E-04	mg/m^3	0.000002
				Cobalt	1.22E+01	mg/kg	1.5E-08	µg/m^3	9.0E-03	µg/m^3	1.3E-10	1.0E-10	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.0E-11	mg/m^3	8.0E-04	mg/m^3	0.000000003
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	9.6E-09	mg/m^3	5.0E-05	mg/m^3	0.0002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								8.7E-09					0.0002
	Total Flenniken Branch Air										8.7E-09					0.0002
Total Flenniken Branch Surface Soil											5.9E-06					0.2

Table E-8R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Hours/Day) = Optional Figure
Receptor Population = Trespasser
Receptor Age = Adult Teen

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Calculation		CDF Multi Risk		Cancer Risk	Intake Equation/Calculation		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	6.6E-13	mg/kg-day	1.3E+05	mg/kg-day^-1	8.5E-08	4.6E-12	mg/kg-day	7.0E-10	mg/kg-day	0.007
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	6.8E-03	mg/kg-day	1.0E+00	mg/kg-day	0.007
				Arsenic	1.75E+01	mg/kg	2.4E-07	mg/kg-day	1.5E+00	mg/kg-day^-1	3.6E-07	1.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.006
				Chromium	3.00E+01	mg/kg	Mutagenic Mode of Action See Table 3B				1.2E-06	5.8E-06	mg/kg-day	3.0E-03	mg/kg-day	0.002
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	5.9E-05	mg/kg-day	4.0E-02	mg/kg-day	0.001
				Iron	3.33E+04	mg/kg	NA	NA	NA	NA	NA	6.1E-03	mg/kg-day	7.0E-01	mg/kg-day	0.009
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	2.4E-02	mg/kg-day	0.009
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.0E-07	mg/kg-day	1.0E-05	mg/kg-day	0.01
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	6.2E-06	mg/kg-day	5.0E-03	mg/kg-day	0.001
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0004
			Ingestion Total								1.7E-06					0.06
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	2.3E-14	mg/kg-day	1.3E+05	mg/kg-day^-1	3.0E-09	1.6E-13	mg/kg-day	7.0E-10	mg/kg-day	0.0002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	1.4E-08	mg/kg-day	1.5E+00	mg/kg-day^-1	2.1E-08	9.3E-08	mg/kg-day	3.0E-04	mg/kg-day	0.0003
				Chromium	3.00E+01	mg/kg	Mutagenic Mode of Action See Table 3B				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.4E-08					0.0006
	Total On Site Surface Soil										1.7E-06					0.06
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	8.8E-15	µg/m^3	3.3E+01	µg/m^3^-1	3.3E-13	6.1E-14	µg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	9.1E-05	µg/m^3	5.0E-03	mg/m^3	0.00002
				Arsenic	1.75E+01	mg/kg	5.3E-09	µg/m^3	4.3E-03	µg/m^3^-1	2.3E-11	3.7E-06	µg/m^3	1.5E-05	mg/m^3	0.0000002
				Chromium	3.00E+01	mg/kg	Mutagenic Mode of Action See Table 3B				2.3E-09	7.7E-06	µg/m^3	1.0E-04	mg/m^3	0.0000006
				Cobalt	1.73E+01	mg/kg	5.2E-09	µg/m^3	9.0E-03	µg/m^3^-1	4.7E-11	3.7E-06	µg/m^3	6.0E-06	mg/m^3	0.0000006
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.9E-06	µg/m^3	5.0E-05	mg/m^3	0.00006
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	5.2E-11	mg/m^3	1.0E-04	mg/m^3	0.0000005
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								2.3E-09					0.00009
	Total On Site Air										2.3E-09					0.00009
Total On Site Surface Soil											1.7E-06					0.06

Table E-8R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * CSF
Noncancer Hazard = Intake / RfD
Intake = Exposure Concentration * Intake Factor / Averaging Time

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake Equation/ Constant		CSF/ Unit Risk		Cancer Risk	Intake Equation/ Constant		RfD/ RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Mg equation Model or Equation See Table 36				2.5E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				5.0E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mg equation Model or Equation See Table 36				5.4E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				5.0E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mg equation Model or Equation See Table 36				4.8E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	2.2E-15	mg/kg-day	1.5E+05	mg/kg-day^-1	2.9E-06	1.6E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	2.2E-03	mg/kg-day	1.0E+00	mg/kg-day	0.002
				Arsenic	1.02E+01	mg/kg	2.3E-07	mg/kg-day	1.5E+00	mg/kg-day^-1	3.4E-07	1.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.005
				Chromium	2.31E+01	mg/kg	Mg equation Model or Equation See Table 36				9.5E-07	4.4E-06	mg/kg-day	3.0E-03	mg/kg-day	0.001
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.9E-06	mg/kg-day	3.0E-04	mg/kg-day	0.006
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.8E-07	mg/kg-day	6.0E-04	mg/kg-day	0.00006
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	4.8E-03	mg/kg-day	7.0E-01	mg/kg-day	0.007
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.8E-04	mg/kg-day	1.4E-01	mg/kg-day	0.001
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	1.7E-07	mg/kg-day	1.0E-05	mg/kg-day	0.02
			Ingestion Total								1.4E-06					0.04
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Mg equation Model or Equation See Table 36				2.9E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				7.6E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mg equation Model or Equation See Table 36				8.4E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mg equation Model or Equation See Table 36				7.6E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mg equation Model or Equation See Table 36				7.3E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	7.9E-15	mg/kg-day	1.5E+05	mg/kg-day^-1	1.0E-09	5.5E-14	mg/kg-day	7.0E-10	mg/kg-day	0.000008
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	8.1E-09	mg/kg-day	1.5E+00	mg/kg-day^-1	1.2E-08	5.7E-08	mg/kg-day	3.0E-04	mg/kg-day	0.0002
				Chromium	2.31E+01	mg/kg	Mg equation Model or Equation See Table 36				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.2E-08					0.0002
	Total Flenniken Branch Surface Soil										1.4E-06					0.04

Table E-8R
Calculation of COPC Cancer Risks and Noncancer Hazards - Trespasser - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Hours/Day): Optional Entry
Receptor Population: Trespasser
Receptor Age: Adult Only

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Calculation		CDI Unit Risk		Cancer Risk	Intake Equation/Calculation		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
	Air	Fleinaken Estate	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	Mulgenia Model of Airborne Dust Table 36				5.0E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mulgenia Model of Airborne Dust Table 36				9.9E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mulgenia Model of Airborne Dust Table 36				1.1E-13	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mulgenia Model of Airborne Dust Table 36				9.9E-15	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	mg/kg	Mulgenia Model of Airborne Dust Table 36				9.5E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.0E-15	µg/m^3	3.3E+01	µg/m^3^-1	1.1E-13	2.1E-17	mg/m^3	4.0E-08	mg/m^3	0.0000000005
				Aluminum	1.29E+04	mg/kg	4.2E-06	µg/m^3	NA	NA	NA	2.9E-06	mg/m^3	5.0E-03	mg/m^3	0.000006
				Arsenic	1.02E+01	mg/kg	3.1E-09	µg/m^3	4.3E-03	µg/m^3^-1	1.3E-11	2.1E-11	mg/m^3	1.5E-05	mg/m^3	0.0000001
				Chromium	2.31E+01	mg/kg	Mulgenia Model of Airborne Dust Table 36				2.1E-09	5.9E-11	mg/m^3	1.0E-04	mg/m^3	0.0000006
				Cobalt	1.22E+01	mg/kg	3.7E-09	µg/m^3	9.0E-03	µg/m^3	3.3E-11	2.6E-11	mg/m^3	6.0E-06	mg/m^3	0.0000004
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.0E-12	mg/m^3	8.0E-04	mg/m^3	0.0000000006
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-09	mg/m^3	5.0E-05	mg/m^3	0.000005
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								2.2E-09					0.000006
	Total Fleinaken Estate Air										2.2E-09					0.000006
Total Fleinaken Estate Exposure Unit											1.4E-06					0.04

Table E-9R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-11	mg/kg-day	1.5E+05	(mg/kg-day)-1	1.4E-06	1.2E-10	mg/kg-day	7.0E-10	mg/kg-day	0.2
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	1.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.2
				Arsenic	1.75E+01	mg/kg	5.8E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	5.8E-06	4.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action See Table 29				3.6E-05	1.6E-04	mg/kg-day	3.0E-03	mg/kg-day	0.05
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	7.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.2
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	1.6E-03	mg/kg-day	4.0E-02	mg/kg-day	0.04
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	1.6E-01	mg/kg-day	7.0E-01	mg/kg-day	0.2
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	5.9E-03	mg/kg-day	2.4E-02	mg/kg-day	0.2
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	2.7E-06	mg/kg-day	1.0E-05	mg/kg-day	0.3
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.03
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	2.9E-03	mg/kg-day	3.0E-01	mg/kg-day	0.01
			Ingestion Total								4.3E-05					2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.1E-13	mg/kg-day	1.5E+05	(mg/kg-day)-1	6.7E-08	6.0E-12	mg/kg-day	7.0E-10	mg/kg-day	0.009
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	3.1E-07	mg/kg-day	1.5E+00	(mg/kg-day)-1	4.6E-07	3.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action See Table 29				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								5.3E-07					0.02
	Total On-Site Surface Soil										4.3E-05					2
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	2.4E-14	pg/m^3	3.3E+01	(pg/m^3)-1	9.0E-13	2.8E-13	pg/m^3	4.0E-08	mg/m^3	0.000000007
				Aluminum	4.33E+04	mg/kg	3.5E-05	pg/m^3	NA	NA	NA	4.1E-04	pg/m^3	5.0E-03	mg/m^3	0.00008
				Arsenic	1.75E+01	mg/kg	1.4E-08	pg/m^3	4.3E-03	(pg/m^3)-1	6.1E-11	1.7E-07	pg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action See Table 29				1.3E-08	3.5E-07	pg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.73E+01	mg/kg	1.4E-08	pg/m^3	9.0E-03	(pg/m^3)-1	1.3E-10	1.6E-07	pg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.3E-05	pg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	3.7E-10	mg/m^3	1.0E-04	mg/m^3	0.000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.3E-08					0.0004
	Total On-Site Air										1.3E-08					0.0004
Total On-Site Surface Soil											4.3E-05					2

Table E-9R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Fleniken Branch																
Soil	Surface Soil	Fleniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				7.3E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.4E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.6E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.4E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.4E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	3.6E-12	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	4.7E-07	4.2E-11	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.06
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	5.9E-02	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.06
				Arsenic	1.02E+01	(mg/kg)	2.2E-06	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	3.4E-06	2.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.09
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 29				2.7E-05	1.2E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.04
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	5.2E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.2
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	1.0E-05	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.02
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.3E-01	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.2
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	4.9E-03	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.03
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	4.7E-06	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.5
			Ingestion Total								3.3E-05					1
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				2.6E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.2E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.7E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.2E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.0E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	1.8E-13	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	2.3E-08	2.0E-12	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.003
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	1.8E-07	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	2.7E-07	2.1E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.007
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 29				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								9.0E-07					0.01
	Total Fleniken Branch Surface Soil										3.4E-05					1

Table E-9R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleming Branch	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				2.4E-14	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				4.7E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				5.2E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 29				4.7E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 29				4.6E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	8.1E-15	pg/m^3	1.3E+01	(pg/m^3)^-1	1.1E-13	9.4E-14	pg/m^3	4.0E-08	mg/m^3	0.0000000002
				Aluminum	1.29E+04	(mg/kg)	NA	NA	NA	NA	NA	1.3E-04	pg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.02E+01	(mg/kg)	8.3E-09	pg/m^3	4.3E-03	(pg/m^3)^-1	3.6E-11	9.7E-06	pg/m^3	1.5E-05	mg/m^3	0.0000006
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 29				1.0E-06	2.6E-10	mg/m^3	1.0E-04	mg/m^3	0.0000003
				Cobalt	1.22E+01	(mg/kg)	9.9E-09	pg/m^3	9.0E-03	pg/m^3	8.9E-11	1.2E-10	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	2.3E-05	pg/m^3	8.0E-04	mg/m^3	0.003
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	1.1E-03	mg/m^3	5.0E-05	mg/m^3	0.00002
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.0E-06					0.004
	Total Fleming Branch Air										1.0E-06					0.004
Total Fleming Branch Surface Soil											1.4E-05					1

Table E-10R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	1.3E-12	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.7E-07	1.5E-11	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.02
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	2.0E-02	(mg/kg-day)	1.00E+00	(mg/kg-day)	0.02
				Arsenic	1.75E+01	(mg/kg)	4.8E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	7.1E-07	5.6E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.02
				Chromium	3.66E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4.0				4.4E-06	1.9E-05	(mg/kg-day)	3.00E-03	(mg/kg-day)	0.006
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	9.2E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.03
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	2.0E-04	(mg/kg-day)	4.00E-02	(mg/kg-day)	0.005
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	2.0E-02	(mg/kg-day)	7.00E-01	(mg/kg-day)	0.03
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	7.4E-04	(mg/kg-day)	2.40E-02	(mg/kg-day)	0.03
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	3.3E-07	(mg/kg-day)	1.00E-05	(mg/kg-day)	0.03
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	2.1E-05	(mg/kg-day)	5.00E-03	(mg/kg-day)	0.004
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	3.6E-04	(mg/kg-day)	3.00E-01	(mg/kg-day)	0.001
			Ingestion Total								5.3E-06					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	8.5E-14	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.1E-08	9.9E-13	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.001
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	(mg/kg)	5.1E-08	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	7.7E-08	6.0E-07	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.002
				Chromium	3.66E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4.0				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								8.8E-08					0.003
	Total On-Site Surface Soil										5.4E-06					0.2
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	5.9E-15	µg/m^3	3.8E+01	(µg/m3)^-1	2.2E-13	6.8E-14	µg/m^3	4.00E-08	(mg/m^3)	0.000000002
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	1.0E-04	µg/m^3	5.00E-03	(mg/m^3)	0.00002
				Arsenic	1.75E+01	(mg/kg)	3.5E-09	µg/m^3	4.3E-03	(µg/m3)^-1	1.5E-11	4.1E-08	µg/m^3	1.50E-05	(mg/m^3)	0.000003
				Chromium	3.66E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4.0				3.3E-09	8.6E-08	µg/m^3	1.00E-04	(mg/m^3)	0.00000009
				Cobalt	1.73E+01	(mg/kg)	3.5E-09	µg/m^3	9.0E-03	(µg/m3)^-1	3.2E-11	4.1E-08	µg/m^3	6.00E-06	(mg/m^3)	0.000007
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	3.3E-06	µg/m^3	5.00E-05	(mg/m^3)	0.00007
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	9.2E-11	(mg/m^3)	1.00E-04	(mg/m^3)	0.00000009
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.3E-09					0.0001
	Total On-Site Air										3.3E-09					0.0001
Total On-Site Surface Soil											5.4E-06					0.2

Table E-10R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				9.0E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.8E-07	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.9E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.8E-09	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.7E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	4.5E-13	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	5.8E-08	5.2E-12	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.007
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	7.4E-03	(mg/kg-day)	1.00E+00	(mg/kg-day)	0.007
				Arsenic	1.02E+01	(mg/kg)	2.8E-07	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	4.2E-07	3.2E-06	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.01
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				3.4E-06	1.5E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.005
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	6.5E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.02
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	1.3E-06	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.002
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.6E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.02
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	6.0E-04	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.004
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	5.8E-07	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.06
			Ingestion Total								4.1E-06					0.1
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				2.0E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				5.1E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				5.7E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				5.1E-10	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				4.9E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	2.9E-14	(mg/kg-day)$^{-1}$	1.3E+05	(mg/kg-day)$^{-1}$	3.8E-09	3.4E-13	(mg/kg-day)	7.00E-10	(mg/kg-day)	0.0005
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	3.0E-08	(mg/kg-day)$^{-1}$	1.5E+00	(mg/kg-day)$^{-1}$	4.5E-08	3.5E-07	(mg/kg-day)	3.00E-04	(mg/kg-day)	0.001
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.1E-07					0.002
	Total Flenniken Branch Surface Soil										4.2E-06					0.1

Table E-10R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Child User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleming Branch	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				6.0E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.2E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.3E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.2E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				1.1E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	2.0E-15	pg/m^3	3.3E+01	(pg/m^3)^-1	7.6E-14	2.3E-14	pg/m^3	4.00E-08	(mg/m^3	0.0000000006
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	3.3E-05	pg/m^3	5.00E-03	(mg/m^3	0.000007
				Arsenic	1.02E+01	(mg/kg)	2.1E-09	pg/m^3	4.3E-03	(pg/m^3)^-1	8.8E-12	2.4E-06	pg/m^3	1.50E-05	(mg/m^3	0.0000002
				Chromium	2.81E+01	(mg/kg)	Mutagenic Mode of Action - See Table 4-0				2.5E-09	6.6E-11	(mg/m^3	1.0E-04	(mg/m^3	0.0000000
				Cobalt	1.22E+01	(mg/kg)	2.4E-09	pg/m^3	9.0E-03	pg/m^3	2.2E-11	2.9E-11	(mg/m^3	6.0E-06	(mg/m^3	0.000005
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	6.9E-04	pg/m^3	8.0E-04	(mg/m^3	0.0009
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	2.7E-09	(mg/m^3	5.0E-05	(mg/m^3	0.00005
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								2.6E-09					0.0009
	Total Fleming Branch Air										2.6E-09					0.0009
Total Fleming Branch Surface Soil											4.2E-06					0.1

Table E-11R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	3.3E-12	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	4.3E-07	1.2E-11	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.02
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	1.7E-02	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.02
				Arsenic	1.75E+01	(mg/kg)	1.2E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.8E-06	4.2E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.01
				Chromium	3.66E+01	(mg/kg)	4.2E-06	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	2.1E-06	1.5E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.005
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	6.2E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.02
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	1.5E-04	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.004
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	1.5E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.02
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	5.6E-04	(mg/kg-day)	2.4E-02	(mg/kg-day)	0.02
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	2.5E-07	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.03
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	1.6E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.003
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	2.7E-04	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.0009
			Ingestion Total								4.3E-06					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	4.2E-13	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	5.5E-08	1.5E-12	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.002
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	(mg/kg)	2.5E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	3.8E-07	8.9E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.003
				Chromium	3.66E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								4.3E-07					0.005
	Total On-Site Surface Soil										4.8E-06					0.2
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	(mg/kg)	7.9E-14	pg/m^3	3.8E+01	(pg/m3)^-1	3.0E-12	2.8E-13	pg/m^3	4.0E-08	mg/m^3	0.000000007
				Aluminum	4.33E+04	(mg/kg)	NA	NA	NA	NA	NA	4.1E-04	pg/m^3	5.0E-03	mg/m^3	0.00008
				Arsenic	1.75E+01	(mg/kg)	4.7E-08	pg/m^3	4.3E-03	(pg/m3)^-1	2.0E-10	1.7E-07	pg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	3.66E+01	(mg/kg)	9.9E-08	pg/m^3	8.4E-02	(pg/m3)^-1	8.4E-09	3.5E-07	pg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.73E+01	(mg/kg)	4.7E-08	pg/m^3	9.0E-03	(pg/m3)^-1	4.2E-10	1.6E-07	pg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	3.72E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	(mg/kg)	NA	NA	NA	NA	NA	1.3E-05	pg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	(mg/kg)	NA	NA	NA	NA	NA	3.7E-10	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Zinc	6.73E+02	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								9.0E-09					0.0004
	Total On-Site Air										9.0E-09					0.0004
Total On-Site Surface Soil											4.8E-06					0.2

Table E-11R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	5.8E-09	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	4.3E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	1.1E-08	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	8.4E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	1.3E-08	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	9.2E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	1.1E-08	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	8.4E-10	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	1.1E-08	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	8.0E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	1.1E-12	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	1.5E-07	4.0E-12	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.006
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	5.6E-03	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.006
				Arsenic	1.02E+01	(mg/kg)	7.0E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	1.0E-06	2.4E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.008
				Chromium	2.81E+01	(mg/kg)	3.2E-06	(mg/kg-day)	5.0E-01	(mg/kg-day)-1	1.6E-06	1.1E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.004
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	4.9E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.02
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	9.6E-07	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.002
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.2E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.02
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	4.6E-04	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.003
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	4.4E-07	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.04
			Ingestion Total								2.9E-06					0.1
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	3.3E-09	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	2.3E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	6.3E-09	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	4.6E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	6.9E-09	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	5.0E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	6.3E-09	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	4.6E-10	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	(mg/kg)	6.0E-09	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	4.4E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	1.4E-13	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	1.9E-08	5.0E-13	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.0007
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	1.5E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	2.2E-07	5.2E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.002
				Chromium	2.81E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.9E-07					0.002
	Total Flenniken Branch Surface Soil										3.2E-06					0.1

Table E-11R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleming Branch	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	1.4E-10	pg/m^3	1.1E-04	(ug/m3)^-1	1.5E-14	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	2.7E-10	pg/m^3	1.1E-03	(ug/m3)^-1	3.0E-13	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	3.0E-10	pg/m^3	1.1E-04	(ug/m3)^-1	3.3E-14	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	2.7E-10	pg/m^3	1.1E-04	(ug/m3)^-1	3.0E-14	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	2.6E-10	pg/m^3	1.1E-05	(ug/m3)^-1	2.9E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	2.7E-14	pg/m^3	3.8E+01	(ug/m3)^-1	1.0E-12	9.4E-14	pg/m^3	4.0E-08	(mg/m^3)	0.0000000002
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	1.3E-04	pg/m^3	5.0E-03	(mg/m^3)	0.00003
				Arsenic	1.02E+01	(mg/kg)	2.8E-08	pg/m^3	4.3E-03	(ug/m3)^-1	1.2E-10	9.7E-08	pg/m^3	1.5E-05	(mg/m^3)	0.0000006
				Chromium	2.81E+01	(mg/kg)	7.6E-08	pg/m^3	8.4E-02	pg/m^3	6.4E-09	2.6E-10	(mg/m^3)	1.0E-04	(mg/m^3)	0.0000003
				Cobalt	1.22E+01	(mg/kg)	3.3E-08	pg/m^3	9.0E-03	pg/m^3	3.0E-10	1.2E-10	(mg/m^3)	6.0E-06	(mg/m^3)	0.00002
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	2.3E-03	pg/m^3	8.0E-04	(mg/m^3)	0.003
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	1.1E-03	(mg/m^3)	5.0E-05	(mg/m^3)	0.0002
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								6.3E-09					0.004
	Total Fleming Branch Air										6.3E-09					0.004
Total Fleming Branch Surface Soil											3.2E-06					0.1

Table E-12R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On-Site																
Soil	Surface Soil	On-Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.9E-13	mg/kg-day	1.5E+05	mg/kg-day-1	2.4E-08	1.4E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.1E-03	mg/kg-day	1.0E+00	mg/kg-day	0.002
				Arsenic	1.75E+01	mg/kg	6.7E-08	mg/kg-day	1.5E+00	mg/kg-day-1	1.0E-07	5.2E-07	mg/kg-day	3.0E-04	mg/kg-day	0.002
				Chromium	3.66E+01	mg/kg	2.3E-07	mg/kg-day	5.0E-01	mg/kg-day-1	1.2E-07	1.8E-06	mg/kg-day	3.0E-03	mg/kg-day	0.0006
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	8.6E-07	mg/kg-day	3.0E-04	mg/kg-day	0.003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	1.8E-05	mg/kg-day	4.0E-02	mg/kg-day	0.0005
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	1.9E-03	mg/kg-day	7.0E-01	mg/kg-day	0.003
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	6.9E-05	mg/kg-day	2.4E-02	mg/kg-day	0.003
				Thallium	6.50E-01	mg/kg	NA	NA	NA	NA	NA	3.1E-08	mg/kg-day	1.0E-05	mg/kg-day	0.003
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.9E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	3.3E-05	mg/kg-day	3.0E-01	mg/kg-day	0.0001
			Ingestion Total								2.4E-07					0.02
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.3E-14	mg/kg-day	1.5E+05	mg/kg-day-1	1.7E-09	1.0E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	8.1E-09	mg/kg-day	1.5E+00	mg/kg-day-1	1.2E-08	6.3E-08	mg/kg-day	3.0E-04	mg/kg-day	0.0002
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.50E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.4E-08					0.0004
	Total On-Site Surface Soil										2.6E-07					0.02
	Air	On-Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	8.8E-15	pg/m^3	3.3E+01	(pg/m^3)^-1	3.3E-13	6.8E-14	pg/m^3	4.0E-08	mg/m^3	0.000000002
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	1.0E-04	pg/m^3	5.0E-03	mg/m^3	0.00002
				Arsenic	1.75E+01	mg/kg	5.3E-09	pg/m^3	4.3E-03	(pg/m^3)^-1	2.3E-11	4.1E-08	pg/m^3	1.5E-05	mg/m^3	0.0000003
				Chromium	3.66E+01	mg/kg	1.1E-08	pg/m^3	8.4E-02	(pg/m^3)^-1	9.3E-10	8.6E-08	pg/m^3	1.0E-04	mg/m^3	0.0000009
				Cobalt	1.73E+01	mg/kg	5.3E-09	pg/m^3	9.0E-03	(pg/m^3)^-1	4.7E-11	4.1E-08	pg/m^3	6.0E-06	mg/m^3	0.000007
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	3.3E-06	pg/m^3	5.0E-05	mg/m^3	0.00007
				Thallium	6.50E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	9.2E-11	mg/m^3	1.0E-04	mg/m^3	0.0000009
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.0E-09					0.0001
	Total On-Site Air										1.0E-09					0.0001
Total On-Site Surface Soil											2.6E-07					0.02

Table E-12R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	(mg/kg)	3.3E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	2.4E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	6.4E-10	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	4.7E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	7.0E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	5.1E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	6.4E-10	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	4.7E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	6.1E-10	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	4.5E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	6.3E-14	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	8.2E-09	4.9E-13	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.00007
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	8.9E-04	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.0007
				Arsenic	1.02E+01	(mg/kg)	3.9E-08	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	5.8E-08	3.0E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.001
				Chromium	2.81E+01	(mg/kg)	1.8E-07	(mg/kg-day)	5.0E-01	(mg/kg-day)-1	9.0E-08	1.4E-06	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.00005
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	8.1E-07	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.002
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	1.2E-07	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.0002
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	1.5E-03	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.002
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	5.7E-05	(mg/kg-day)	1.4E-01	(mg/kg-day)	0.00004
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	5.5E-06	(mg/kg-day)	1.0E-05	(mg/kg-day)	0.005
			Ingestion Total								1.6E-07					0.01
			Dermal	Benzo(a)anthracene	5.10E-02	(mg/kg)	1.0E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	7.5E-11	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	2.0E-10	(mg/kg-day)	7.3E+00	(mg/kg-day)-1	1.5E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	2.2E-10	(mg/kg-day)	7.3E-01	(mg/kg-day)-1	1.6E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	2.0E-10	(mg/kg-day)	7.3E-02	(mg/kg-day)-1	1.5E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	1.9E-10	(mg/kg-day)	7.3E-03	(mg/kg-day)-1	1.4E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	4.6E-15	(mg/kg-day)	1.3E+05	(mg/kg-day)-1	5.9E-10	3.6E-14	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.00005
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	(mg/kg)	4.7E-09	(mg/kg-day)	1.5E+00	(mg/kg-day)-1	7.0E-09	3.7E-08	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.0001
				Chromium	2.81E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								9.4E-09					0.0002
	Total Flenniken Branch Surface Soil										1.7E-07					0.01

Table E-12R
Calculation of COPC Cancer Risks and Noncancer Hazards - Recreational Adult User - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Fleetwood Estate	Inhalation	Benzo(a)anthracene	5.10E-02	(mg/kg)	1.5E-11	pg/m^3	1.1E-04	(ug/m^3)^-1	1.7E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	(mg/kg)	3.0E-11	pg/m^3	1.1E-03	(ug/m^3)^-1	3.3E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	(mg/kg)	3.3E-11	pg/m^3	1.1E-04	(ug/m^3)^-1	3.7E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	(mg/kg)	3.0E-11	pg/m^3	1.1E-04	(ug/m^3)^-1	3.3E-15	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	(mg/kg)	2.9E-11	pg/m^3	1.1E-05	(ug/m^3)^-1	3.2E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	(mg/kg)	3.0E-15	pg/m^3	3.3E+01	(ug/m^3)^-1	1.1E-13	2.3E-14	pg/m^3	4.0E-08	(mg/m^3)	0.0000000006
				Aluminum	1.39E+04	(mg/kg)	NA	NA	NA	NA	NA	3.3E-05	pg/m^3	5.0E-03	(mg/m^3)	0.000007
				Arsenic	1.02E+01	(mg/kg)	3.1E-09	pg/m^3	4.3E-03	(ug/m^3)^-1	1.3E-11	2.4E-06	pg/m^3	1.5E-05	(mg/m^3)	0.0000002
				Chromium	2.81E+01	(mg/kg)	8.4E-09	pg/m^3	8.4E-02	pg/m^3	7.1E-10	6.6E-11	(mg/m^3)	1.0E-04	(mg/m^3)	0.00000007
				Cobalt	1.22E+01	(mg/kg)	3.7E-09	pg/m^3	9.0E-03	pg/m^3	3.3E-11	2.9E-11	(mg/m^3)	6.0E-06	(mg/m^3)	0.0000005
				Cyanide	2.40E+00	(mg/kg)	NA	NA	NA	NA	NA	6.9E-04	pg/m^3	8.0E-04	(mg/m^3)	0.00009
				Iron	3.03E+04	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	(mg/kg)	NA	NA	NA	NA	NA	2.7E-09	(mg/m^3)	5.0E-05	(mg/m^3)	0.000005
				Thallium	1.10E+00	(mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								7.6E-10					0.00009
	Total Fleetwood Estate Air										7.6E-10					0.00009
Total Fleetwood Estate Surface Soil											1.7E-07					0.01

Table E-13R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Exposure Frequency (Days/Year): Two Hundred
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Constant		CDI Total Risk		Cancer Risk	Intake Equation/Constant		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
On Site																
Soil	Total Soil	On Site	Ingestion	Benzo(a)anthracene	8.10E-02	mg/kg	3.3E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	3.7E-09	mg/kg-day	7.3E+00	mg/kg-day^{-1}	2.7E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.9E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	3.7E-09	mg/kg-day	7.3E-02	mg/kg-day^{-1}	2.7E-10	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-03	mg/kg-day^{-1}	2.9E-11	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	2.8E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.0E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.2E-12	mg/kg-day	1.3E+05	mg/kg-day^{-1}	1.5E-07	8.2E-11	mg/kg-day	7.0E-10	mg/kg-day	0.1
				PCB-1232	5.40E-01	mg/kg	2.2E-08	mg/kg-day	2.0E+00	mg/kg-day^{-1}	4.4E-08	NA	NA	NA	NA	NA
				Aluminum	3.20E+04	mg/kg	NA	NA	NA	NA	NA	9.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.09
				Arsenic	1.72E+01	mg/kg	4.2E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	6.2E-07	2.9E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Chromium	3.70E+01	mg/kg	1.5E-06	mg/kg-day	5.0E-01	mg/kg-day^{-1}	7.5E-07	1.0E-04	mg/kg-day	3.0E-03	mg/kg-day	0.03
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	5.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.2
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	9.8E-04	mg/kg-day	4.0E-02	mg/kg-day	0.02
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	1.1E-01	mg/kg-day	7.0E-01	mg/kg-day	0.2
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	3.9E-03	mg/kg-day	2.4E-02	mg/kg-day	0.2
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.8E-06	mg/kg-day	1.0E-05	mg/kg-day	0.2
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	5.0E-03	mg/kg-day	0.02
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	1.8E-03	mg/kg-day	3.0E-01	mg/kg-day	0.006
			Ingestion Total								1.6E-06					1
			Dermal	Benzo(a)anthracene	8.10E-02	mg/kg	1.3E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	9.8E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	1.5E-09	mg/kg-day	7.3E+00	mg/kg-day^{-1}	1.1E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.2E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	1.5E-09	mg/kg-day	7.3E-02	mg/kg-day^{-1}	1.1E-10	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E-03	mg/kg-day^{-1}	1.2E-11	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	1.1E-09	mg/kg-day	7.3E-01	mg/kg-day^{-1}	8.3E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.1E-13	mg/kg-day	1.3E+05	mg/kg-day^{-1}	1.4E-08	7.3E-12	mg/kg-day	7.0E-10	mg/kg-day	0.01
				PCB-1232	5.40E-01	mg/kg	9.0E-09	mg/kg-day	2.0E+00	mg/kg-day^{-1}	1.9E-08	NA	NA	NA	NA	NA
				Aluminum	3.20E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.72E+01	mg/kg	6.6E-08	mg/kg-day	1.5E+00	mg/kg-day^{-1}	9.8E-08	4.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	3.70E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.5E-07					0.03
	Total On Site Total Soil										1.7E-06					1

Table E-13R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Exposure Concentration		CF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	On Site	Inhalation	Benzo(a)anthracene	8.10E-02	mg/kg	4.7E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	5.2E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	5.3E-11	µg/m^3	1.1E-03	(µg/m^3)^-1	5.8E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	6.4E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	5.3E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	5.8E-15	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-05	(µg/m^3)^-1	6.4E-16	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	4.0E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	4.4E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.7E-14	µg/m^3	3.3E+01	(µg/m^3)^-1	6.4E-13	1.2E-12	µg/m^3	4.0E-08	mg/m^3	0.000000003
				PCB-1232	5.40E-01	mg/kg	2.1E-05	µg/m^3	5.7E-04	(µg/m^3)^-1	1.2E-08	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	1.3E-03	µg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.72E+01	mg/kg	1.0E-03	µg/m^3	4.3E-03	(µg/m^3)^-1	4.3E-11	7.0E-07	µg/m^3	1.5E-05	mg/m^3	0.00005
				Chromium	3.70E+01	mg/kg	2.1E-03	µg/m^3	8.4E-02	(µg/m^3)^-1	1.8E-09	1.5E-06	µg/m^3	1.0E-04	mg/m^3	0.00002
				Cobalt	1.75E+01	mg/kg	1.0E-03	µg/m^3	9.0E-03	(µg/m^3)^-1	9.2E-11	7.1E-07	µg/m^3	6.0E-06	mg/m^3	0.00001
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	5.6E-05	µg/m^3	5.0E-05	mg/m^3	0.001
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	1.6E-09	mg/m^3	1.0E-04	mg/m^3	0.00002
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.4E-08					0.002
	Total On Site Air										1.4E-08					0.002
Total On Site Total Soil											1.8E-08					1
Flenniken Branch																
Soil	Total Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	2.1E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.5E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.9E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	4.4E-09	mg/kg-day	7.3E-01	(mg/kg-day)^-1	3.2E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	4.0E-09	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.9E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	3.9E-09	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.8E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	4.0E-13	mg/kg-day	1.3E+05	(mg/kg-day)^-1	5.2E-08	2.8E-11	mg/kg-day	7.0E-10	mg/kg-day	0.04
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	3.9E-02	mg/kg-day	1.0E+00	mg/kg-day	0.04
				Arsenic	1.02E+01	mg/kg	2.5E-07	mg/kg-day	1.5E+00	(mg/kg-day)^-1	3.7E-07	1.7E-05	mg/kg-day	3.0E-04	mg/kg-day	0.06
				Chromium	2.31E+01	mg/kg	1.1E-06	mg/kg-day	5.0E-01	(mg/kg-day)^-1	5.7E-07	7.9E-05	mg/kg-day	3.0E-03	mg/kg-day	0.03
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	6.8E-06	mg/kg-day	6.0E-04	mg/kg-day	0.01
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	8.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.1
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	3.2E-03	mg/kg-day	1.4E-01	mg/kg-day	0.02
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	3.1E-06	mg/kg-day	1.0E-05	mg/kg-day	0.3
			Ingestion Total								1.0E-06					0.7

Table E-13R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC value	EPC Unit	Cancer Risk Calculations: Intake Exposure Concentration value	Intake Exposure Concentration Unit	CSF Unit Risk value	CSF Unit Risk Unit	Cancer Risk	Noncancer Hazard Calculations: Intake Exposure Concentration value	Intake Exposure Concentration Unit	RfD/RfC value	RfD/RfC Unit	Hazard Quotient
Soil	Total Soil	Fleetwood Estate	Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	8.4E-10	mg/kg-day	7.3E-01	mg/kg-day^-1	6.2E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E+00	mg/kg-day^-1	1.2E-08	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.8E-09	mg/kg-day	7.3E-01	mg/kg-day^-1	1.3E-09	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.7E-09	mg/kg-day	7.3E-02	mg/kg-day^-1	1.2E-10	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.6E-09	mg/kg-day	7.3E-03	mg/kg-day^-1	1.2E-11	NA	NA	NA	NA	NA
				2,3,7,8-TCDD (TEQ)	9.90E-06	mg/kg	3.8E-14	mg/kg-day	1.3E+05	mg/kg-day^-1	4.9E-09	NA	mg/kg-day	7.0E-10	mg/kg-day	0.004
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	3.9E-08	mg/kg-day	1.5E+00	mg/kg-day^-1	5.8E-08	2.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								7.7E-08					0.01
	Total Fleetwood Estate Total Soil										1.1E-06					0.3
	Air	Fleetwood Estate	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	3.0E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	3.3E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-03	(µg/m^3)^-1	6.4E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	6.4E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	7.0E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	5.8E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	6.4E-15	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	5.6E-11	µg/m^3	1.1E-05	(µg/m^3)^-1	6.1E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD (TEQ)	9.90E-06	mg/kg	5.8E-15	µg/m^3	3.3E+01	(µg/m^3)^-1	2.2E-13	4.0E-13	µg/m^3	4.0E-08	mg/m^3	0.000000001
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	5.6E-04	µg/m^3	5.0E-03	mg/m^3	0.00001
				Arsenic	1.02E+01	mg/kg	5.9E-09	µg/m^3	4.3E-03	(µg/m^3)^-1	2.5E-11	4.1E-07	µg/m^3	1.5E-05	mg/m^3	0.000003
				Chromium	2.81E+01	mg/kg	1.6E-08	µg/m^3	8.4E-02	(µg/m^3)^-1	1.4E-09	1.1E-09	µg/m^3	1.0E-04	mg/m^3	0.000001
				Cobalt	1.22E+01	mg/kg	7.0E-09	µg/m^3	9.0E-03	(µg/m^3)^-1	6.3E-11	4.9E-10	mg/m^3	6.0E-06	mg/m^3	0.000083
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.2E-02	µg/m^3	8.0E-04	mg/m^3	0.01
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	4.6E-03	mg/m^3	5.0E-05	mg/m^3	0.00009
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.4E-09					0.02
	Total Fleetwood Estate Total Air										1.4E-09					0.02
Total Fleetwood Estate Total Soil											1.1E-06					0.3

Table E-14R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Construction Time (Years): Eighty
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
On Site																
Soil	Total Soil	On Site	Ingestion	Benzo(a)anthracene	8.10E-02	mg/kg	2.5E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.8E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	2.8E-10	mg/kg-day	7.3E+00	mg/kg-day^{-1}	2.0E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.2E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	2.8E-10	mg/kg-day	7.3E-02	mg/kg-day^{-1}	2.0E-11	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E-03	mg/kg-day^{-1}	2.2E-12	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	2.1E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.5E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	8.9E-14	mg/kg-day	1.3E+05	mg/kg-day^{-1}	1.2E-08	6.2E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0009
				PCB-1262	5.40E-01	mg/kg	1.7E-09	mg/kg-day	2.0E+00	mg/kg-day^{-1}	3.3E-09	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	7.0E-03	mg/kg-day	1.0E+00	mg/kg-day	0.007
				Arsenic	1.72E+01	mg/kg	5.1E-08	mg/kg-day	1.5E+00	mg/kg-day^{-1}	4.7E-08	2.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	3.70E+01	mg/kg	1.1E-07	mg/kg-day	5.0E-01	mg/kg-day^{-1}	5.7E-08	7.9E-06	mg/kg-day	3.0E-03	mg/kg-day	0.003
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.8E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	7.5E-05	mg/kg-day	4.0E-02	mg/kg-day	0.002
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	8.4E-03	mg/kg-day	7.0E-01	mg/kg-day	0.01
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	3.0E-04	mg/kg-day	2.4E-02	mg/kg-day	0.01
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/kg-day	1.0E-05	mg/kg-day	0.01
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	8.4E-06	mg/kg-day	5.0E-03	mg/kg-day	0.002
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	1.4E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0005
			Ingestion Total								1.2E-07					0.06
			Dermal	Benzo(a)anthracene	8.10E-02	mg/kg	2.2E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.6E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	2.5E-10	mg/kg-day	7.3E+00	mg/kg-day^{-1}	1.8E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	2.0E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	2.5E-10	mg/kg-day	7.3E-02	mg/kg-day^{-1}	1.8E-11	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E-03	mg/kg-day^{-1}	2.0E-12	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	1.9E-10	mg/kg-day	7.3E-01	mg/kg-day^{-1}	1.4E-10	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.3E-14	mg/kg-day	1.3E+05	mg/kg-day^{-1}	2.4E-09	1.3E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				PCB-1262	5.40E-01	mg/kg	1.6E-09	mg/kg-day	2.0E+00	mg/kg-day^{-1}	3.2E-09	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.72E+01	mg/kg	1.1E-08	mg/kg-day	1.5E+00	mg/kg-day^{-1}	1.6E-08	7.6E-07	mg/kg-day	3.0E-04	mg/kg-day	0.003
				Chromium	3.70E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.75E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.29E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.4E-08					0.004
	Total On Site Total Soil										1.5E-07					0.06

Table E-14R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	On-Site	Inhalation	Benzo(a)anthracene	8.10E-02	mg/kg	1.2E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.3E-15	NA	NA	NA	NA	NA
				Benzo(a)pyrene	9.10E-02	mg/kg	1.3E-11	µg/m^3	1.1E-03	(µg/m^3)^-1	1.5E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.6E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	9.10E-02	mg/kg	1.3E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.5E-15	NA	NA	NA	NA	NA
				Chrysene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-05	(µg/m^3)^-1	1.6E-16	NA	NA	NA	NA	NA
				Indeno(1,2,3-cd)pyrene	6.90E-02	mg/kg	1.0E-11	µg/m^3	1.1E-04	(µg/m^3)^-1	1.1E-15	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.2E-15	µg/m^3	3.3E+01	(µg/m^3)^-1	1.6E-13	2.9E-15	µg/m^3	4.0E-08	mg/m^3	0.000000007
				PCB-1262	5.40E-01	mg/kg	5.2E-06	µg/m^3	5.7E-04	(µg/m^3)^-1	3.0E-09	NA	NA	NA	NA	NA
				Aluminum	3.26E+04	mg/kg	NA	NA	NA	NA	NA	3.3E-04	µg/m^3	5.0E-03	mg/m^3	0.00007
				Arsenic	1.72E+01	mg/kg	2.5E-09	µg/m^3	4.3E-03	(µg/m^3)^-1	1.1E-11	1.7E-07	µg/m^3	1.5E-05	mg/m^3	0.00001
				Chromium	3.70E+01	mg/kg	5.4E-09	µg/m^3	8.4E-02	(µg/m^3)^-1	4.5E-10	3.8E-07	µg/m^3	1.0E-04	mg/m^3	0.0000004
				Cobalt	1.75E+01	mg/kg	2.5E-09	µg/m^3	9.0E-03	(µg/m^3)^-1	2.3E-11	1.8E-07	µg/m^3	6.0E-06	mg/m^3	0.00003
				Copper	3.48E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.92E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Magnesium	1.29E+03	mg/kg	NA	NA	NA	NA	NA	1.4E-05	µg/m^3	5.0E-05	mg/m^3	0.0003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.0E-10	mg/m^3	1.0E-04	mg/m^3	0.0000004
				Zinc	6.32E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.5E-09					0.0004
	Total On-Site Air										3.5E-09					0.0004
Total On-Site Total Soil											1.5E-07					0.03
Flenniken Branch																
Soil	Total Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	1.6E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	1.1E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E+00	(mg/kg-day)^-1	2.2E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	3.4E-10	mg/kg-day	7.3E-01	(mg/kg-day)^-1	2.5E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	3.1E-10	mg/kg-day	7.3E-02	(mg/kg-day)^-1	2.2E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	2.9E-10	mg/kg-day	7.3E-03	(mg/kg-day)^-1	2.1E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	3.0E-14	mg/kg-day	1.3E+05	(mg/kg-day)^-1	3.9E-09	2.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	3.0E-03	mg/kg-day	1.0E+00	mg/kg-day	0.003
				Arsenic	1.02E+01	mg/kg	1.9E-03	mg/kg-day	1.5E+00	(mg/kg-day)^-1	2.8E-03	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.004
				Chromium	2.31E+01	mg/kg	6.6E-03	mg/kg-day	5.0E-01	(mg/kg-day)^-1	4.3E-03	6.0E-06	mg/kg-day	3.0E-03	mg/kg-day	0.002
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.1
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.1E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0009
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	6.5E-03	mg/kg-day	7.0E-01	mg/kg-day	0.009
				Magnesium	1.14E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-04	mg/kg-day	1.4E-01	mg/kg-day	0.002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/kg-day	1.0E-05	mg/kg-day	0.02
			Ingestion Total								7.7E-03					0.2

Table E-14R
Calculation of COPC Cancer Risks and Noncancer Hazards - Construction Worker - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Eight
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					value	Unit	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							value	Unit	value	Unit		value	Unit	value	Unit	
Soil	Total Soil	Elizabeth Branch	Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	1.4E-10	mg/kg-day	7.3E-01	mg/kg-day^-1	1.0E-10	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E+00	mg/kg-day^-1	2.0E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	3.0E-10	mg/kg-day	7.3E-01	mg/kg-day^-1	2.2E-10	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	2.8E-10	mg/kg-day	7.3E-02	mg/kg-day^-1	2.0E-11	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	2.6E-10	mg/kg-day	7.3E-03	mg/kg-day^-1	1.9E-12	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	6.3E-15	mg/kg-day	1.3E+05	mg/kg-day^-1	8.2E-10	4.4E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00006
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	6.5E-09	mg/kg-day	1.5E+00	mg/kg-day^-1	9.7E-09	4.5E-07	mg/kg-day	3.0E-04	mg/kg-day	0.002
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								1.3E-08					0.002
	Total Elizabeth Branch Total Soil										9.0E-08					0.2
	Air	Elizabeth Branch	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	7.4E-12	µg/m^3	1.1E-04	µg/m^3^-1	8.1E-16	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-03	µg/m^3^-1	1.6E-14	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	1.6E-11	µg/m^3	1.1E-04	µg/m^3^-1	1.8E-15	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	1.5E-11	µg/m^3	1.1E-04	µg/m^3^-1	1.6E-15	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	1.4E-11	µg/m^3	1.1E-05	µg/m^3^-1	1.5E-16	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.4E-15	µg/m^3	3.8E+01	µg/m^3^-1	5.5E-14	1.0E-13	µg/m^3	4.0E-06	mg/m^3	0.000000003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	1.4E-04	µg/m^3	5.0E-03	mg/m^3	0.000003
				Arsenic	1.02E+01	mg/kg	1.5E-09	µg/m^3	4.3E-03	µg/m^3^-1	6.4E-12	1.0E-07	µg/m^3	1.5E-05	mg/m^3	0.0000007
				Chromium	2.31E+01	mg/kg	4.0E-09	µg/m^3	8.4E-02	µg/m^3	3.4E-10	2.8E-10	mg/m^3	1.0E-04	mg/m^3	0.0000003
				Cobalt	1.22E+01	mg/kg	1.8E-09	µg/m^3	9.0E-03	µg/m^3	1.6E-11	1.2E-10	mg/m^3	6.0E-06	mg/m^3	0.000002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.0E-03	µg/m^3	8.0E-04	mg/m^3	0.004
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.2E-03	mg/m^3	5.0E-05	mg/m^3	0.00002
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								3.0E-10					0.004
	Total Elizabeth Branch Air										3.0E-10					0.004
Total Elizabeth Branch Total Soil											9.1E-08					0.2

Table E-15R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Exposure Concentration		CDF Total Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	4.2E-11	mg/kg-day	1.3E+05	(mg/kg-day)^-1	5.4E-06	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	2.5E-05	mg/kg-day	1.5E+00	(mg/kg-day)^-1	3.8E-05	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Multiple Modes of Action. See Table 41				1.2E-04	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								1.6E-04					NA
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	2.8E-12	mg/kg-day	1.3E+05	(mg/kg-day)^-1	3.6E-07	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	1.7E-06	mg/kg-day	1.5E+00	(mg/kg-day)^-1	2.5E-06	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Multiple Modes of Action. See Table 41				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								2.9E-06					NA
	Total On Site Surface Soil										1.6E-04					NA
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.8E-12	µg/m^3	3.8E+01	(µg/m^3)^-1	7.0E-11	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	1.1E-06	µg/m^3	4.3E-03	µg/m^3	4.7E-09	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Multiple Modes of Action. See Table 41				5.4E-07	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	1.1E-06	µg/m^3	9.0E-03	(µg/m^3)^-1	1.0E-08	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								5.6E-07					NA
	Total On Site Air										5.6E-07					NA
Total On Site Surface Soil											1.6E-04					NA
Flenniken Branch																

Table E-15R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time/Frequency: Eight
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
					value	Unit	Intake Equation/Concentration		CF Total Risk		Cancer Risk	Intake Equation/Concentration		RfD/RfC		Hazard Quotient
							value	Unit	value	Unit		value	Unit	value	Unit	
Soil	Surface Soil	Residential Exposure	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 41				2.4E-07	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				4.8E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 41				5.2E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				4.8E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 41				4.6E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	1.4E-11	(mg/kg-day)-1	1.5E+05	(mg/kg-day)-1	1.9E-06	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	8.8E-06	(mg/kg-day)-1	1.5E+00	(mg/kg-day)-1	1.3E-05	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Modes of Action, See Table 41				1.2E-04	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								1.3E-04					NA
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Modes of Action, See Table 41				6.0E-08	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				1.2E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Modes of Action, See Table 41				1.3E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Modes of Action, See Table 41				1.2E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Modes of Action, See Table 41				1.1E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	9.5E-13	(mg/kg-day)-1	1.5E+05	(mg/kg-day)-1	1.2E-07	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	9.8E-07	(mg/kg-day)-1	1.5E+00	(mg/kg-day)-1	1.5E-06	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Modes of Action, See Table 41				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.0E-06					NA
	Total Residential Exposure Surface Soil										1.4E-04					NA

Table E-15R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
	Air	Flenniken Branch	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	Mutagenic Mode of Action: See Table 41				9.8E-13	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 41				1.9E-11	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Mutagenic Mode of Action: See Table 41				2.1E-12	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Mutagenic Mode of Action: See Table 41				1.9E-12	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Mutagenic Mode of Action: See Table 41				1.8E-13	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	6.3E-13	µg/m^3	3.8E+01	(µg/m^3)^-1	2.4E-11	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	6.5E-07	µg/m^3	4.3E-03	(µg/m^3)^-1	2.8E-09	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Mutagenic Mode of Action: See Table 41				5.4E-07	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	7.7E-07	µg/m^3	9.0E-03	µg/m^3	6.9E-09	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								5.5E-07					NA
	Total Flenniken Branch Air										5.5E-07					NA
Total Flenniken Branch Total Soil											1.4E-04					NA

Table E-16R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime - Fulltime
Receptor Population - Residential
Receptor Age - Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Unit	Intake Exposure Concentration		CDF Mutl Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.7E-10	mg/kg-day	7.0E-10	mg/kg-day	0.5
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	5.5E-01	mg/kg-day	1.0E+00	mg/kg-day	0.6
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	3.0E-04	mg/kg-day	0.7
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.7E-04	mg/kg-day	3.0E-03	mg/kg-day	0.2
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	3.0E-04	mg/kg-day	0.7
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	4.8E-03	mg/kg-day	4.0E-02	mg/kg-day	0.1
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.7
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.8E-02	mg/kg-day	1.4E-01	mg/kg-day	0.1
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	8.1E-06	mg/kg-day	1.0E-05	mg/kg-day	0.8
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	5.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.1
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	8.6E-03	mg/kg-day	3.0E-01	mg/kg-day	0.03
			Ingestion Total								NA					5
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	1.8E-11	mg/kg-day	7.0E-10	mg/kg-day	0.03
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	1.8E-05	mg/kg-day	3.0E-04	mg/kg-day	0.06
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.09
	Total On Site Surface Soil										NA					5
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	5.0E-12	µg/m3	4.0E-06	mg/m3	0.00000001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	7.3E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.0E-09	mg/m3	1.5E-05	mg/m3	0.00002
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	6.2E-09	mg/m3	1.0E-04	mg/m3	0.000006
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.9E-09	mg/m3	6.0E-06	mg/m3	0.00005
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/m3	5.0E-05	mg/m3	0.005
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	6.6E-09	mg/m3	1.0E-04	mg/m3	0.000007
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.007
	Total On Site Air										NA					0.007
Total On Site Surface Soil											NA					5
Flenniken Branch																

Table E-16R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.3E-10	mg/kg-day	7.0E-10	mg/kg-day	0.2
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.2
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.3E-04	mg/kg-day	3.0E-04	mg/kg-day	0.4
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	3.6E-04	mg/kg-day	3.0E-03	mg/kg-day	0.1
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.6E-04	mg/kg-day	3.0E-04	mg/kg-day	0.5
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.1E-05	mg/kg-day	6.0E-04	mg/kg-day	0.05
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	3.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.6
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.5E-02	mg/kg-day	1.4E-01	mg/kg-day	0.1
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	1.4E-05	mg/kg-day	1.0E-05	mg/kg-day	1
			Ingestion Total								NA					4
			Dermal	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	6.1E-12	mg/kg-day	7.0E-10	mg/kg-day	0.0088
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.035
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.04
	Total Flenniken Branch Surface Soil										NA					4

Table E-16R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.7E-12	µg/m^3	4.0E-08	mg/m^3	0.000000042
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-03	µg/m^3	5.0E-03	mg/m^3	0.0005
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-09	mg/m3	1.5E-05	mg/m3	0.0001
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	4.8E-09	mg/m3	1.0E-04	mg/m3	0.00005
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-09	mg/m3	6.0E-06	mg/m3	0.0003
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.0E-02	µg/m^3	8.0E-04	mg/m^3	0.06
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.9E-07	mg/m3	5.0E-05	mg/m3	0.004
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.07
	Total Flenniken Branch Air										NA					0.07
Total Flenniken Branch Surface Soil											NA					4

Table E-17R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Unit	Intake Equation/Concentration		CDF Multi Route		Cancer Risk	Intake Equation/Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.5E-11	mg/kg-day	7.0E-10	mg/kg-day	0.05
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	5.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.05
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.07
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.4E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.07
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	4.5E-04	mg/kg-day	4.0E-02	mg/kg-day	0.01
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	4.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.07
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.7E-03	mg/kg-day	1.4E-01	mg/kg-day	0.01
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	7.6E-07	mg/kg-day	1.0E-05	mg/kg-day	0.08
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.7E-05	mg/kg-day	5.0E-03	mg/kg-day	0.009
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	8.1E-04	mg/kg-day	3.0E-01	mg/kg-day	0.003
			Ingestion Total								NA					0.4
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	4.4E-12	mg/kg-day	7.0E-10	mg/kg-day	0.006
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.009
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.02
	Total On Site Surface Soil										NA					0.4
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	5.0E-12	µg/m3	4.0E-08	mg/m3	0.00000001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	7.3E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.0E-09	mg/m3	1.5E-05	mg/m3	0.00002
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	6.2E-09	mg/m3	1.0E-04	mg/m3	0.000006
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.9E-09	mg/m3	6.0E-06	mg/m3	0.0005
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	2.4E-07	mg/m3	5.0E-05	mg/m3	0.005
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	6.6E-09	mg/m3	1.0E-04	mg/m3	0.000007
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.007
	Total On Site Air										NA					0.007
Total On Site Surface Soil											NA					0.5

Table E-17R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Lifetime
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CSF Mutl Rsk		Cancer Rsk	Intake Exposure Concentration		RfD Rfc		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.2E-11	mg/kg-day	7.0E-10	mg/kg-day	0.02
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	1.7E-02	mg/kg-day	1.0E+00	mg/kg-day	0.02
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.2E-05	mg/kg-day	3.0E-04	mg/kg-day	0.04
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	3.4E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.05
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	2.9E-06	mg/kg-day	6.0E-04	mg/kg-day	0.005
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	3.6E-02	mg/kg-day	7.0E-01	mg/kg-day	0.05
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.4E-03	mg/kg-day	1.4E-01	mg/kg-day	0.01
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	1.3E-06	mg/kg-day	1.0E-05	mg/kg-day	0.1
			Ingestion Total								NA					0.3
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.5E-12	mg/kg-day	7.0E-10	mg/kg-day	0.002
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.005
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.007
	Total Flenniken Branch Surface Soil										NA					0.3

Table E-17R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.7E-12	µg/m^3	4.0E-08	mg/m^3	0.00000004
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-03	µg/m^3	5.0E-03	mg/m^3	0.0005
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-06	µg/m^3	1.5E-05	mg/m^3	0.0001
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	4.8E-09	mg/m3	1.0E-04	mg/m3	0.00005
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-09	mg/m3	6.0E-06	mg/m3	0.0003
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	5.0E-02	µg/m^3	8.0E-04	mg/m^3	0.06
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.9E-07	mg/m3	5.0E-05	mg/m3	0.004
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.07
	Total Flenniken Branch Air										NA					0.07
Total Flenniken Branch Total Soil											NA					0.4

Table E-18R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime Exposure
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Exposure Concentration		CF Dual Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					ppm	Unit	ppm	Unit	ppm	Unit		ppm	Unit	ppm	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	1.81E-11	mg/kg-day	1.3E+05	mg/kg-day-1	2.4E-06	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	6.44E-06	mg/kg-day	1.5E+00	mg/kg-day-1	9.7E-06	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action. See Table 4C				5.4E-05	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								6.6E-05					NA
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	5.94E-13	mg/kg-day	1.3E+05	mg/kg-day-1	7.7E-08	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	3.51E-07	mg/kg-day	1.5E+00	mg/kg-day-1	5.3E-07	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action. See Table 4C				NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								8.0E-07					NA
	Total On Site Surface Soil										6.7E-05					NA
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	7.07E-13	µg/m3	3.3E+01	(µg/m3)-1	2.7E-11	NA	NA	NA	NA	NA
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	4.19E-07	µg/m3	4.3E-03	(µg/m3)-1	1.8E-09	NA	NA	NA	NA	NA
				Chromium	3.66E+01	mg/kg	Mutagenic Mode of Action. See Table 4C				1.9E-07	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	4.27E-07	µg/m3	9.0E-03	(µg/m3)-1	3.8E-09	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.9E-07					NA
	Total On Site Air										1.9E-07					NA
Total On Site Surface Soil											6.7E-05					NA

Table E-18R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime Eight
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
							Intake Equation/Constant		CF Total Risk		Cancer Risk	Intake Equation/Constant		RfD/RfC		Hazard Quotient
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Model or Action See Table 4S				1.1E-07	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				2.2E-06	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Model or Action See Table 4S				2.4E-07	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				2.2E-08	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Model or Action See Table 4S				2.1E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	6.19E-12	mg/kg/day	1.3E+05	mg/kg/day-1	8.0E-07	NA	NA	NA	NA	NA
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	3.81E-06	mg/kg/day	1.5E+00	mg/kg/day-1	5.7E-06	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Model or Action See Table 4S				4.2E-05	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Ingestion Total								5.1E-05					NA
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Model or Action See Table 4S				1.4E-09	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				9.4E-09	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Model or Action See Table 4S				1.1E-08	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Model or Action See Table 4S				9.4E-09	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	Multiple Model or Action See Table 4S				2.7E-09	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	2.03E-13	mg/kg/day	1.3E+05	mg/kg/day-1	2.6E-08	NA	NA	NA	NA	NA
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	2.08E-07	mg/kg/day	1.5E+00	mg/kg/day-1	3.1E-07	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Model or Action See Table 4S				NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								3.7E-07					NA
	Total Flenniken Branch Surface Soil										5.1E-05					NA

Table E-18R
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Cancer Risk = Intake * CSF
Noncancer Hazard Quotient = Intake / RfD
Noncancer Age Adjusted = Intake / RfD

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
							Intake Equation/Constant		CSF/Unit Risk		Cancer Risk	Intake Equation/Constant		RfD/RfC		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	Fleetwood Estate	Inhalation	Benzo(a)anthracene	5.10E-02	mg/kg	Multiple Mode of Action, See Table 4.3				3.4E-13	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	Multiple Mode of Action, See Table 4.3				6.7E-12	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	Multiple Mode of Action, See Table 4.3				7.4E-13	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	Multiple Mode of Action, See Table 4.3				6.7E-13	NA	NA	NA	NA	NA
				Chrysene	9.00E-02	mg/kg	Multiple Mode of Action, See Table 4.3				6.5E-14	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	2.42E-13	µg/m^3	3.8E+01	(µg/m^3)^-1	9.2E-12	NA	NA	NA	NA	NA
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	2.48E-07	µg/m^3	4.3E-03	(µg/m^3)^-1	1.1E-09	NA	NA	NA	NA	NA
				Chromium	2.81E+01	mg/kg	Multiple Mode of Action, See Table 4.3				1.4E-07	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	2.56E-07	µg/m^3	9.0E-03	µg/m^3	2.3E-09	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								1.5E-07					NA
	Total Fleetwood Estate Air										1.5E-07					NA
Total Fleetwood Estate Surface Soil											5.1E-05					NA

Table E-19R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Eight
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDF Mutl Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	1.9E-10	mg/kg-day	7.0E-10	mg/kg-day	0.3
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.3
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	3.0E-04	mg/kg-day	0.4
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	2.3E-04	mg/kg-day	3.0E-03	mg/kg-day	0.08
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.1E-04	mg/kg-day	3.0E-04	mg/kg-day	0.4
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	2.4E-03	mg/kg-day	4.0E-02	mg/kg-day	0.06
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	2.4E-01	mg/kg-day	7.0E-01	mg/kg-day	0.3
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	8.9E-03	mg/kg-day	1.4E-01	mg/kg-day	0.06
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	4.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.4
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	2.5E-04	mg/kg-day	5.0E-03	mg/kg-day	0.05
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	4.3E-03	mg/kg-day	3.0E-01	mg/kg-day	0.01
			Ingestion Total								NA					2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	6.0E-12	mg/kg-day	7.0E-10	mg/kg-day	0.009
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.01
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.02
	Total On Site Surface Soil										NA					2
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.3E-12	µg/m3	4.0E-08	mg/m3	0.000000083
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	1.5E-05	mg/m3	0.00001
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.1E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	6.0E-06	mg/m3	0.0003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.6E-07	mg/m3	5.0E-05	mg/m3	0.003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.4E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.005
	Total On Site Air										NA					0.005
Total On Site Surface Soil											NA					2

Table E-19R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Lifetime
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDF Total Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	6.3E-11	mg/kg-day	7.0E-10	mg/kg-day	0.09
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	8.9E-02	mg/kg-day	1.0E+00	mg/kg-day	0.09
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	6.5E-05	mg/kg-day	3.0E-04	mg/kg-day	0.2
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	1.3E-04	mg/kg-day	3.0E-03	mg/kg-day	0.06
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	7.8E-05	mg/kg-day	3.0E-04	mg/kg-day	0.3
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.5E-05	mg/kg-day	6.0E-04	mg/kg-day	0.03
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	1.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.3
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	7.3E-03	mg/kg-day	1.4E-01	mg/kg-day	0.05
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	7.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.7
				Vanadium	2.25E+01	mg/kg	NA	NA	NA	NA	NA	1.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.03
			Ingestion Total								NA					2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	2.0E-12	mg/kg-day	7.0E-10	mg/kg-day	0.003
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	2.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.007
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.01
	Total Flenniken Branch Surface Soil										NA					2

Table E-19R
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Lifetime Fylgte
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concentration	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CSF Mutl Rsk		Cancer Risk	Intake Exposure Concentration		RfD Rfc		
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	Hazard Quotient
	Air	Fleetwood Estate	Inhalation	Benzo[a]anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo[a]pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo[b]fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo[k]fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.1E-12	µg/m^3	4.0E-08	mg/m^3	0.000000003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	1.6E-03	µg/m^3	5.0E-03	mg/m^3	0.00003
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.2E-06	µg/m^3	1.5E-05	mg/m^3	0.000003
				Chromium	2.31E+01	mg/kg	NA	NA	NA	NA	NA	3.2E-09	mg/m^3	1.0E-04	mg/m^3	0.000003
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.4E-09	mg/m^3	6.0E-06	mg/m^3	0.00002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.3E-02	µg/m^3	8.0E-04	mg/m^3	0.04
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/m^3	5.0E-05	mg/m^3	0.003
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.04
	Total Fleetwood Estate Air										NA					0.04
Total Fleetwood Estate Surface Soil											NA					2

Table E-20R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CDF Mutl Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
On Site																
Soil	Surface Soil	On Site	Ingestion	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	1.7E-11	mg/kg-day	7.0E-10	mg/kg-day	0.02
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	2.6E-02	mg/kg-day	1.0E+00	mg/kg-day	0.03
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-05	mg/kg-day	3.0E-03	mg/kg-day	0.007
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	1.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.03
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	2.2E-04	mg/kg-day	4.0E-02	mg/kg-day	0.006
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	2.3E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	8.3E-04	mg/kg-day	1.4E-01	mg/kg-day	0.006
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	3.8E-07	mg/kg-day	1.0E-05	mg/kg-day	0.04
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	2.3E-05	mg/kg-day	5.0E-03	mg/kg-day	0.005
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	4.0E-04	mg/kg-day	3.0E-01	mg/kg-day	0.001
			Ingestion Total								NA					0.2
			Dermal	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	6.3E-13	mg/kg-day	7.0E-10	mg/kg-day	0.001
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	3.8E-07	mg/kg-day	3.0E-04	mg/kg-day	0.001
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.002
	Total On Site Surface Soil										NA					0.2
	Air	On Site	Inhalation	2,3,7,8-TCDD TEQ	2.90E-05	mg/kg	NA	NA	NA	NA	NA	3.3E-12	µg/m3	4.0E-06	mg/m3	0.000000003
				Aluminum	4.33E+04	mg/kg	NA	NA	NA	NA	NA	4.9E-06	mg/m3	5.0E-03	mg/m3	0.001
				Arsenic	1.75E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	1.5E-05	mg/m3	0.00001
				Chromium	3.66E+01	mg/kg	NA	NA	NA	NA	NA	4.1E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Cobalt	1.73E+01	mg/kg	NA	NA	NA	NA	NA	2.0E-09	mg/m3	6.0E-06	mg/m3	0.000003
				Copper	3.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.83E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.39E+03	mg/kg	NA	NA	NA	NA	NA	1.6E-07	mg/m3	5.0E-05	mg/m3	0.003
				Thallium	6.30E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Vanadium	3.92E+01	mg/kg	NA	NA	NA	NA	NA	4.4E-09	mg/m3	1.0E-04	mg/m3	0.000004
				Zinc	6.73E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.005
	Total On Site Air										NA					0.005
Total On Site Surface Soil											NA					0.2

Table E-20R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (Years): Fulltime
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake Exposure Concentration		CSF Total Risk		Cancer Risk	Intake Exposure Concentration		RfD Ref		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Flenniken Branch																
Soil	Surface Soil	Flenniken Branch	Ingestion	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	5.9E-12	mg/kg-day	7.0E-10	mg/kg-day	0.008
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	8.3E-03	mg/kg-day	1.0E+00	mg/kg-day	0.008
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	6.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	1.7E-05	mg/kg-day	3.0E-03	mg/kg-day	0.01
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	7.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.02
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	1.4E-06	mg/kg-day	6.0E-04	mg/kg-day	0.002
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	1.8E-02	mg/kg-day	7.0E-01	mg/kg-day	0.03
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	6.8E-04	mg/kg-day	1.4E-01	mg/kg-day	0.005
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	6.6E-07	mg/kg-day	1.0E-05	mg/kg-day	0.07
			Ingestion Total								NA					0.2
			Dermal	Benzo(a)anthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(a)pyrene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(b)fluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzo(k)fluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	2.1E-13	mg/kg-day	7.0E-10	mg/kg-day	0.00003
				Aluminum	1.29E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	2.2E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0007
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Dermal Total								NA					0.001
	Total Flenniken Branch Surface Soil										NA					0.2

Table E-20R
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Soil Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
	Air	Flenniken Branch	Inhalation	Benzoraranthracene	5.10E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzoraryprene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorbifluoranthene	1.10E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Benzorkifluoranthene	1.00E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Chrysene	9.60E-02	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				2,3,7,8-TCDD TEQ	9.90E-06	mg/kg	NA	NA	NA	NA	NA	1.1E-12	µg/m^3	4.0E-08	mg/m^3	0.00000003
				Aluminum	1.39E+04	mg/kg	NA	NA	NA	NA	NA	1.6E-03	µg/m^3	5.0E-03	mg/m^3	0.0003
				Arsenic	1.02E+01	mg/kg	NA	NA	NA	NA	NA	1.2E-06	µg/m^3	1.5E-05	mg/m^3	0.00008
				Chromium	2.81E+01	mg/kg	NA	NA	NA	NA	NA	3.2E-09	mg/m3	1.0E-04	mg/m3	0.00003
				Cobalt	1.22E+01	mg/kg	NA	NA	NA	NA	NA	1.4E-09	mg/m3	6.0E-06	mg/m3	0.0002
				Cyanide	2.40E+00	mg/kg	NA	NA	NA	NA	NA	3.3E-02	µg/m^3	8.0E-04	mg/m^3	0.04
				Iron	3.03E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Manganese	1.14E+03	mg/kg	NA	NA	NA	NA	NA	1.3E-07	mg/m3	5.0E-05	mg/m3	0.003
				Thallium	1.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Inhalation Total								NA					0.04
	Total Flenniken Branch Air										NA					0.04
Total Flenniken Branch Surface Soil											NA					0.2

Table E-21
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Age-adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	2.2E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				2,4-Dinitrotoluene	5.0E+00	µg/L	6.5E-05	mg/kg-day	3.1E-01	(mg/kg-day)-1	2.0E-05	--	--	--	--	--
				4,4'-DDD	3.20E-02	µg/L	4.1E-07	mg/kg-day	2.4E-01	(mg/kg-day)-1	9.9E-08	--	--	--	--	--
				Benzene	1.12E+00	µg/L	1.4E-05	mg/kg-day	5.5E-02	(mg/kg-day)-1	7.9E-07	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	3.0E-04	mg/kg-day	1.4E-02	(mg/kg-day)-1	4.1E-06	--	--	--	--	--
				Bromodichloromethane	3.20E-01	µg/L	4.1E-06	mg/kg-day	6.2E-02	(mg/kg-day)-1	2.5E-07	--	--	--	--	--
				Bromomethane	1.45E+00	µg/L	1.9E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Chloroform	9.10E+00	µg/L	1.2E-04	mg/kg-day	3.1E-02	(mg/kg-day)-1	3.6E-06	--	--	--	--	--
				Dibromochloromethane	1.60E+00	µg/L	2.1E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Dieldrin	3.40E-02	µg/L	4.4E-07	mg/kg-day	1.6E+01	(mg/kg-day)-1	7.0E-06	--	--	--	--	--
				Ethylbenzene	1.90E+00	µg/L	2.5E-05	mg/kg-day	1.1E-02	(mg/kg-day)-1	2.7E-07	--	--	--	--	--
				Naphthalene	3.14E+00	µg/L	4.0E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	3.01E+00	µg/L	3.9E-05	mg/kg-day	4.0E-01	(mg/kg-day)-1	1.5E-05	--	--	--	--	--
				Phenol	1.57E+02	µg/L	2.0E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Tetrachloroethene	5.89E+00	µg/L	7.6E-05	mg/kg-day	2.1E-03	(mg/kg-day)-1	1.6E-07	--	--	--	--	--
				Trichloroethene	1.99E+00	µg/L	Mutagenic Mode of Action See Table 4-7				1.7E-06	--	--	--	--	--
				1,3-Dichloropropene	8.74E+00	µg/L	1.1E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Aluminum	5.62E+04	µg/L	7.2E-01	mg/kg-day	NA	--	NA	--	--	--	--	--
				Antimony	7.74E+00	µg/L	1.0E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Arsenic	1.40E+01	µg/L	1.8E-04	mg/kg-day	1.5E+00	(mg/kg-day)-1	2.7E-04	--	--	--	--	--
				Barium	1.03E+01	µg/L	1.3E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Cadmium	2.34E+00	µg/L	3.0E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Chromium	3.14E+01	µg/L	Mutagenic Mode of Action See Table 4-2				5.6E-04	--	--	--	--	--
				Cobalt	1.14E+03	µg/L	1.5E-02	mg/kg-day	NA	--	NA	--	--	--	--	--
				Copper	2.80E+02	µg/L	3.6E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Cyanide	1.07E+01	µg/L	1.4E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Iron	2.54E+03	µg/L	3.3E-02	mg/kg-day	NA	--	NA	--	--	--	--	--
				Lead	1.49E+01	µg/L	1.9E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Magnesium	6.91E+04	µg/L	8.9E-01	mg/kg-day	NA	--	NA	--	--	--	--	--
				Manganese	6.99E+00	µg/L	9.0E-05	mg/kg-day	NA	--	NA	--	--	--	--	--
				Molybdenum	1.20E+02	µg/L	1.5E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Nickel	7.56E+02	µg/L	9.7E-03	mg/kg-day	NA	--	NA	--	--	--	--	--
				Selenium	1.75E+01	µg/L	2.2E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Strontium	1.80E+03	µg/L	2.3E-02	mg/kg-day	NA	--	NA	--	--	--	--	--
				Thallium	2.27E+01	µg/L	2.9E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Vanadium	2.30E+01	µg/L	3.0E-04	mg/kg-day	NA	--	NA	--	--	--	--	--
				Zinc	2.33E+04	µg/L	3.0E-01	mg/kg-day	NA	--	NA	--	--	--	--	--
			Ingestion Total								8.3E-04					--

Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	2.5E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				2,4-Dinitrotoluene	5.06E+00	µg/L	3.9E-06	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	1.2E-06	--	--	--	--	--
				4,4'-DDD	3.20E-02	µg/L	4.0E-06	(mg/kg-day)	2.4E-01	(mg/kg-day)^-1	9.5E-07	--	--	--	--	--
				Benzene	1.12E+00	µg/L	2.2E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	1.2E-07	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	2.0E-02	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	2.8E-04	--	--	--	--	--
				Bromodichloromethane	3.20E-01	µg/L	2.9E-07	(mg/kg-day)	6.2E-02	(mg/kg-day)^-1	1.8E-08	--	--	--	--	--
				Bromomethane	1.45E+00	µg/L	5.9E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chloroform	9.10E+00	µg/L	1.0E-05	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	3.3E-07	--	--	--	--	--
				Dibenzofuran	1.60E+00	µg/L	3.6E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Dieldrin	3.40E-02	µg/L	8.1E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	1.3E-05	--	--	--	--	--
				Ethylbenzene	1.93E+00	µg/L	1.5E-05	(mg/kg-day)	1.1E-02	(mg/kg-day)^-1	1.6E-07	--	--	--	--	--
				Naphthalene	3.14E+00	µg/L	2.6E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	3.01E+00	µg/L	1.5E-04	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	6.0E-05	--	--	--	--	--
				Phenol	1.57E+02	µg/L	9.3E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Tetrachloroethene	5.89E+00	µg/L	4.5E-05	(mg/kg-day)	2.1E-03	(mg/kg-day)^-1	9.4E-08	--	--	--	--	--
				Trichloroethene	1.99E+00	µg/L	Mutagenic Mode of Action See Table 47				2.8E-07	--	--	--	--	--
				vinyl chloride	8.94E+00	µg/L	7.4E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Aluminum	5.62E+04	µg/L	4.0E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Antimony	7.94E+00	µg/L	5.7E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Arsenic	1.40E+01	µg/L	1.0E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.5E-06	--	--	--	--	--
				Beryllium	1.03E+01	µg/L	7.4E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cadmium	2.34E+00	µg/L	1.7E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chromium	3.14E+01	µg/L	Mutagenic Mode of Action See Table 42				1.4E-04	--	--	--	--	--
				Cobalt	1.14E+03	µg/L	3.3E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Copper	2.30E+02	µg/L	2.0E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cyanide	1.07E+01	µg/L	7.6E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Iron	2.54E+03	µg/L	1.8E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Lead	1.49E+01	µg/L	1.1E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Manganese	6.91E+04	µg/L	4.9E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Mercury	6.99E+00	µg/L	5.0E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Molybdenum	1.20E+02	µg/L	8.6E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Nickel	7.56E+02	µg/L	1.1E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Selenium	1.75E+01	µg/L	1.2E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Strontium	1.30E+03	µg/L	1.3E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Thallium	2.27E+01	µg/L	1.6E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Vanadium	2.30E+01	µg/L	1.6E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Zinc	2.33E+04	µg/L	1.0E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
			Dermal Total								5.0E-04					...
	Total Shallow Groundwater										1.4E-03					...
	Indoor Air (while showering)	Shallow	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	µg/L	1.5E-03	(mg/m^3)	NA	--	NA	--	--	--	--	--
				Benzene	1.12E+00	µg/L	1.2E-03	(mg/m^3)	7.8E-06	(µg/m3)^-1	9.6E-11	--	--	--	--	--
				Bromodichloromethane	3.20E-01	µg/L	2.3E-09	(mg/m^3)	3.7E-05	(µg/m3)^-1	8.6E-11	--	--	--	--	--
				Bromomethane	1.45E+00	µg/L	1.5E-03	(mg/m^3)	NA	--	NA	--	--	--	--	--
				Chloroform	9.10E+00	µg/L	8.1E-03	(mg/m^3)	2.3E-05	(µg/m3)^-1	1.9E-09	--	--	--	--	--
				Dibenzofuran	1.60E+00	µg/L	6.1E-09	(mg/m^3)	NA	--	NA	--	--	--	--	--
				Ethylbenzene	1.93E+00	µg/L	1.9E-03	(mg/m^3)	2.5E-06	(µg/m3)^-1	4.7E-11	--	--	--	--	--
				Naphthalene	3.14E+00	µg/L	1.9E-03	(mg/m^3)	3.4E-05	(µg/m3)^-1	6.3E-10	--	--	--	--	--
				Tetrachloroethene	5.89E+00	µg/L	4.7E-03	(mg/m^3)	2.6E-07	(µg/m3)^-1	1.2E-11	--	--	--	--	--
				Trichloroethene	1.99E+00	µg/L	1.3E-03	(mg/m^3)	4.1E-06	(µg/m3)^-1	7.2E-11	--	--	--	--	--
				vinyl chloride	8.94E+00	µg/L	8.6E-03	(mg/m^3)	NA	--	NA	--	--	--	--	--
	Total Indoor Air										2.8E-09					...
Total Shallow Groundwater											1.4E-03					...

Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	1.5E-05	(mg/kg-day)	9.1E-02	(mg/kg-day)^-1	1.4E-06	--	--	--	--	--
				2,4-Dinitrotoluene	1.29E+01	µg/L	1.7E-04	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	5.1E-05	--	--	--	--	--
				2,6-Dinitrotoluene	4.66E+00	µg/L	6.0E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	9.0E-05	--	--	--	--	--
				Benzene	8.61E-01	µg/L	1.1E-05	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	6.1E-07	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	8.6E-04	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	1.2E-05	--	--	--	--	--
				Bromomethane	2.90E+00	µg/L	3.7E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chloroform	2.02E+00	µg/L	2.6E-05	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	8.0E-07	--	--	--	--	--
				Dieldrin	3.50E-02	µg/L	4.5E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	7.2E-06	--	--	--	--	--
				Heptachlor epoxide	5.40E-02	µg/L	6.9E-07	(mg/kg-day)	9.1E+00	(mg/kg-day)^-1	6.3E-06	--	--	--	--	--
				Naphthalene	1.00E+00	µg/L	2.1E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	2.50E+00	µg/L	3.2E-05	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	1.3E-05	--	--	--	--	--
				Trichloroethene	5.30E-01	µg/L	Mutagenic Mode of Action See Table 47				4.9E-07	--	--	--	--	--
				Aluminum	3.66E+03	µg/L	5.0E-02	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Arsenic	6.67E+00	µg/L	8.6E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	1.3E-04	--	--	--	--	--
				Barium	4.80E+00	µg/L	6.2E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cadmium	2.75E+00	µg/L	3.5E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chromium	2.11E+01	µg/L	Mutagenic Mode of Action See Table 42				3.8E-04	--	--	--	--	--
				Cobalt	1.52E+01	µg/L	1.9E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Copper	3.43E+01	µg/L	4.5E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cyanide	1.10E+01	µg/L	1.4E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Iron	1.25E+04	µg/L	1.6E-01	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Lead	4.66E+00	µg/L	6.0E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Magnesium	1.00E+05	µg/L	1.3E+00	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Manganese	1.54E+01	µg/L	2.0E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Molybdenum	2.00E+02	µg/L	2.6E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Nickel	4.83E+01	µg/L	6.2E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Selenium	3.44E+01	µg/L	4.4E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Strontium	8.60E+03	µg/L	1.1E-01	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Thallium	1.74E+01	µg/L	2.2E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Vanadium	2.80E+01	µg/L	3.6E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Zinc	1.24E+02	µg/L	1.6E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
			Ingestion Total								6.9E-04					--
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	7.5E-07	(mg/kg-day)	9.1E-02	(mg/kg-day)^-1	6.8E-08	--	--	--	--	--
				2,4-Dinitrotoluene	1.29E+01	µg/L	1.0E-05	(mg/kg-day)	3.1E-01	(mg/kg-day)^-1	3.1E-06	--	--	--	--	--
				2,6-Dinitrotoluene	4.66E+00	µg/L	4.4E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	6.6E-06	--	--	--	--	--
				Benzene	8.61E-01	µg/L	1.7E-06	(mg/kg-day)	5.5E-02	(mg/kg-day)^-1	9.1E-08	--	--	--	--	--
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	5.9E-02	(mg/kg-day)	1.4E-02	(mg/kg-day)^-1	8.3E-04	--	--	--	--	--
				Bromomethane	2.90E+00	µg/L	1.2E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chloroform	2.02E+00	µg/L	2.3E-06	(mg/kg-day)	3.1E-02	(mg/kg-day)^-1	7.2E-08	--	--	--	--	--
				Dieldrin	3.50E-02	µg/L	8.4E-07	(mg/kg-day)	1.6E+01	(mg/kg-day)^-1	1.3E-05	--	--	--	--	--
				Heptachlor epoxide	5.40E-02	µg/L	8.6E-07	(mg/kg-day)	9.1E+00	(mg/kg-day)^-1	7.8E-06	--	--	--	--	--
				Naphthalene	1.00E+00	µg/L	1.3E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Pentachlorophenol	2.50E+00	µg/L	1.2E-04	(mg/kg-day)	4.0E-01	(mg/kg-day)^-1	5.0E-05	--	--	--	--	--
				Trichloroethene	5.30E-01	µg/L	Mutagenic Mode of Action See Table 47				8.1E-08	--	--	--	--	--
				Aluminum	3.66E+03	µg/L	2.3E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Arsenic	6.67E+00	µg/L	4.3E-07	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	7.1E-07	--	--	--	--	--
				Barium	4.80E+00	µg/L	3.4E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cadmium	2.75E+00	µg/L	2.0E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Chromium	2.11E+01	µg/L	Mutagenic Mode of Action See Table 42				9.3E-05	--	--	--	--	--
				Cobalt	1.52E+01	µg/L	4.3E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Copper	3.43E+01	µg/L	2.5E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Cyanide	1.10E+01	µg/L	7.9E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Iron	1.25E+04	µg/L	9.0E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--

				Lead	4.60E+00	pg/L	3.3E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
Groundwater	Groundwater	Deep	Dermal	Manganese	1.00E+05	pg/L	7.2E-03	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Mercury	1.54E-01	pg/L	1.1E-08	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Molybdenum	2.00E+02	pg/L	1.4E-05	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Nickel	4.83E+01	pg/L	6.9E-07	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Selenium	3.44E+01	pg/L	2.5E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Strontium	8.60E+03	pg/L	6.1E-04	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Thallium	1.74E+01	pg/L	1.2E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Vanadium	2.80E+01	pg/L	2.0E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
				Zinc	1.24E+02	pg/L	5.3E-06	(mg/kg-day)	NA	--	NA	--	--	--	--	--
			Dermal Total								1.0E-03					...
	Total Deep Groundwater										1.7E-03					...
	Indoor Air (while showering)	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	pg/L	1.0E-06	(mg/m^3)	2.6E-05	(µg/m3)^-1	2.7E-10	--	--	--	--	...
				Benzene	8.61E-01	pg/L	9.5E-09	(mg/m^3)	7.8E-06	(µg/m3)^-1	7.4E-11	--	--	--	--	...
				Bromomethane	2.90E+00	pg/L	2.9E-06	(mg/m^3)	NA	--	NA	--	--	--	--	...
				Chloroform	2.02E+00	pg/L	1.8E-06	(mg/m^3)	2.3E-05	(µg/m3)^-1	4.1E-10	--	--	--	--	...
				Naphthalene	1.60E+00	pg/L	9.5E-09	(mg/m^3)	3.4E-05	(µg/m3)^-1	3.2E-10	--	--	--	--	...
				Trichloroethene	5.30E-01	pg/L	5.1E-09	(mg/m^3)	4.1E-06	(µg/m3)^-1	2.1E-11	--	--	--	--	...
			Inhalation Total								1.1E-09					...
	Total Indoor Air										1.1E-09					...
Total Deep Groundwater											1.7E-03					...

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	8.5E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	2.5E-04	mg/kg-day	2.0E-03	mg/kg-day	0.13
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	5.6E-05	mg/kg-day	4.0E-03	mg/kg-day	0.014
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	2.0E-02	mg/kg-day	0.057
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	1.6E-05	mg/kg-day	2.0E-02	mg/kg-day	0.00080
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	7.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.052
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	4.5E-04	mg/kg-day	1.0E-02	mg/kg-day	0.045
				Dibromochloromethane	1.60E+00	µg/L	---	--	--	--	--	8.0E-05	mg/kg-day	1.0E-03	mg/kg-day	0.080
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	5.0E-05	mg/kg-day	0.034
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	9.6E-05	mg/kg-day	1.0E-01	mg/kg-day	0.0010
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	2.0E-02	mg/kg-day	0.008
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	1.5E-04	mg/kg-day	5.0E-03	mg/kg-day	0.030
				Phenol	1.57E+02	µg/L	---	--	--	--	--	7.8E-03	mg/kg-day	3.0E-01	mg/kg-day	0.026
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	2.9E-04	mg/kg-day	6.0E-03	mg/kg-day	0.049
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	9.9E-05	mg/kg-day	5.0E-04	mg/kg-day	0.20
				Vinyl chloride	8.94E+00	µg/L	---	--	--	--	--	4.5E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0022
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	2.8E+00	mg/kg-day	1.0E+00	mg/kg-day	2.8
				Antimony	7.94E+00	µg/L	---	--	--	--	--	4.0E-04	mg/kg-day	4.0E-04	mg/kg-day	1.0
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	7.0E-04	mg/kg-day	3.0E-04	mg/kg-day	2.3
				Barium	1.03E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	2.0E-03	mg/kg-day	0.26
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	5.0E-04	mg/kg-day	0.2
				Chromium	3.14E+01	µg/L	---	--	--	--	--	1.6E-03	mg/kg-day	3.0E-03	mg/kg-day	0.52
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	5.7E-02	mg/kg-day	3.0E-04	mg/kg-day	190
				Copper	2.80E+02	µg/L	---	--	--	--	--	1.4E-02	mg/kg-day	4.0E-02	mg/kg-day	0.35
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	5.3E-04	mg/kg-day	6.0E-04	mg/kg-day	0.89
				Iron	2.54E+03	µg/L	---	--	--	--	--	1.3E-01	mg/kg-day	7.0E-01	mg/kg-day	0.2
				Lead	1.49E+01	µg/L	---	--	--	--	--	7.4E-04	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	3.4E+00	mg/kg-day	2.4E-02	mg/kg-day	140
				Mercury	6.99E+00	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	3.0E-04	mg/kg-day	1.2
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	6.0E-03	mg/kg-day	5.0E-03	mg/kg-day	1.2
				Nickel	7.56E+02	µg/L	---	--	--	--	--	3.8E-02	mg/kg-day	2.0E-02	mg/kg-day	1.9
				Selenium	1.75E+01	µg/L	---	--	--	--	--	8.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.17
				Silver	1.80E+03	µg/L	---	--	--	--	--	9.0E-02	mg/kg-day	6.0E-01	mg/kg-day	0.15
				Thallium	2.27E+01	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	1.0E-05	mg/kg-day	110
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	5.0E-03	mg/kg-day	0.23
				Zinc	2.33E+04	µg/L	---	--	--	--	--	1.2E+00	mg/kg-day	3.0E-01	mg/kg-day	3.9
			Ingestion Total								--					465

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	1.9E-05	mg/kg-day	2.0E-03	mg/kg-day	0.0095
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	1.9E-05	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0028
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	9.6E-02	mg/kg-day	2.0E-02	mg/kg-day	4.8
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	1.4E-06	mg/kg-day	2.0E-02	mg/kg-day	0.00006.8
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	2.9E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0021
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	4.9E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0049
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	1.7E-04	mg/kg-day	1.0E-03	mg/kg-day	0.17
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.076
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	6.9E-05	mg/kg-day	1.0E-01	mg/kg-day	0.0006.9
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	2.0E-02	mg/kg-day	0.0062
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	7.1E-04	mg/kg-day	5.0E-03	mg/kg-day	0.14
				Phenol	1.57E+02	µg/L	---	--	--	--	--	4.8E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0016
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	2.1E-04	mg/kg-day	6.0E-03	mg/kg-day	0.035
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	2.0E-05	mg/kg-day	5.0E-04	mg/kg-day	0.040
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0017
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	1.2E-02	mg/kg-day	1.0E+00	mg/kg-day	0.012
				Antimony	7.94E+00	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	6.0E-05	mg/kg-day	0.029
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.010
				Barium	1.03E+01	µg/L	---	--	--	--	--	2.2E-06	mg/kg-day	1.4E-05	mg/kg-day	0.16
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	5.1E-07	mg/kg-day	2.5E-05	mg/kg-day	0.021
				Chromium	3.14E+01	µg/L	---	--	--	--	--	6.9E-06	mg/kg-day	7.5E-05	mg/kg-day	0.092
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.34
				Copper	2.80E+02	µg/L	---	--	--	--	--	6.2E-05	mg/kg-day	4.0E-02	mg/kg-day	0.0015
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	2.3E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0039
				Iron	2.54E+03	µg/L	---	--	--	--	--	5.6E-04	mg/kg-day	7.0E-01	mg/kg-day	0.000080
				Lead	1.49E+01	µg/L	---	--	--	--	--	3.3E-07	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	1.5E-02	mg/kg-day	9.6E-04	mg/kg-day	16
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.5E-06	mg/kg-day	2.1E-05	mg/kg-day	0.073
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	2.6E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0053
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.6E-05	mg/kg-day	3.0E-04	mg/kg-day	0.042
				Selenium	1.75E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	5.0E-03	mg/kg-day	0.00077
				Strontium	1.80E+03	µg/L	---	--	--	--	--	4.0E-04	mg/kg-day	6.0E-01	mg/kg-day	0.000066
				Thallium	2.27E+01	µg/L	---	--	--	--	--	5.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.50
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	1.0E-04	mg/kg-day	0.0509
				Zinc	2.33E+04	µg/L	---	--	--	--	--	5.1E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0103
			Dermal Total								--					22
	Total Shallow Groundwater										--					487

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Total Shallow Groundwater											--					487
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	--	--	--	--	--	6.0E-05	mg/kg-day	6.0E-03	mg/kg-day	0.010
				2,4-Dinitrotoluene	1.29E+01	µg/L	--	--	--	--	--	6.4E-04	mg/kg-day	2.0E-03	mg/kg-day	0.32
				2,6-Dinitrotoluene	4.66E+00	µg/L	--	--	--	--	--	2.3E-04	mg/kg-day	3.0E-04	mg/kg-day	0.76
				Benzene	8.61E-01	µg/L	--	--	--	--	--	4.3E-05	mg/kg-day	4.0E-03	mg/kg-day	0.011
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	--	--	--	--	--	3.3E-03	mg/kg-day	2.0E-02	mg/kg-day	0.17
				Bromomethane	2.90E+00	µg/L	--	--	--	--	--	1.4E-04	mg/kg-day	1.4E-03	mg/kg-day	0.10
				Chloroform	2.02E+00	µg/L	--	--	--	--	--	1.0E-04	mg/kg-day	1.0E-02	mg/kg-day	0.010
				Dieldrin	3.50E-02	µg/L	--	--	--	--	--	1.7E-06	mg/kg-day	5.0E-05	mg/kg-day	0.035
				Heptachlor epoxide	5.40E-02	µg/L	--	--	--	--	--	2.7E-06	mg/kg-day	1.3E-05	mg/kg-day	0.21
				Naphthalene	1.66E+00	µg/L	--	--	--	--	--	8.3E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0040
				Pentachlorophenol	2.50E+00	µg/L	--	--	--	--	--	1.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.025
				Tetrachloroethene	5.60E-01	µg/L	--	--	--	--	--	2.8E-05	mg/kg-day	5.0E-04	mg/kg-day	0.056
				Aluminum	3.56E+03	µg/L	--	--	--	--	--	1.8E-01	mg/kg-day	1.0E+00	mg/kg-day	0.18
				Arsenic	6.67E+00	µg/L	--	--	--	--	--	3.3E-04	mg/kg-day	3.0E-04	mg/kg-day	1.1
				Barium	4.80E+00	µg/L	--	--	--	--	--	2.4E-04	mg/kg-day	2.0E-03	mg/kg-day	0.12
				Cadmium	2.75E+00	µg/L	--	--	--	--	--	1.4E-04	mg/kg-day	5.0E-04	mg/kg-day	0.27
				Chromium	2.11E+01	µg/L	--	--	--	--	--	1.1E-03	mg/kg-day	3.0E-03	mg/kg-day	0.35
				Cobalt	1.52E+01	µg/L	--	--	--	--	--	7.6E-04	mg/kg-day	3.0E-04	mg/kg-day	2.52
				Copper	3.48E+01	µg/L	--	--	--	--	--	1.7E-03	mg/kg-day	4.0E-02	mg/kg-day	0.04
				Cyanide	1.10E+01	µg/L	--	--	--	--	--	5.5E-04	mg/kg-day	6.0E-04	mg/kg-day	0.91
				Iron	1.25E+04	µg/L	--	--	--	--	--	6.3E-01	mg/kg-day	7.0E-01	mg/kg-day	0.89
				Lead	4.66E+00	µg/L	--	--	--	--	--	2.3E-04	mg/kg-day	NA	--	NA
				Manganese	1.00E+05	µg/L	--	--	--	--	--	5.0E+00	mg/kg-day	2.4E-02	mg/kg-day	209
				Mercury	1.54E-01	µg/L	--	--	--	--	--	7.7E-06	mg/kg-day	3.0E-04	mg/kg-day	0.026
				Molybdenum	2.00E+02	µg/L	--	--	--	--	--	1.0E-02	mg/kg-day	5.0E-03	mg/kg-day	2.0
				Nickel	4.83E+01	µg/L	--	--	--	--	--	2.4E-03	mg/kg-day	2.0E-02	mg/kg-day	0.12
				Selenium	3.44E+01	µg/L	--	--	--	--	--	1.7E-03	mg/kg-day	5.0E-03	mg/kg-day	0.34
				Strontium	8.60E+03	µg/L	--	--	--	--	--	4.3E-01	mg/kg-day	6.0E-01	mg/kg-day	0.71
				Thallium	1.74E+01	µg/L	--	--	--	--	--	8.7E-04	mg/kg-day	1.0E-05	mg/kg-day	87
				Vanadium	2.80E+01	µg/L	--	--	--	--	--	1.4E-03	mg/kg-day	5.0E-03	mg/kg-day	0.28
				Zinc	1.24E+02	µg/L	--	--	--	--	--	6.2E-03	mg/kg-day	3.0E-01	mg/kg-day	0.021
			Ingestion Total								--					307
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	--	--	--	--	--	3.7E-06	mg/kg-day	6.0E-03	mg/kg-day	0.000611
				2,4-Dinitrotoluene	1.29E+01	µg/L	--	--	--	--	--	4.7E-05	mg/kg-day	2.0E-03	mg/kg-day	0.024
				2,6-Dinitrotoluene	4.66E+00	µg/L	--	--	--	--	--	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.069
				Benzene	8.61E-01	µg/L	--	--	--	--	--	3.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.0022
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	--	--	--	--	--	2.8E-01	mg/kg-day	2.0E-02	mg/kg-day	14
				Bromomethane	2.90E+00	µg/L	--	--	--	--	--	5.9E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0042

Table E-22
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Deep	Dermal	Chloroform	2.02E+00	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0011
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	3.9E-06	mg/kg-day	5.0E-05	mg/kg-day	0.079
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	4.1E-06	mg/kg-day	1.3E-05	mg/kg-day	0.31
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	6.3E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0031
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	5.9E-04	mg/kg-day	5.0E-03	mg/kg-day	0.117
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	5.8E-06	mg/kg-day	5.0E-04	mg/kg-day	0.012
				Aluminum	3.36E+03	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	1.0E+00	mg/kg-day	0.00035
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0049
				Barium	4.60E+00	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	1.4E-05	mg/kg-day	0.075
				Cobalt	2.75E+00	µg/L	---	--	--	--	--	6.1E-07	mg/kg-day	2.5E-05	mg/kg-day	0.024
				Chromium	2.11E+01	µg/L	---	--	--	--	--	4.6E-06	mg/kg-day	7.5E-05	mg/kg-day	0.062
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0045
				Copper	3.48E+01	µg/L	---	--	--	--	--	7.7E-06	mg/kg-day	4.0E-02	mg/kg-day	0.000019
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	2.4E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0040
				Iron	1.25E+04	µg/L	---	--	--	--	--	2.8E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0039
				Lead	4.66E+00	µg/L	---	--	--	--	--	1.0E-07	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	2.2E-02	mg/kg-day	9.6E-04	mg/kg-day	23
				Mercury	1.54E-01	µg/L	---	--	--	--	--	3.4E-08	mg/kg-day	2.1E-05	mg/kg-day	0.0016
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	4.4E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0088
				Nickel	4.83E+01	µg/L	---	--	--	--	--	2.1E-06	mg/kg-day	8.0E-04	mg/kg-day	0.0027
				Selenium	3.44E+01	µg/L	---	--	--	--	--	7.6E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0015
				Strontium	8.60E+03	µg/L	---	--	--	--	--	1.9E-03	mg/kg-day	6.0E-01	mg/kg-day	0.0032
				Thallium	1.74E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	1.0E-05	mg/kg-day	0.38
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	6.2E-06	mg/kg-day	1.3E-04	mg/kg-day	0.047
				Zinc	1.24E+02	µg/L	---	--	--	--	--	1.6E-05	mg/kg-day	3.0E-01	mg/kg-day	0.000055
			Dermal Total								--					35
	Total Deep Groundwater										--					345
Total Deep Groundwater											--					345

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	--	--	--	--	--	5.1E-05	(mg/kg-day)	NA	--	NA
				2,4-Dinitrotoluene	5.0E+00	µg/L	--	--	--	--	--	1.5E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.076
				4,4'-DDD	3.20E-02	µg/L	--	--	--	--	--	9.6E-07	(mg/kg-day)	NA	--	NA
				Benzene	1.12E+00	µg/L	--	--	--	--	--	3.4E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0084
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	--	--	--	--	--	6.9E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.034
				Bromodichloromethane	3.20E-01	µg/L	--	--	--	--	--	9.6E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00048
				Bromomethane	1.45E+00	µg/L	--	--	--	--	--	4.3E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.031
				Chloroform	9.10E+00	µg/L	--	--	--	--	--	2.7E-04	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.027
				Dibenzofuran	1.60E+00	µg/L	--	--	--	--	--	4.8E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.048
				Dieldrin	3.40E-02	µg/L	--	--	--	--	--	1.0E-06	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.020
				Ethylbenzene	1.90E+00	µg/L	--	--	--	--	--	5.8E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00058
				Naphthalene	3.14E+00	µg/L	--	--	--	--	--	9.4E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0047
				Pentachlorophenol	3.01E+00	µg/L	--	--	--	--	--	9.0E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.018
				Phenol	1.57E+02	µg/L	--	--	--	--	--	4.7E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.016
				Tetrachloroethene	5.84E+00	µg/L	--	--	--	--	--	1.8E-04	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.029
				Trichloroethene	1.99E+00	µg/L	--	--	--	--	--	6.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.12
				1,1,1-Trichloroethane	8.94E+00	µg/L	--	--	--	--	--	2.7E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.0013
				Aluminum	5.62E+04	µg/L	--	--	--	--	--	1.7E+00	(mg/kg-day)	1.0E+00	(mg/kg-day)	1.7
				Antimony	7.94E+00	µg/L	--	--	--	--	--	2.4E-04	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.59
				Arsenic	1.40E+01	µg/L	--	--	--	--	--	4.2E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.4
				Barium	1.03E+01	µg/L	--	--	--	--	--	3.1E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.15
				Cadmium	2.34E+00	µg/L	--	--	--	--	--	7.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.14
				Chromium	3.14E+01	µg/L	--	--	--	--	--	9.4E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.31
				Cobalt	1.14E+03	µg/L	--	--	--	--	--	3.4E-02	(mg/kg-day)	3.0E-04	(mg/kg-day)	114
				Copper	2.80E+02	µg/L	--	--	--	--	--	8.4E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.21
				Cyanide	1.07E+01	µg/L	--	--	--	--	--	3.2E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.53
				Iron	2.54E+03	µg/L	--	--	--	--	--	7.6E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.11
				Lead	1.49E+01	µg/L	--	--	--	--	--	4.5E-04	(mg/kg-day)	NA	--	NA
				Magnesium	6.91E+04	µg/L	--	--	--	--	--	2.1E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	86
				Manganese	6.99E+00	µg/L	--	--	--	--	--	2.1E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.70
				Molybdenum	1.20E+02	µg/L	--	--	--	--	--	3.6E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.72
				Nickel	7.56E+02	µg/L	--	--	--	--	--	2.3E-02	(mg/kg-day)	2.0E-02	(mg/kg-day)	1.1
				Selenium	1.75E+01	µg/L	--	--	--	--	--	5.2E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.105
				Strontium	1.80E+03	µg/L	--	--	--	--	--	5.4E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.090
				Thallium	2.27E+01	µg/L	--	--	--	--	--	6.8E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	68
				Vanadium	2.30E+01	µg/L	--	--	--	--	--	6.9E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.14
				Zinc	2.33E+04	µg/L	--	--	--	--	--	7.0E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	2.3
			Ingestion Total								--					279

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	Hazard Quotient
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	5.4E-05	mg/kg-day	NA	--	NA
				2,4-Dinitrotoluene	5.0E+00	µg/L	---	--	--	--	--	8.7E-06	mg/kg-day	2.0E-03	mg/kg-day	0.0043
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	8.7E-06	mg/kg-day	NA	--	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	4.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.0012
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	4.5E-02	mg/kg-day	2.0E-02	mg/kg-day	2.2
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	6.4E-07	mg/kg-day	2.0E-02	mg/kg-day	0.000032
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	1.4E-03	mg/kg-day	0.00094
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	2.3E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0023
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	7.9E-05	mg/kg-day	1.0E-03	mg/kg-day	0.079
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.036
				Ethylbenzene	1.90E+00	µg/L	---	--	--	--	--	3.2E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00032
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	5.8E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0029
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	3.3E-04	mg/kg-day	5.0E-03	mg/kg-day	0.066
				Phenol	1.57E+02	µg/L	---	--	--	--	--	2.2E-04	mg/kg-day	3.0E-01	mg/kg-day	0.00072
				Tetrachloroethene	5.84E+00	µg/L	---	--	--	--	--	9.9E-05	mg/kg-day	6.0E-03	mg/kg-day	0.016
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	9.3E-06	mg/kg-day	5.0E-04	mg/kg-day	0.019
				1,1,2-Trichloro-1,2,2-trifluoroethane	8.94E+00	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	2.0E-01	mg/kg-day	0.000081
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	1.0E-02	mg/kg-day	1.0E+00	mg/kg-day	0.010
				Antimony	7.94E+00	µg/L	---	--	--	--	--	1.4E-06	mg/kg-day	6.0E-05	mg/kg-day	0.024
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0083
				Barium	1.03E+01	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	1.4E-05	mg/kg-day	0.13
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	4.2E-07	mg/kg-day	2.5E-05	mg/kg-day	0.017
				Chromium	3.14E+01	µg/L	---	--	--	--	--	5.6E-06	mg/kg-day	7.5E-05	mg/kg-day	0.074
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	8.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.27
				Copper	2.80E+02	µg/L	---	--	--	--	--	5.0E-05	mg/kg-day	4.0E-02	mg/kg-day	0.00125
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0032
				Iron	2.54E+03	µg/L	---	--	--	--	--	4.5E-04	mg/kg-day	7.0E-01	mg/kg-day	0.00065
				Lead	1.49E+01	µg/L	---	--	--	--	--	2.7E-07	mg/kg-day	NA	--	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	1.2E-02	mg/kg-day	9.6E-04	mg/kg-day	13
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	2.1E-05	mg/kg-day	0.059
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0043
				Nickel	7.56E+02	µg/L	---	--	--	--	--	2.7E-05	mg/kg-day	8.0E-04	mg/kg-day	0.034
				Selenium	1.75E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	5.0E-03	mg/kg-day	0.00062
				Strontium	1.80E+03	µg/L	---	--	--	--	--	3.2E-04	mg/kg-day	6.0E-01	mg/kg-day	0.00053
				Thallium	2.27E+01	µg/L	---	--	--	--	--	4.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.404
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	4.1E-06	mg/kg-day	1.3E-04	mg/kg-day	0.031
				Zinc	2.33E+04	µg/L	---	--	--	--	--	2.5E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0083
			Dermal Total								--					16
	Total Shallow Groundwater										--					29

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	Hazard Quotient
Groundwater	Indoor Air (while showering)	Shallow	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	µg/L	--	--	--	--	--	4.5E-06	mg/m^3	7.0E-03	mg/m^3	0.000000064
				Benzene	1.12E+00	µg/L	--	--	--	--	--	3.0E-06	mg/m^3	3.0E-02	mg/m^3	0.00000012
				Bromodichloromethane	3.20E-01	µg/L	--	--	--	--	--	8.5E-07	mg/m^3	NA	--	NA
				Bromomethane	1.45E+00	µg/L	--	--	--	--	--	4.0E-06	mg/m^3	5.0E-03	mg/m^3	0.000000800
				Chloroform	9.10E+00	µg/L	--	--	--	--	--	2.0E-07	mg/m^3	9.8E-02	mg/m^3	0.000000204
				Dibenzofuran	1.60E+00	µg/L	--	--	--	--	--	1.8E-06	mg/m^3	NA	--	NA
				Ethylbenzene	1.90E+00	µg/L	--	--	--	--	--	5.4E-06	mg/m^3	1.0E+00	mg/m^3	0.000000054
				Naphthalene	3.14E+00	µg/L	--	--	--	--	--	5.4E-06	mg/m^3	3.0E-03	mg/m^3	0.0000018
				Tetrachloroethene	5.89E+00	µg/L	--	--	--	--	--	1.4E-07	mg/m^3	4.0E-02	mg/m^3	0.000000034
				Trichloroethene	1.99E+00	µg/L	--	--	--	--	--	5.1E-06	mg/m^3	2.0E-03	mg/m^3	0.000002600
				m-Xylene + p-Xylene	8.94E+00	µg/L	--	--	--	--	--	2.5E-07	mg/m^3	1.0E-01	mg/m^3	0.000000025
	Total Indoor Air										--					0.000006.8
Total Shallow Groundwater											--					2%.
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	--	--	--	--	--	3.6E-05	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.006.0
				2,4-Dinitrotoluene	1.29E+01	µg/L	--	--	--	--	--	3.9E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.19
				2,6-Dinitrotoluene	4.66E+00	µg/L	--	--	--	--	--	1.4E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.47
				Benzene	8.61E-01	µg/L	--	--	--	--	--	2.6E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.006.5
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	--	--	--	--	--	2.0E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.10
				Bromomethane	2.90E+00	µg/L	--	--	--	--	--	8.7E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.062
				Chloroform	2.02E+00	µg/L	--	--	--	--	--	6.0E-05	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.006.0
				Dieldrin	3.50E-02	µg/L	--	--	--	--	--	1.0E-06	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.021
				Heptachlor epoxide	5.40E-02	µg/L	--	--	--	--	--	1.6E-06	(mg/kg-day)	1.3E-05	(mg/kg-day)	0.12
				Naphthalene	1.60E+00	µg/L	--	--	--	--	--	4.8E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0024
				Pentachlorophenol	2.50E+00	µg/L	--	--	--	--	--	7.5E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.015
				Trichloroethene	5.80E-01	µg/L	--	--	--	--	--	1.7E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.035
				Aluminum	3.66E+03	µg/L	--	--	--	--	--	1.2E-01	(mg/kg-day)	1.0E+00	(mg/kg-day)	0.12
				Arsenic	6.67E+00	µg/L	--	--	--	--	--	2.0E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.67
				Barium	4.80E+00	µg/L	--	--	--	--	--	1.4E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.072
				Cadmium	2.75E+00	µg/L	--	--	--	--	--	8.2E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.16
				Chromium	2.11E+01	µg/L	--	--	--	--	--	6.3E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.21
				Cobalt	1.52E+01	µg/L	--	--	--	--	--	4.5E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.5
				Copper	3.48E+01	µg/L	--	--	--	--	--	1.0E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.026
				Cyanide	1.10E+01	µg/L	--	--	--	--	--	3.3E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.55
				Iron	1.25E+04	µg/L	--	--	--	--	--	3.8E-01	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.54
				Lead	4.66E+00	µg/L	--	--	--	--	--	1.4E-04	(mg/kg-day)	NA	--	NA
				Magnesium	1.00E+05	µg/L	--	--	--	--	--	3.0E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	125
				Manganese	1.54E-01	µg/L	--	--	--	--	--	4.6E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.015
				Molybdenum	2.00E+02	µg/L	--	--	--	--	--	6.0E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	1.2
				Nickel	4.83E+01	µg/L	--	--	--	--	--	1.4E-03	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.072

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	float	Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	float	slope	float		slope	float	slope	float	
Groundwater	Groundwater	Deep	Ingestion	Selenium	3.44E+01	µg/L	---	--	--	--	--	1.0E-03	mg/kg-day	5.0E-03	mg/kg-day	0.21
				Strontium	8.60E+03	µg/L	---	--	--	--	--	2.6E-01	mg/kg-day	6.0E-01	mg/kg-day	0.43
				Thallium	1.74E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	1.0E-05	mg/kg-day	52
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	8.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.17
				Zinc	1.24E+02	µg/L	---	--	--	--	--	3.7E-03	mg/kg-day	3.0E-01	mg/kg-day	0.012
			Ingestion Total								--					185
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	6.0E-03	mg/kg-day	0.00027
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	2.0E-03	mg/kg-day	0.011
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	7.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.032
				Benzene	8.61E-01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.00041
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.1E-01	mg/kg-day	2.0E-02	mg/kg-day	5.5
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	2.6E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0019
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	1.0E-02	mg/kg-day	0.00051
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.037
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	1.3E-05	mg/kg-day	0.15
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.9E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0015
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	2.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.055
				Trichloroethene	5.80E-01	µg/L	---	--	--	--	--	2.7E-06	mg/kg-day	5.0E-04	mg/kg-day	0.0054
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	6.9E-04	mg/kg-day	1.0E+00	mg/kg-day	0.00069
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0040
				Beryllium	4.80E+00	µg/L	---	--	--	--	--	8.5E-07	mg/kg-day	1.4E-05	mg/kg-day	0.0610
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	4.9E-07	mg/kg-day	2.5E-05	mg/kg-day	0.020
				Chromium	2.11E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	7.5E-05	mg/kg-day	0.050
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0036
				Copper	3.48E+01	µg/L	---	--	--	--	--	6.2E-06	mg/kg-day	4.0E-02	mg/kg-day	0.00015
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	2.0E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0033
				Iron	1.25E+04	µg/L	---	--	--	--	--	2.2E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0032
				Lead	4.66E+00	µg/L	---	--	--	--	--	8.3E-06	mg/kg-day	NA	--	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	1.8E-02	mg/kg-day	9.6E-04	mg/kg-day	19
				Mercury	1.54E-01	µg/L	---	--	--	--	--	2.7E-08	mg/kg-day	2.1E-05	mg/kg-day	0.0013
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	3.6E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0071
				Nickel	4.83E+01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	8.0E-04	mg/kg-day	0.0021
				Selenium	3.44E+01	µg/L	---	--	--	--	--	6.1E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0012
				Strontium	8.60E+03	µg/L	---	--	--	--	--	1.5E-03	mg/kg-day	6.0E-01	mg/kg-day	0.0025
				Thallium	1.74E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	1.0E-05	mg/kg-day	0.31
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	5.0E-06	mg/kg-day	1.3E-04	mg/kg-day	0.038
				Zinc	1.24E+02	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	3.0E-01	mg/kg-day	0.0000044
			Dermal Total								--					26
	Total Deep Groundwater										--					211

Table E-23
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	Hazard Quotient
Groundwater	Indoor Air	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	ug/L	---	--	--	--	--	3.0E-06	mg/m^3	7.0E-03	mg/m^3	0.0000043
				Benzene	8.61E-01	ug/L	---	--	--	--	--	2.8E-06	mg/m^3	3.0E-02	mg/m^3	0.00000092
				Bromomethane	2.90E+00	ug/L	---	--	--	--	--	8.6E-06	mg/m^3	5.0E-03	mg/m^3	0.0000017
				Chloroform	2.02E+00	ug/L	---	--	--	--	--	5.2E-06	mg/m^3	9.8E-02	mg/m^3	0.00000053
				Naphthalene	1.60E+00	ug/L	---	--	--	--	--	2.8E-06	mg/m^3	3.0E-03	mg/m^3	0.00000092
				Tetrachloroethene	5.30E-01	ug/L	---	--	--	--	--	1.5E-06	mg/m^3	2.0E-03	mg/m^3	0.0000074
	Volatile Inhalation		Inhalation Total								--					0.0000040
	Total Indoor Air										--					0.0000040
Total Deep Groundwater											--					211

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Chemical Potential Cancer Risks																					
Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Contaminant	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CDI Equation Key		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tribbey	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	ppbL	6.8E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
2,4-Dinitrotoluene					5.00E+00	ppbL	2.1E-05	mg/kg-day	4.1E-01	mg/kg-day-1	8.4E-06	...	...	...	...	...
4,4'-DDD					4.20E-02	ppbL	1.4E-07	mg/kg-day	2.4E-01	mg/kg-day-1	4.1E-08	...	...	...	...	...
Benzene					1.12E+00	ppbL	4.5E-06	mg/kg-day	5.5E-02	mg/kg-day-1	2.5E-07	...	...	...	...	...
bis(2-Ethylhexyl)phthalate					2.40E+01	ppbL	9.6E-05	mg/kg-day	1.4E-02	mg/kg-day-1	1.4E-06	...	...	...	...	...
Bromodichloromethane					4.20E-01	ppbL	1.4E-06	mg/kg-day	6.2E-02	mg/kg-day-1	1E-07	...	...	...	...	...
Bromoform					1.45E+00	ppbL	5.8E-06	mg/kg-day	NA	...	NA	...	...	...	...	...
Chloroform					9.10E+00	ppbL	3.7E-05	mg/kg-day	3.1E-02	mg/kg-day-1	1.1E-06	...	...	...	...	...
Dibromochloromethane					1.00E+00	ppbL	4.5E-06	mg/kg-day	NA	...	NA	...	...	...	...	...
Dieldrin					4.40E-02	ppbL	1.4E-07	mg/kg-day	1.6E+01	mg/kg-day-1	2.2E-06	...	...	...	...	...
Ethylbenzene					1.04E+00	ppbL	7.4E-06	mg/kg-day	1.1E-02	mg/kg-day-1	8E-08	...	...	...	...	...
Hexachlorobenzene					4.14E+00	ppbL	1.4E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Pentachlorophenol					4.01E+00	ppbL	1.2E-05	mg/kg-day	4.0E-01	mg/kg-day-1	4.8E-06	...	...	...	...	...
Phenol					1.57E+02	ppbL	6.4E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Tetrachloroethene					5.00E+00	ppbL	2.4E-05	mg/kg-day	2.1E-02	mg/kg-day-1	5.0E-07	...	...	...	...	...
Trichloroethene					1.00E+00	ppbL	Multiple Mode of Action - See Table 4				5.5E-07	...	...	...	...	...
1,1,1-Trichloroethane					9.4E+00	ppbL	4.1E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Aluminum					5.62E+04	ppbL	2.4E-01	mg/kg-day	NA	...	NA	...	...	...	...	...
Antimony					7.94E+00	ppbL	4.2E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Arsenic					1.40E+01	ppbL	5.7E-05	mg/kg-day	1.5E+00	mg/kg-day-1	5E-05	...	...	...	...	...
Barium					1.04E+01	ppbL	4.2E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Calcium					2.94E+00	ppbL	9.5E-06	mg/kg-day	NA	...	NA	...	...	...	...	...
Chromium					4.14E+01	ppbL	Multiple Mode of Action - See Table 4				2.0E-04	...	...	...	...	...
Cobalt					1.14E+04	ppbL	4.6E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Copper					2.10E+02	ppbL	1.1E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Cyanide					1.07E+01	ppbL	4.4E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Iron					2.54E+04	ppbL	1.0E-02	mg/kg-day	NA	...	NA	...	...	...	...	...
Lead					1.40E+01	ppbL	9.1E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Magnesium					9.94E+04	ppbL	2.0E-01	mg/kg-day	NA	...	NA	...	...	...	...	...
Manganese					9.94E+00	ppbL	2.0E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Molybdenum					1.20E+02	ppbL	4.9E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Nickel					7.50E+02	ppbL	4.1E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Potassium					1.75E+01	ppbL	7.1E-05	mg/kg-day	NA	...	NA	...	...	...	...	...
Selenium					1.10E+02	ppbL	7.4E-04	mg/kg-day	NA	...	NA	...	...	...	...	...
Thallium					2.22E+01	ppbL	9.2E-05	mg/kg-day	NA	...	NA	...	...	...	...	...

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Time=Future
Exposure Frequency=Present
Exposure Age=Adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Noncancer Hazard Calculations				
					Dose	Units	Intake/Exposure Concentration		CDF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Dose	Units	Dose	Units		Dose	Units	Dose	Units	
Groundwater	Groundwater	Tap Water	Ingestion	Aluminum	2.70E+01	ug/L	9.4E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Zinc	2.24E+04	ug/L	9.5E-02	mg/kg-day	NA	---	NA	---	---	---	---	---
			Ingestion Total								4.0E-04					---
			Dermal	1,2,4-Trimethylbenzene	1.70E+00	ug/L	1.1E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				2,4-Dinitrotoluene	5.00E+00	ug/L	1.[illegible]E-04	mg/kg-day	4.1E-01	mg/kg-day^{-1}	5.0E-07	---	---	---	---	---
				4,4'-DDD	4.20E-02	ug/L	1.[illegible]E-07	mg/kg-day	2.4E-01	mg/kg-day^{-1}	4.4E-07	---	---	---	---	---
				Benzene	1.10E+00	ug/L	[illegible]E-07	mg/kg-day	5.5E-02	mg/kg-day^{-1}	5.4E-08	---	---	---	---	---
				bis(2-Ethylhexyl)phthalate	2.40E+01	ug/L	[illegible]E-04	mg/kg-day	1.4E-02	mg/kg-day^{-1}	1.4E-04	---	---	---	---	---
				Bromodichloromethane	4.20E-01	ug/L	1.4E-07	mg/kg-day	[illegible].2E-02	mg/kg-day^{-1}	2E-09	---	---	---	---	---
				Bromoform	1.45E+00	ug/L	2.7E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chloroform	[illegible].10E+00	ug/L	4.1E-07	mg/kg-day	4.1E-02	mg/kg-day^{-1}	1.5E-08	---	---	---	---	---
				Dibromochloromethane	1.00E+00	ug/L	1.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Dieldrin	4.40E-02	ug/L	4.7E-07	mg/kg-day	1.6E+01	mg/kg-day^{-1}	[illegible].0E-06	---	---	---	---	---
				Ethylbenzene	1.04E+00	ug/L	[illegible].1E-07	mg/kg-day	1.1E-02	mg/kg-day^{-1}	7.4E-09	---	---	---	---	---
				Naphthalene	4.14E+00	ug/L	1.2E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Pentachlorophenol	4.01E+00	ug/L	[illegible].0E-05	mg/kg-day	4.0E-01	mg/kg-day^{-1}	2.[illegible]E-05	---	---	---	---	---
				Phenol	1.57E+02	ug/L	4.5E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Tetrachloroethene	5.[illegible]E+00	ug/L	2.1E-05	mg/kg-day	2.1E-02	mg/kg-day^{-1}	4.4E-08	---	---	---	---	---
				Trichloroethene	1.[illegible]E+00	ug/L	Multiple Mode of Action - See Table 4				1.4E-07	---	---	---	---	---
				[illegible]	[illegible]E+00	ug/L	4.4E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Aluminum	5.[illegible]E+04	ug/L	1.2E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Antimony	7.[illegible]E+00	ug/L	1.[illegible]E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Arsenic	1.40E+01	ug/L	4.1E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	4.7E-07	---	---	---	---	---
				Barium	1.04E+01	ug/L	2.4E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Cadmium	2.4E+00	ug/L	5.2E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chromium	4.14E+01	ug/L	Multiple Mode of Action - See Table 4				NA	---	---	---	---	---
				Cobalt	1.14E+04	ug/L	1.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Copper	2.[illegible]E+02	ug/L	[illegible].2E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Cyanide	1.07E+01	ug/L	2.4E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Iron	2.54E+04	ug/L	5.[illegible]E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Lead	1.40E+01	ug/L	4.4E-08	mg/kg-day	NA	---	NA	---	---	---	---	---
				Manganese	[illegible].[illegible]E+04	ug/L	1.5E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Mercury	[illegible].[illegible]E+00	ug/L	1.5E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Molybdenum	1.20E+02	ug/L	2.7E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Nickel	7.50E+02	ug/L	4.4E-06	mg/kg-day	NA	---	NA	---	---	---	---	---

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knowville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Age-Adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Total Exposure Concentration		CDI Equation Risk		Cancer Risk	Total Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water	Dermal	Arsenic	1.75E+01	ug/L	4.0E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chromium	1.10E+04	ug/L	4.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Thallium	2.27E+01	ug/L	5.0E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Molybdenum	2.40E+01	ug/L	5.1E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Zinc	2.44E+04	ug/L	4.1E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
			Dermal Total								1.7E-04					---
	Total Tap Water Groundwater										4.7E-04					---
	Indoor Air	Tap Water	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	ug/L	5.[illegible]E-07	mg/m^3	NA	---	NA	---	---	---	---	---
	volatile chemicals			Benzene	1.12E+00	ug/L	4.0E-07	mg/m^3	7.[illegible]E-05	mg/m^3^-1	4.0E-11	---	---	---	---	---
				Ethylbenzene	4.20E-01	ug/L	1.[illegible]E-07	mg/m^3	4.7E-05	mg/m^3^-1	4.2E-11	---	---	---	---	---
				Ethylene dibromide	1.45E+00	ug/L	5.5E-07	mg/m^3	NA	---	NA	---	---	---	---	---
				Chloroform	9.10E+00	ug/L	4.0E-07	mg/m^3	2.4E-05	mg/m^3^-1	9.6E-10	---	---	---	---	---
				Methylene chloride	1.00E+00	ug/L	2.4E-07	mg/m^3	NA	---	NA	---	---	---	---	---
				Ethylene	1.04E+00	ug/L	7.0E-07	mg/m^3	2.5E-05	mg/m^3^-1	1.7E-11	---	---	---	---	---
				Naphthalene	4.14E+00	ug/L	7.0E-07	mg/m^3	4.4E-05	mg/m^3^-1	2.4E-10	---	---	---	---	---
				Tetrachloroethene	5.[illegible]E+00	ug/L	1.[illegible]E-06	mg/m^3	2.0E-07	mg/m^3^-1	4.0E-12	---	---	---	---	---
				Trichloroethene	1.04E+00	ug/L	9.0E-07	mg/m^3	4.1E-06	mg/m^3^-1	3.7E-11	---	---	---	---	---
				Vinyl chloride (carcinogen)	9.4E+00	ug/L	4.2E-07	mg/m^3	NA	---	NA	---	---	---	---	---
	Total Indoor Air										1.0E-09					---
Total Tap Water Groundwater											4.7E-04					---
Groundwater	Groundwater	Dermal	Inhalation	1,2-Dichlorobenzene	1.20E+00	ug/L	4.0E-07	mg/kg-day	9.1E-02	mg/kg-day^-1	4.4E-07	---	---	---	---	---
				2,4-Dinitrotoluene	1.20E+01	ug/L	5.2E-05	mg/kg-day	4.1E-01	mg/kg-day^-1	1.0E-05	---	---	---	---	---
				2,6-Dinitrotoluene	4.00E+00	ug/L	1.0E-05	mg/kg-day	1.5E+00	mg/kg-day^-1	2.[illegible]E-05	---	---	---	---	---
				Benzene	9.1E-01	ug/L	4.5E-07	mg/kg-day	5.5E-02	mg/kg-day^-1	1.0E-07	---	---	---	---	---
				bis(2-Ethylhexyl)phthalate	9.70E+01	ug/L	2.7E-04	mg/kg-day	1.4E-02	mg/kg-day^-1	4.[illegible]E-06	---	---	---	---	---
				Ethylene dibromide	2.90E+00	ug/L	1.2E-05	mg/kg-day	NA	---	NA	---	---	---	---	---
				Chloroform	2.00E+00	ug/L	2.[illegible]E-06	mg/kg-day	9.1E-02	mg/kg-day^-1	2.5E-07	---	---	---	---	---
				Dieldrin	4.50E-02	ug/L	1.4E-07	mg/kg-day	1.6E+01	mg/kg-day^-1	2.4E-06	---	---	---	---	---
				Heptachlor epoxide	5.40E-02	ug/L	2.2E-07	mg/kg-day	9.1E+00	mg/kg-day^-1	2.0E-06	---	---	---	---	---
				Naphthalene	1.00E+00	ug/L	6.5E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Pentachlorophenol	2.50E+00	ug/L	1.0E-05	mg/kg-day	4.0E-01	mg/kg-day^-1	4.1E-06	---	---	---	---	---
				Tetrachloroethene	5.[illegible]E-01	ug/L	Mutagenic Mode of Action Per Table 4				1.0E-07	---	---	---	---	---
				Aluminum	4.[illegible]E+04	ug/L	1.6E-02	mg/kg-day	NA	---	NA	---	---	---	---	---
				Arsenic	6.67E+00	ug/L	2.7E-05	mg/kg-day	1.5E+00	mg/kg-day^-1	4.1E-05	---	---	---	---	---
				Cadmium	4.[illegible]E+00	ug/L	2.0E-05	mg/kg-day	NA	---	NA	---	---	---	---	---

Table E-24

Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure

Central Tendency Exposure

Smokey Mountain Smelters

Knoxville, Tennessee

Exposure Time Period: Future
Exposure Frequency: Resident
Exposure Age: Age-Adjusted

				Chemical Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
Medium	Exposure Medium	Exposure Point	Exposure Route		Value	Units	Total Exposure Concentration		CF Without Fill		Cancer Risk	Total Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Deep	Ingestion	Cadmium	2.25E+00	pg/L	1.1E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Chromium	2.11E+01	pg/L	Multiple Modes of Action - See Table 4-4				1.4E-04	..	...	...	...	...
				Cobalt	1.52E+01	pg/L	7.2E-06	mg/kg-day	NA	...	NA	..	...	...	...	...
				Copper	4.41E+01	pg/L	1.4E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Cyanide	1.10E+01	pg/L	4.5E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Iron	1.25E+04	pg/L	5.1E-02	mg/kg-day	NA	...	NA	..	...	...	...	...
				Lead	4.00E+00	pg/L	1.6E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Manganese	1.00E+05	pg/L	4.1E-01	mg/kg-day	NA	...	NA	..	...	...	...	...
				Mercury	1.54E-01	pg/L	6.4E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Molybdenum	2.00E+02	pg/L	8.1E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Nickel	4.[illegible]E+01	pg/L	2.0E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Selenium	4.44E+01	pg/L	1.4E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Strontium	[illegible]E+04	pg/L	4.5E-02	mg/kg-day	NA	...	NA	..	...	...	...	...
				Thallium	1.74E+01	pg/L	7.1E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Vanadium	2.[illegible]E+01	pg/L	1.1E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
				Zinc	1.24E+02	pg/L	5.0E-04	mg/kg-day	NA	...	NA	..	...	...	...	...
			Ingestion Total								2.4E-04					...
			Dermal	1,2-Dichloroethane	1.20E+01	pg/L	4.4E-07	mg/kg-day	4.1E-02	mg/kg-day^{-1}	4.1E-05	..	...	...	...	...
				2,4-Dinitrotoluene	1.20E+01	pg/L	4.6E-07	mg/kg-day	4.1E-01	mg/kg-day^{-1}	1.4E-06	..	...	...	...	...
				2,6-Dinitrotoluene	4.00E+00	pg/L	2.0E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	4.0E-07	..	...	...	...	...
				Benzene	6.1E-01	pg/L	2.7E-07	mg/kg-day	5.5E-02	mg/kg-day^{-1}	4.2E-09	..	...	...	...	...
				bis(2-Ethylhexyl)phthalate	6.70E+01	pg/L	2.7E-06	mg/kg-day	1.4E-02	mg/kg-day^{-1}	4.[illegible]E-05	..	...	...	...	...
				Ethylbenzene	2.00E+00	pg/L	5.5E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Chloroform	2.00E+00	pg/L	1.1E-07	mg/kg-day	4.1E-02	mg/kg-day^{-1}	4.4E-09	..	...	...	...	...
				Dieldrin	4.50E-02	pg/L	4.[illegible]E-07	mg/kg-day	1.6E+01	mg/kg-day^{-1}	6.1E-07	..	...	...	...	...
				Heptachlor epoxide	5.40E-02	pg/L	4.0E-07	mg/kg-day	9.1E+00	mg/kg-day^{-1}	4.6E-07	..	...	...	...	...
				Naphthalene	1.00E+00	pg/L	6.1E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Pentachlorophenol	2.50E+00	pg/L	5.7E-05	mg/kg-day	4.0E-01	mg/kg-day^{-1}	2.4E-05	..	...	...	...	...
				Tetrachloroethene	5.00E-01	pg/L	Multiple Modes of Action - See Table 4-4				4.[illegible]E-09	..	...	...	...	...
				Aluminum	4.[illegible]E+04	pg/L	1.6E-05	mg/kg-day	NA	...	NA	..	...	...	...	...
				Arsenic	6.67E+00	pg/L	1.5E-07	mg/kg-day	1.5E+00	mg/kg-day^{-1}	2.2E-07	..	...	...	...	...
				Barium	4.[illegible]E+00	pg/L	1.1E-07	mg/kg-day	NA	...	NA	..	...	...	...	...
				Cadmium	2.25E+00	pg/L	6.1E-10	mg/kg-day	NA	...	NA	..	...	...	...	...
				Chromium	2.11E+01	pg/L	Multiple Modes of Action - See Table 4-4				NA	..	...	...	...	...
				Cobalt	1.52E+01	pg/L	1.4E-07	mg/kg-day	NA	...	NA	..	...	...	...	...

Table E-24
Calculation of COPC Cancer Risks and Noncancer Hazards - Age-Adjusted Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Age-adjusted

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Deep	Dermal	Copper	3.40E+01	µg/L	7.7E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Cyanide	1.10E+01	µg/L	2.4E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Iron	1.25E+04	µg/L	2.[illegible]E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Lead	4.66E+00	µg/L	1.0E-0[illegible]	mg/kg-day	NA	---	NA	---	---	---	---	---
				Manganese	1.00E+05	µg/L	2.2E-0[illegible]	mg/kg-day	NA	---	NA	---	---	---	---	---
				Mercury	1.54E-01	µg/L	3.4E-09	mg/kg-day	NA	---	NA	---	---	---	---	---
				Molybdenum	2.00E+02	µg/L	4.4E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
				Nickel	4.[illegible]E+01	µg/L	2.1E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Selenium	3.44E+01	µg/L	7.6E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Strontium	[illegible]E+0[illegible]	µg/L	1.9E-04	mg/kg-day	NA	---	NA	---	---	---	---	---
				Thallium	1.74E+01	µg/L	3.9E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Vanadium	2.[illegible]E+01	µg/L	6.2E-07	mg/kg-day	NA	---	NA	---	---	---	---	---
				Zinc	1.24E+02	µg/L	1.6E-06	mg/kg-day	NA	---	NA	---	---	---	---	---
			Dermal Total								4.2E-04					---
	Total Deep Groundwater										6.5E-04					---
	Indoor Air (while showering)	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	µg/L	3.9E-09	mg/m³	2.6E-05	(µg/m³)-1	1.0E-10	---	---	---	---	---
				Benzene	[illegible]1E-01	µg/L	3.6E-09	mg/m³	7.[illegible]E-06	(µg/m³)-1	2.[illegible]E-11	---	---	---	---	---
				Bromomethane	2.90E+00	µg/L	1.1E-0[illegible]	mg/m³	NA	---	NA	---	---	---	---	---
				Chloroform	2.02E+00	µg/L	6.7E-09	mg/m³	2.3E-05	(µg/m³)-1	1.5E-10	---	---	---	---	---
				Naphthalene	1.60E+00	µg/L	3.6E-09	mg/m³	3.4E-05	(µg/m³)-1	1.2E-10	---	---	---	---	---
				Trichloroethene	5.[illegible]E-01	µg/L	1.9E-09	mg/m³	4.1E-06	(µg/m³)-1	7.[illegible]E-12	---	---	---	---	---
			Inhalation Total								4.1E-10					---
	Total Indoor Air										4.1E-10					---
Total Deep Groundwater											6.5E-04					---

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	4.2E-05	(mg/kg-day)	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	1.3E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.063
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	8.0E-07	(mg/kg-day)	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	2.8E-05	(mg/kg-day)	4.0E-03	(mg/kg-day)	0.0070
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	5.7E-04	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.029
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	8.0E-06	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.00040
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	3.6E-05	(mg/kg-day)	1.4E-03	(mg/kg-day)	0.026
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	2.3E-04	(mg/kg-day)	1.0E-02	(mg/kg-day)	0.023
				Dibromochloromethane	1.60E+00	µg/L	---	--	--	--	--	4.0E-05	(mg/kg-day)	1.0E-03	(mg/kg-day)	0.040
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	8.5E-07	(mg/kg-day)	5.0E-05	(mg/kg-day)	0.017
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	4.8E-05	(mg/kg-day)	1.0E-01	(mg/kg-day)	0.00048
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	7.8E-05	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.0039
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	7.5E-05	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.015
				Phenol	1.57E+02	µg/L	---	--	--	--	--	3.9E-03	(mg/kg-day)	3.0E-01	(mg/kg-day)	0.013
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	1.5E-04	(mg/kg-day)	6.0E-03	(mg/kg-day)	0.024
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	5.0E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.099
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	2.2E-04	(mg/kg-day)	2.0E-01	(mg/kg-day)	0.0011
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	1.4E+00	(mg/kg-day)	1.0E+00	(mg/kg-day)	1.4
				Antimony	7.94E+00	µg/L	---	--	--	--	--	2.0E-04	(mg/kg-day)	4.0E-04	(mg/kg-day)	0.50
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	3.5E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	1.2
				Barium	1.03E+01	µg/L	---	--	--	--	--	2.6E-04	(mg/kg-day)	2.0E-03	(mg/kg-day)	0.13
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	5.8E-05	(mg/kg-day)	5.0E-04	(mg/kg-day)	0.12
				Chromium	3.14E+01	µg/L	---	--	--	--	--	7.8E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.26
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	2.8E-02	(mg/kg-day)	3.0E-04	(mg/kg-day)	95
				Copper	2.80E+02	µg/L	---	--	--	--	--	7.0E-03	(mg/kg-day)	4.0E-02	(mg/kg-day)	0.17
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	2.7E-04	(mg/kg-day)	6.0E-04	(mg/kg-day)	0.44
				Iron	2.54E+03	µg/L	---	--	--	--	--	6.3E-02	(mg/kg-day)	7.0E-01	(mg/kg-day)	0.090
				Lead	1.49E+01	µg/L	---	--	--	--	--	3.7E-04	(mg/kg-day)	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	1.7E+00	(mg/kg-day)	2.4E-02	(mg/kg-day)	72
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.7E-04	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.58
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	3.0E-03	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.60
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.9E-02	(mg/kg-day)	2.0E-02	(mg/kg-day)	0.94
				Selenium	1.75E+01	µg/L	---	--	--	--	--	4.4E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.087
				Silver	1.80E+03	µg/L	---	--	--	--	--	4.5E-02	(mg/kg-day)	6.0E-01	(mg/kg-day)	0.075
				Thallium	2.27E+01	µg/L	---	--	--	--	--	5.7E-04	(mg/kg-day)	1.0E-05	(mg/kg-day)	57
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	5.7E-04	(mg/kg-day)	5.0E-03	(mg/kg-day)	0.11
				Zinc	2.33E+04	µg/L	---	--	--	--	--	5.8E-01	(mg/kg-day)	3.0E-01	(mg/kg-day)	1.9
			Ingestion Total								---					232

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Noncancer Hazard Calculation				
					Value	Unit	Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	8.2E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	2.0E-03	mg/kg-day	0.0
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	7.2E-06	mg/kg-day	4.0E-03	mg/kg-day	0.0018
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	6.8E-02	mg/kg-day	2.0E-02	mg/kg-day	3.4
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	9.6E-07	mg/kg-day	2.0E-02	mg/kg-day	0.0000483
				Bromomethane	1.48E+00	µg/L	---	--	--	--	--	2.0E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0014
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	3.5E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0035
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	1.0E-03	mg/kg-day	0.12
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	2.7E-06	mg/kg-day	5.0E-05	mg/kg-day	0.054
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	4.9E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00049
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	8.7E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0044
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	5.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.10
				Phenol	1.57E+02	µg/L	---	--	--	--	--	3.3E-04	mg/kg-day	3.0E-01	mg/kg-day	0.0011
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	1.5E-04	mg/kg-day	6.0E-03	mg/kg-day	0.025
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	1.4E-05	mg/kg-day	5.0E-04	mg/kg-day	0.028
				1,2,4-Trichlorobenzene	8.94E+00	µg/L	---	--	--	--	--	2.5E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0012
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	6.2E-03	mg/kg-day	1.0E+00	mg/kg-day	0.0062
				Antimony	7.94E+00	µg/L	---	--	--	--	--	8.7E-07	mg/kg-day	6.0E-05	mg/kg-day	0.015
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	1.5E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0051
				Barium	1.03E+01	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	1.4E-05	mg/kg-day	0.081
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	2.6E-07	mg/kg-day	2.5E-05	mg/kg-day	0.0103
				Chromium	3.14E+01	µg/L	---	--	--	--	--	3.5E-06	mg/kg-day	7.5E-05	mg/kg-day	0.046
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	5.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.17
				Copper	2.80E+02	µg/L	---	--	--	--	--	3.1E-05	mg/kg-day	4.0E-02	mg/kg-day	0.000777
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0020
				Iron	2.54E+03	µg/L	---	--	--	--	--	2.8E-04	mg/kg-day	7.0E-01	mg/kg-day	0.000040
				Lead	1.49E+01	µg/L	---	--	--	--	--	1.6E-07	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	7.6E-03	mg/kg-day	9.6E-04	mg/kg-day	7.9
				Mercury	6.99E+00	µg/L	---	--	--	--	--	7.7E-07	mg/kg-day	2.1E-05	mg/kg-day	0.037
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0026
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.7E-05	mg/kg-day	8.0E-04	mg/kg-day	0.0206
				Selenium	1.75E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	5.0E-03	mg/kg-day	0.000038
				Strontium	1.80E+03	µg/L	---	--	--	--	--	2.0E-04	mg/kg-day	6.0E-01	mg/kg-day	0.000333
				Thallium	2.27E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	1.0E-05	mg/kg-day	0.25
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	1.3E-04	mg/kg-day	0.019
				Zinc	2.33E+04	µg/L	---	--	--	--	--	1.5E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0051
			Dermal Total								--					12
	Total Shallow Groundwater										--					245

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Total Shallow Groundwater											--					245
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	3.0E-05	mg/kg-day	6.0E-03	mg/kg-day	0.0050
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	3.2E-04	mg/kg-day	2.0E-03	mg/kg-day	0.16
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	3.0E-04	mg/kg-day	0.39
				Benzene	8.61E-01	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0054
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.7E-03	mg/kg-day	2.0E-02	mg/kg-day	0.084
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	7.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.052
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.0E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0050
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	8.7E-07	mg/kg-day	5.0E-05	mg/kg-day	0.017
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	1.3E-05	mg/kg-day	0.104
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	4.0E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0020
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	6.2E-05	mg/kg-day	5.0E-03	mg/kg-day	0.012
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	1.4E-05	mg/kg-day	5.0E-04	mg/kg-day	0.029
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	9.1E-02	mg/kg-day	1.0E+00	mg/kg-day	0.091
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.7E-04	mg/kg-day	3.0E-04	mg/kg-day	0.55
				Barium	4.80E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	2.0E-03	mg/kg-day	0.060
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	6.9E-05	mg/kg-day	5.0E-04	mg/kg-day	0.14
				Chromium	2.11E+01	µg/L	---	--	--	--	--	5.3E-04	mg/kg-day	3.0E-03	mg/kg-day	0.18
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	3.8E-04	mg/kg-day	3.0E-04	mg/kg-day	1.26
				Copper	3.48E+01	µg/L	---	--	--	--	--	8.7E-04	mg/kg-day	4.0E-02	mg/kg-day	0.022
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	2.7E-04	mg/kg-day	6.0E-04	mg/kg-day	0.46
				Iron	1.25E+04	µg/L	---	--	--	--	--	3.1E-01	mg/kg-day	7.0E-01	mg/kg-day	0.45
				Lead	4.66E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	2.5E+00	mg/kg-day	2.4E-02	mg/kg-day	104
				Mercury	1.54E-01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	3.0E-04	mg/kg-day	0.013
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	5.0E-03	mg/kg-day	5.0E-03	mg/kg-day	1.0
				Nickel	4.83E+01	µg/L	---	--	--	--	--	1.2E-03	mg/kg-day	2.0E-02	mg/kg-day	0.06
				Selenium	3.44E+01	µg/L	---	--	--	--	--	8.6E-04	mg/kg-day	5.0E-03	mg/kg-day	0.17
				Strontium	8.60E+03	µg/L	---	--	--	--	--	2.1E-01	mg/kg-day	6.0E-01	mg/kg-day	0.36
				Thallium	1.74E+01	µg/L	---	--	--	--	--	4.3E-04	mg/kg-day	1.0E-05	mg/kg-day	43
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	7.0E-04	mg/kg-day	5.0E-03	mg/kg-day	0.14
				Zinc	1.24E+02	µg/L	---	--	--	--	--	3.1E-03	mg/kg-day	3.0E-01	mg/kg-day	0.010
			Ingestion Total								--					154
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	3.7E-06	mg/kg-day	6.0E-03	mg/kg-day	0.000611
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	4.7E-05	mg/kg-day	2.0E-03	mg/kg-day	0.024
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.069
				Benzene	8.61E-01	µg/L	---	--	--	--	--	3.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.002
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	2.8E-01	mg/kg-day	2.0E-02	mg/kg-day	14
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	5.9E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0042

Table E-25
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Deep	Dermal	Chloroform	2.02E+00	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0011
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	3.9E-06	mg/kg-day	5.0E-05	mg/kg-day	0.079
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	4.1E-06	mg/kg-day	1.3E-05	mg/kg-day	0.31
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	6.3E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0031
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	5.9E-04	mg/kg-day	5.0E-03	mg/kg-day	0.12
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	5.8E-06	mg/kg-day	5.0E-04	mg/kg-day	0.012
				Aluminum	3.36E+03	µg/L	---	--	--	--	--	4.2E-04	mg/kg-day	1.0E+00	mg/kg-day	0.000413
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	7.2E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0024
				Beryllium	4.60E+00	µg/L	---	--	--	--	--	5.2E-07	mg/kg-day	1.4E-05	mg/kg-day	0.036
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	3.0E-07	mg/kg-day	2.5E-05	mg/kg-day	0.012
				Chromium	2.11E+01	µg/L	---	--	--	--	--	2.3E-06	mg/kg-day	7.5E-05	mg/kg-day	0.031
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	6.7E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0022
				Copper	3.48E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	4.0E-02	mg/kg-day	0.000010
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	6.0E-04	mg/kg-day	0.0020
				Iron	1.25E+04	µg/L	---	--	--	--	--	1.4E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0020
				Lead	4.66E+00	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	1.1E-02	mg/kg-day	9.6E-04	mg/kg-day	12
				Mercury	1.54E-01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	2.1E-05	mg/kg-day	0.000081
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	5.0E-03	mg/kg-day	0.00044
				Nickel	4.83E+01	µg/L	---	--	--	--	--	1.1E-06	mg/kg-day	8.0E-04	mg/kg-day	0.0013
				Selenium	3.44E+01	µg/L	---	--	--	--	--	3.8E-06	mg/kg-day	5.0E-03	mg/kg-day	0.0006
				Strontium	8.60E+03	µg/L	---	--	--	--	--	9.5E-04	mg/kg-day	6.0E-01	mg/kg-day	0.00016
				Thallium	1.74E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	1.0E-05	mg/kg-day	0.19
				Vanadium	2.80E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	1.3E-04	mg/kg-day	0.024
				Zinc	1.24E+02	µg/L	---	--	--	--	--	8.2E-06	mg/kg-day	3.0E-01	mg/kg-day	0.000027
			Dermal Total								--					26
	Total Deep Groundwater										--					130
Total Deep Groundwater											--					130

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Shallow	Ingestion	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	2.5E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.0E+00	µg/L	---	--	--	--	--	7.6E-05	mg/kg-day	2.0E-03	mg/kg-day	0.038
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	4.8E-07	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	1.7E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0042
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	3.4E-04	mg/kg-day	2.0E-02	mg/kg-day	0.01725
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	4.8E-06	mg/kg-day	2.0E-02	mg/kg-day	0.0002
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	1.4E-03	mg/kg-day	0.016
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	1.4E-04	mg/kg-day	1.0E-02	mg/kg-day	0.014
				Dibromochloromethane	1.60E+00	µg/L	---	--	--	--	--	2.4E-05	mg/kg-day	1.0E-03	mg/kg-day	0.024
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	5.1E-07	mg/kg-day	5.0E-05	mg/kg-day	0.0102
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	2.9E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00029
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	4.7E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0024
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	4.5E-05	mg/kg-day	5.0E-03	mg/kg-day	0.00901
				Phenol	1.57E+02	µg/L	---	--	--	--	--	2.4E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0078
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	8.8E-05	mg/kg-day	6.0E-03	mg/kg-day	0.015
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	3.0E-05	mg/kg-day	5.0E-04	mg/kg-day	0.060
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	1.3E-04	mg/kg-day	2.0E-01	mg/kg-day	0.0007
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	8.4E-01	mg/kg-day	1.0E+00	mg/kg-day	0.84
				Antimony	7.94E+00	µg/L	---	--	--	--	--	1.2E-04	mg/kg-day	4.0E-04	mg/kg-day	0.30
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	2.1E-04	mg/kg-day	3.0E-04	mg/kg-day	0.70
				Barium	1.03E+01	µg/L	---	--	--	--	--	1.5E-04	mg/kg-day	2.0E-03	mg/kg-day	0.077
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	3.5E-05	mg/kg-day	5.0E-04	mg/kg-day	0.070
				Chromium	3.14E+01	µg/L	---	--	--	--	--	4.7E-04	mg/kg-day	3.0E-03	mg/kg-day	0.16
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	1.7E-02	mg/kg-day	3.0E-04	mg/kg-day	57
				Copper	2.80E+02	µg/L	---	--	--	--	--	4.2E-03	mg/kg-day	4.0E-02	mg/kg-day	0.105
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	6.0E-04	mg/kg-day	0.27
				Iron	2.54E+03	µg/L	---	--	--	--	--	3.8E-02	mg/kg-day	7.0E-01	mg/kg-day	0.054
				Lead	1.49E+01	µg/L	---	--	--	--	--	2.2E-04	mg/kg-day	NA	---	NA
				Magnesium	6.91E+04	µg/L	---	--	--	--	--	1.0E+00	mg/kg-day	2.4E-02	mg/kg-day	43
				Mercury	6.99E+00	µg/L	---	--	--	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.35
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	1.8E-03	mg/kg-day	5.0E-03	mg/kg-day	0.36
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.1E-02	mg/kg-day	2.0E-02	mg/kg-day	0.57
				Selenium	1.75E+01	µg/L	---	--	--	--	--	2.6E-04	mg/kg-day	5.0E-03	mg/kg-day	0.052
				Strontium	1.80E+03	µg/L	---	--	--	--	--	2.7E-02	mg/kg-day	6.0E-01	mg/kg-day	0.045
				Thallium	2.27E+01	µg/L	---	--	--	--	--	3.4E-04	mg/kg-day	1.0E-05	mg/kg-day	34
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	3.4E-04	mg/kg-day	5.0E-03	mg/kg-day	0.069
				Zinc	2.33E+04	µg/L	---	--	--	--	--	3.5E-01	mg/kg-day	3.0E-01	mg/kg-day	1.2
			Ingestion Total								--					140

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/UnitRisk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater	Shallow	Dermal	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	3.5E-05	mg/kg-day	NA	---	NA
				2,4-Dinitrotoluene	5.06E+00	µg/L	---	--	--	--	--	5.7E-06	mg/kg-day	2.0E-03	mg/kg-day	0.0029
				4,4'-DDD	3.20E-02	µg/L	---	--	--	--	--	5.7E-06	mg/kg-day	NA	---	NA
				Benzene	1.12E+00	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	4.0E-03	mg/kg-day	0.00078
				bis(2-Ethylhexyl)phthalate	2.30E+01	µg/L	---	--	--	--	--	2.9E-02	mg/kg-day	2.0E-02	mg/kg-day	1.5
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	4.2E-07	mg/kg-day	2.0E-02	mg/kg-day	0.000021
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	8.6E-07	mg/kg-day	1.4E-03	mg/kg-day	0.00061
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	1.5E-05	mg/kg-day	1.0E-02	mg/kg-day	0.0015
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	5.2E-05	mg/kg-day	1.0E-03	mg/kg-day	0.052
				Dieldrin	3.40E-02	µg/L	---	--	--	--	--	1.2E-06	mg/kg-day	5.0E-05	mg/kg-day	0.023
				Ethylbenzene	1.93E+00	µg/L	---	--	--	--	--	2.1E-05	mg/kg-day	1.0E-01	mg/kg-day	0.00021
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	3.8E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0019
				Pentachlorophenol	3.01E+00	µg/L	---	--	--	--	--	2.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.043
				Phenol	1.57E+02	µg/L	---	--	--	--	--	1.4E-04	mg/kg-day	3.0E-01	mg/kg-day	0.00047
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	6.5E-05	mg/kg-day	6.0E-03	mg/kg-day	0.011
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	6.1E-06	mg/kg-day	5.0E-04	mg/kg-day	0.012
				1,1,1-Trichloroethane	8.94E+00	µg/L	---	--	--	--	--	1.1E-04	mg/kg-day	2.0E-01	mg/kg-day	0.000550
				Aluminum	5.62E+04	µg/L	---	--	--	--	--	5.1E-03	mg/kg-day	1.0E+00	mg/kg-day	0.0051
				Antimony	7.94E+00	µg/L	---	--	--	--	--	7.2E-07	mg/kg-day	6.0E-05	mg/kg-day	0.012
				Arsenic	1.40E+01	µg/L	---	--	--	--	--	1.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0042
				Barium	1.03E+01	µg/L	---	--	--	--	--	9.3E-07	mg/kg-day	1.4E-05	mg/kg-day	0.067
				Cadmium	2.34E+00	µg/L	---	--	--	--	--	2.1E-07	mg/kg-day	2.5E-05	mg/kg-day	0.0084
				Chromium	3.14E+01	µg/L	---	--	--	--	--	2.8E-06	mg/kg-day	7.5E-05	mg/kg-day	0.038
				Cobalt	1.14E+03	µg/L	---	--	--	--	--	4.1E-05	mg/kg-day	3.0E-04	mg/kg-day	0.14
				Copper	2.80E+02	µg/L	---	--	--	--	--	2.5E-05	mg/kg-day	4.0E-02	mg/kg-day	0.000625
				Cyanide	1.07E+01	µg/L	---	--	--	--	--	9.6E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0016
				Iron	2.54E+03	µg/L	---	--	--	--	--	2.3E-04	mg/kg-day	7.0E-01	mg/kg-day	0.000330
				Lead	1.49E+01	µg/L	---	--	--	--	--	1.3E-07	mg/kg-day	NA	---	NA
				Manganese	6.91E+04	µg/L	---	--	--	--	--	6.2E-03	mg/kg-day	9.6E-04	mg/kg-day	6.5
				Mercury	6.99E+00	µg/L	---	--	--	--	--	6.3E-07	mg/kg-day	2.1E-05	mg/kg-day	0.030
				Molybdenum	1.20E+02	µg/L	---	--	--	--	--	1.1E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0022
				Nickel	7.56E+02	µg/L	---	--	--	--	--	1.4E-05	mg/kg-day	8.0E-04	mg/kg-day	0.017
				Selenium	1.75E+01	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	5.0E-03	mg/kg-day	0.000321
				Strontium	1.80E+03	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	6.0E-01	mg/kg-day	0.00027
				Thallium	2.27E+01	µg/L	---	--	--	--	--	2.0E-06	mg/kg-day	1.0E-05	mg/kg-day	0.205
				Vanadium	2.30E+01	µg/L	---	--	--	--	--	2.1E-06	mg/kg-day	1.0E-04	mg/kg-day	0.016
				Zinc	2.33E+04	µg/L	---	--	--	--	--	1.2E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0042
			Dermal Total								--					9
	Total Shallow Groundwater										--					148

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		
					value	Unit	value	Unit	value	Unit		value	Unit	value	Unit	Hazard Quotient
Groundwater	Indoor Air (while showering)	Shallow	Inhalation	1,2,4-Trimethylbenzene	1.70E+00	µg/L	---	--	--	--	--	4.5E-06	mg/m^3	7.0E-03	mg/m^3	0.0000064
				Benzene	1.12E+00	µg/L	---	--	--	--	--	3.0E-06	mg/m^3	3.0E-02	mg/m^3	0.0000012
				Bromodichloromethane	3.20E-01	µg/L	---	--	--	--	--	8.5E-07	mg/m^3	NA	---	NA
				Bromomethane	1.45E+00	µg/L	---	--	--	--	--	4.0E-06	mg/m^3	5.0E-03	mg/m^3	0.0000006
				Chloroform	9.10E+00	µg/L	---	--	--	--	--	2.3E-07	mg/m^3	9.8E-02	mg/m^3	0.0000024
				Dibenzofuran	1.60E+00	µg/L	---	--	--	--	--	1.8E-06	mg/m^3	NA	---	NA
				Ethylbenzene	1.92E+00	µg/L	---	--	--	--	--	5.4E-06	mg/m^3	1.0E+00	mg/m^3	0.000000054
				Naphthalene	3.14E+00	µg/L	---	--	--	--	--	5.4E-06	mg/m^3	3.0E-03	mg/m^3	0.0000018
				Tetrachloroethene	5.89E+00	µg/L	---	--	--	--	--	1.4E-07	mg/m^3	4.0E-02	mg/m^3	0.0000004
				Trichloroethene	1.99E+00	µg/L	---	--	--	--	--	5.1E-06	mg/m^3	2.0E-03	mg/m^3	0.0000026
				Trichlorofluoromethane	8.94E+00	µg/L	---	--	--	--	--	2.5E-07	mg/m^3	1.0E-01	mg/m^3	0.0000025
	Total Indoor Air										--					0.0000063
Total Shallow Groundwater											--					143
Groundwater	Groundwater	Deep	Ingestion	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	1.8E-05	mg/kg-day	6.0E-03	mg/kg-day	0.0030
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	1.9E-04	mg/kg-day	2.0E-03	mg/kg-day	0.10
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	7.0E-05	mg/kg-day	3.0E-04	mg/kg-day	0.23
				Benzene	8.61E-01	µg/L	---	--	--	--	--	1.3E-05	mg/kg-day	4.0E-03	mg/kg-day	0.0032
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.0E-03	mg/kg-day	2.0E-02	mg/kg-day	0.050
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	4.3E-05	mg/kg-day	1.4E-03	mg/kg-day	0.031
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	3.0E-05	mg/kg-day	1.0E-02	mg/kg-day	0.00302
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	5.2E-07	mg/kg-day	5.0E-05	mg/kg-day	0.010
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	8.1E-07	mg/kg-day	1.3E-05	mg/kg-day	0.062
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.4E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0012
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	3.7E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0075
				Trichloroethene	5.60E-01	µg/L	---	--	--	--	--	8.7E-06	mg/kg-day	5.0E-04	mg/kg-day	0.017
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	5.6E-02	mg/kg-day	1.0E+00	mg/kg-day	0.056
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	1.0E-04	mg/kg-day	3.0E-04	mg/kg-day	0.33
				Beryllium	4.60E+00	µg/L	---	--	--	--	--	7.2E-05	mg/kg-day	2.0E-03	mg/kg-day	0.036
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	4.1E-05	mg/kg-day	5.0E-04	mg/kg-day	0.082
				Chromium	2.11E+01	µg/L	---	--	--	--	--	3.2E-04	mg/kg-day	3.0E-03	mg/kg-day	0.11
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	2.3E-04	mg/kg-day	3.0E-04	mg/kg-day	0.76
				Copper	3.48E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	4.0E-02	mg/kg-day	0.013
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	1.6E-04	mg/kg-day	6.0E-04	mg/kg-day	0.27
				Iron	1.25E+04	µg/L	---	--	--	--	--	1.9E-01	mg/kg-day	7.0E-01	mg/kg-day	0.27
				Lead	4.66E+00	µg/L	---	--	--	--	--	7.0E-05	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	1.5E+00	mg/kg-day	2.4E-02	mg/kg-day	62.9
				Mercury	1.54E-01	µg/L	---	--	--	--	--	2.3E-06	mg/kg-day	3.0E-04	mg/kg-day	0.0077
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	3.0E-03	mg/kg-day	5.0E-03	mg/kg-day	0.60
				Nickel	4.83E+01	µg/L	---	--	--	--	--	7.2E-04	mg/kg-day	2.0E-02	mg/kg-day	0.036

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Groundwater	Deep	Ingestion	Selenium	1.44E+01	µg/L	---	--	--	--	--	5.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.10
				Strontium	8.60E+03	µg/L	---	--	--	--	--	1.3E-01	mg/kg-day	6.0E-01	mg/kg-day	0.21
				Thallium	1.74E+01	µg/L	---	--	--	--	--	2.6E-04	mg/kg-day	1.0E-05	mg/kg-day	26
				Iodide	2.80E+01	µg/L	---	--	--	--	--	4.2E-04	mg/kg-day	5.0E-03	mg/kg-day	0.084
				Zinc	1.24E+02	µg/L	---	--	--	--	--	1.9E-03	mg/kg-day	3.0E-01	mg/kg-day	0.0062
			Ingestion Total								--					92
			Dermal	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	6.0E-03	mg/kg-day	0.00027
				2,4-Dinitrotoluene	1.29E+01	µg/L	---	--	--	--	--	2.2E-05	mg/kg-day	2.0E-03	mg/kg-day	0.011
				2,6-Dinitrotoluene	4.66E+00	µg/L	---	--	--	--	--	9.6E-06	mg/kg-day	3.0E-04	mg/kg-day	0.032
				Benzene	8.61E-01	µg/L	---	--	--	--	--	1.7E-06	mg/kg-day	4.0E-03	mg/kg-day	0.00091
				bis(2-Ethylhexyl)phthalate	6.70E+01	µg/L	---	--	--	--	--	1.3E-01	mg/kg-day	2.0E-02	mg/kg-day	6.5
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	2.6E-06	mg/kg-day	1.4E-03	mg/kg-day	0.0019
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.1E-06	mg/kg-day	1.0E-02	mg/kg-day	0.00051
				Dieldrin	3.50E-02	µg/L	---	--	--	--	--	1.8E-06	mg/kg-day	5.0E-05	mg/kg-day	0.037
				Heptachlor epoxide	5.40E-02	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	1.3E-05	mg/kg-day	0.15
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.9E-05	mg/kg-day	2.0E-02	mg/kg-day	0.0015
				Pentachlorophenol	2.50E+00	µg/L	---	--	--	--	--	2.7E-04	mg/kg-day	5.0E-03	mg/kg-day	0.055
				Trichloroethene	5.60E-01	µg/L	---	--	--	--	--	2.7E-06	mg/kg-day	5.0E-04	mg/kg-day	0.0054
				Aluminum	3.66E+03	µg/L	---	--	--	--	--	3.5E-04	mg/kg-day	1.0E+00	mg/kg-day	0.00035
				Arsenic	6.67E+00	µg/L	---	--	--	--	--	6.0E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0020
				Beryllium	4.80E+00	µg/L	---	--	--	--	--	4.3E-07	mg/kg-day	1.4E-05	mg/kg-day	0.031
				Cadmium	2.75E+00	µg/L	---	--	--	--	--	2.5E-07	mg/kg-day	2.5E-05	mg/kg-day	0.0099
				Chromium	2.11E+01	µg/L	---	--	--	--	--	1.9E-06	mg/kg-day	7.5E-05	mg/kg-day	0.025
				Cobalt	1.52E+01	µg/L	---	--	--	--	--	5.5E-07	mg/kg-day	3.0E-04	mg/kg-day	0.0018
				Copper	3.48E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	4.0E-02	mg/kg-day	0.0000773
				Cyanide	1.10E+01	µg/L	---	--	--	--	--	9.9E-07	mg/kg-day	6.0E-04	mg/kg-day	0.0017
				Iron	1.25E+04	µg/L	---	--	--	--	--	1.1E-03	mg/kg-day	7.0E-01	mg/kg-day	0.0016
				Lead	4.66E+00	µg/L	---	--	--	--	--	4.2E-06	mg/kg-day	NA	---	NA
				Manganese	1.00E+05	µg/L	---	--	--	--	--	9.1E-03	mg/kg-day	9.6E-04	mg/kg-day	9.4
				Mercury	1.54E-01	µg/L	---	--	--	--	--	1.4E-06	mg/kg-day	2.1E-05	mg/kg-day	0.00066
				Molybdenum	2.00E+02	µg/L	---	--	--	--	--	1.8E-05	mg/kg-day	5.0E-03	mg/kg-day	0.0036
				Nickel	4.83E+01	µg/L	---	--	--	--	--	8.7E-07	mg/kg-day	8.0E-04	mg/kg-day	0.0011
				Selenium	3.44E+01	µg/L	---	--	--	--	--	3.1E-06	mg/kg-day	5.0E-03	mg/kg-day	0.00062
				Strontium	8.60E+03	µg/L	---	--	--	--	--	7.8E-04	mg/kg-day	6.0E-01	mg/kg-day	0.0013
				Thallium	1.74E+01	µg/L	---	--	--	--	--	1.6E-06	mg/kg-day	1.0E-05	mg/kg-day	0.16
				Iodide	2.80E+01	µg/L	---	--	--	--	--	2.5E-06	mg/kg-day	1.3E-04	mg/kg-day	0.019
				Zinc	1.24E+02	µg/L	---	--	--	--	--	6.7E-06	mg/kg-day	3.0E-01	mg/kg-day	0.000022
			Dermal Total								--					16
	Total Deep Groundwater										--					109

Table E-26
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Resident - Groundwater Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
					slope	Unit	Intake Exposure Concentration		CSF Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Groundwater	Indoor Air	Deep	Inhalation	1,2-Dichloroethane	1.20E+00	µg/L	---	--	--	--	--	3.0E-03	mg/m^3	7.0E-03	mg/m^3	0.0000043
				Benzene	3.1E-01	µg/L	---	--	--	--	--	2.8E-03	mg/m^3	3.0E-02	mg/m^3	0.00000092
				Bromomethane	2.90E+00	µg/L	---	--	--	--	--	3.6E-03	mg/m^3	5.0E-03	mg/m^3	0.0000172
				Chloroform	2.02E+00	µg/L	---	--	--	--	--	5.2E-03	mg/m^3	9.3E-02	mg/m^3	0.00000053
				Naphthalene	1.60E+00	µg/L	---	--	--	--	--	2.8E-03	mg/m^3	3.0E-03	mg/m^3	0.00000092
				Tetrachloroethene	5.60E-01	µg/L	---	--	--	--	--	1.5E-03	mg/m^3	2.0E-03	mg/m^3	0.0000074
	Inhale Showering		Inhalation Total								--					0.0000096
	Total Indoor Air										--					0.0000096
Total Deep Groundwater											--					100

Table E-27
Calculation of COPC Cancer Risks and Noncancer Hazards - Resident- Soil Gas Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child-Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake-Exposure Concentration		CSF-Unit Risk		Cancer Risk	Intake-Exposure Concentration		RfD-RfC		
					alue	Units	alue	Units	alue	Units		alue	Units	alue	Units	Hazard Quotient
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	pg/m	See 1 Calculations Table C-3				1.0E-04	See 1 Calculations Table C-3				---
				1,2,4-Trimethylbenzene	2.19E+00	pg/m					---					0.30
				1,2-Dichloroethane	3.80E+02	pg/m					3.5E-03					52.1
				Benzene	2.10E+00	pg/m					5.8E-06					0.067
				Chloroform	1.20E+00	pg/m					9.8E-06					0.012
				Chloromethane	1.00E+03	pg/m					---					11
				Ethylbenzene	3.18E+00	pg/m					2.8E-06					0.0030
			Inhalation Total								3.6E-03					63
Total Site Indoor Air											3.6E-03					63

Table E-28
Calculation of COPC Cancer Risks and Noncancer Hazards - Resident- Soil Gas Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child-Adult

Medium	Exposure Medium	Exposure Point	Route	Chemical of Potential Concern	CA		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					slope	Units	Exposure Concentration		CSF/Unit Risk		Cancer Risk	Exposure Concentration		RfD/RfC		Hazard Quotient
							slope	Units	slope	Units		slope	Units	slope	Units	
Air	Indoor Air	Site	Inhalation	1,1-Dichloroethane	1.80E+02	µg/m	See Calculations: Table C-4				3.9E-05	See Calculations: Table C-4				...
				1,2,4-Trimethylbenzene	2.19E+00	µg/m					...					0.12
				1,2-Dichloroethane	3.80E+02	µg/m					1.4E-03					20
				Benzene	2.10E+00	µg/m					2.2E-06					0.026
				Chloroform	1.20E+00	µg/m					3.8E-06					0.0045
				Chloromethane	1.00E+03	µg/m					...					4.1
				Ethylbenzene	3.18E+00	µg/m					1.1E-06					0.0012
			Inhalation Total								1.4E-03					24
Total Site Indoor Air											1.4E-03					24

Table E-29
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Angler - Fish Tissue Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	3.1E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	4.0E-05	3.6E-09	mg/kg-day	7.0E-10	mg/kg-day	5.2
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	6.8E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	8.8E-04	7.9E-08	mg/kg-day	7.0E-10	mg/kg-day	113
				PCB-1260	1.80E+00	mg/kg	2.7E-04	mg/kg-day	2.0E+00	(mg/kg-day)-1	5.3E-04	3.1E-03	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	8.1E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	1.2E-05	9.5E-05	mg/kg-day	3.0E-04	(mg/kg-day)-1	0.32
				Chromium	9.50E-01	mg/kg	Mutagenic Mode of Action - See Table 4-5				3.7E-04	1.6E-03	mg/kg-day	3.0E-03	(mg/kg-day)-1	0.55
				Lead	6.30E-02	mg/kg	9.3E-06	mg/kg-day	NA	---	NA	1.1E-04	mg/kg-day	NA	---	NA
			Ingestion Total								1.3E-03					119
Total Knox Creek Carp											1.3E-03					119
Largemouth Bass																
Fish	Fish Tissue	Knox Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	mg/kg	8.7E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.1E-05	1.0E-09	mg/kg-day	7.0E-10	mg/kg-day	1.5
				PCB Dioxin-like Congener TEQ	3.50E-06	mg/kg	5.2E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	6.7E-05	6.0E-09	mg/kg-day	7.0E-10	mg/kg-day	8.6
				PCB-1260	1.20E-01	mg/kg	1.8E-05	mg/kg-day	2.0E+00	(mg/kg-day)-1	3.6E-05	2.1E-04	mg/kg-day	NA	---	NA
				Chromium	6.70E-01	mg/kg	Mutagenic Mode of Action - See Table 4-5				2.6E-04	1.2E-03	mg/kg-day	3.0E-03	(mg/kg-day)-1	0.39
				Mercury	2.90E-01	mg/kg	4.3E-05	mg/kg-day	NA	---	NA	5.0E-04	mg/kg-day	1.0E-04	(mg/kg-day)-1	5.0
			Ingestion Total								3.8E-04					15
Total Knox Creek Largemouth Bass											3.8E-04					15
All Species																
Fish	Fish Tissue	Knox Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	3.1E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	4.0E-05	3.6E-09	mg/kg-day	7.0E-10	mg/kg-day	5.2
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	6.8E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	8.8E-04	7.9E-08	mg/kg-day	7.0E-10	mg/kg-day	113
				PCB-1260	1.80E+00	mg/kg	2.7E-04	mg/kg-day	2.0E+00	(mg/kg-day)-1	5.3E-04	3.1E-03	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	8.1E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	1.2E-05	9.5E-05	mg/kg-day	3.0E-04	(mg/kg-day)-1	0.32
				Chromium	4.80E-01	mg/kg	Mutagenic Mode of Action - See Table 4-5				1.9E-04	8.4E-04	mg/kg-day	3.0E-03	(mg/kg-day)-1	0.28
				Lead	6.30E-02	mg/kg	9.3E-06	mg/kg-day	NA	---	NA	1.1E-04	mg/kg-day	NA	---	NA
				Mercury	1.65E-01	mg/kg	2.4E-05	mg/kg-day	NA	---	NA	2.8E-04	mg/kg-day	1.0E-04	(mg/kg-day)-1	2.8
			Ingestion Total								1.7E-03					119
Total Knox Creek All Species											1.7E-03					119

Table E-30
Calculation of COPC Cancer Risks and Noncancer Hazards - Child Angler - Fish Tissue Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					size	Unit	size	Unit	size	Unit		size	Unit	size	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	7.8E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.0E-05	9.1E-10	mg/kg-day	7.0E-10	mg/kg-day	1.3
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	1.7E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	2.2E-04	2.0E-08	mg/kg-day	7.0E-10	mg/kg-day	28
				PCB-1260	1.30E+00	mg/kg	6.7E-05	mg/kg-day	2.0E+00	(mg/kg-day)-1	1.3E-04	7.8E-04	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	2.0E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	3.1E-06	2.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.079
				Chromium	9.50E-01	mg/kg	Mutagenic Mode of Action - See Table 4b				9.4E-05	4.1E-04	mg/kg-day	3.0E-03	mg/kg-day	0.14
				Lead	6.30E-02	mg/kg	2.3E-06	mg/kg-day	NA	---	NA	2.7E-05	mg/kg-day	NA	---	NA
			Ingestion Total								4.6E-04					30
Total Knoxville Creek Carp											4.6E-04					30
Largemouth Bass																
Fish	Fish Tissue	Knoxville Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	mg/kg	2.2E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	2.8E-06	2.5E-10	mg/kg-day	7.0E-10	mg/kg-day	0.36
				PCB Dioxin-like Congener TEQ	3.50E-06	mg/kg	1.3E-10	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.7E-05	1.5E-09	mg/kg-day	7.0E-10	mg/kg-day	2.2
				PCB-1260	1.20E-01	mg/kg	4.4E-06	mg/kg-day	2.0E+00	(mg/kg-day)-1	8.9E-06	5.2E-05	mg/kg-day	NA	---	NA
				Chromium	6.70E-01	mg/kg	Mutagenic Mode of Action - See Table 4b				6.6E-05	2.9E-04	mg/kg-day	3.0E-03	mg/kg-day	0.096
				Mercury	2.90E-01	mg/kg	1.1E-05	mg/kg-day	NA	---	NA	1.3E-04	mg/kg-day	1.0E-04	mg/kg-day	1.3
			Ingestion Total								9.5E-05					3.9
Total Knoxville Creek Largemouth Bass											9.5E-05					3.9
All Species																
Fish	Fish Tissue	Knoxville Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	mg/kg	7.8E-11	mg/kg-day	1.3E+05	(mg/kg-day)-1	1.0E-05	9.1E-10	mg/kg-day	7.0E-10	mg/kg-day	1.3
				PCB Dioxin-like Congener TEQ	4.60E-05	mg/kg	1.7E-09	mg/kg-day	1.3E+05	(mg/kg-day)-1	2.2E-04	2.0E-08	mg/kg-day	7.0E-10	mg/kg-day	28
				PCB-1260	1.30E+00	mg/kg	6.7E-05	mg/kg-day	2.0E+00	(mg/kg-day)-1	1.3E-04	7.8E-04	mg/kg-day	NA	---	NA
				Arsenic	5.50E-02	mg/kg	2.0E-06	mg/kg-day	1.5E+00	(mg/kg-day)-1	3.1E-06	2.4E-05	mg/kg-day	3.0E-04	mg/kg-day	0.079
				Chromium	4.8E-01	mg/kg	Mutagenic Mode of Action - See Table 4b				4.8E-05	2.1E-04	mg/kg-day	3.0E-03	mg/kg-day	0.070
				Lead	6.30E-02	mg/kg	2.3E-06	mg/kg-day	NA	---	NA	2.7E-05	mg/kg-day	NA	---	NA
				Mercury	1.65E-01	mg/kg	6.1E-06	mg/kg-day	NA	---	NA	7.1E-05	mg/kg-day	1.0E-04	mg/kg-day	0.71
			Ingestion Total								4.2E-04					30
Total Knoxville Creek All Species											4.2E-04					30

Table E-31
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Angler - Fish Tissue Exposure
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	5.0E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	6.6E-05	1.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	1.9
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	1.1E-08	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.4E-03	3.0E-08	(mg/kg-day)	7.0E-10	(mg/kg-day)	43
				PCB-1260	1.30E+00	(mg/kg)	4.3E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	8.7E-04	1.2E-03	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	1.3E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	2.0E-05	3.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Chromium	9.50E-01	(mg/kg)	2.3E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.1E-04	6.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.205
				Lead	6.30E-02	(mg/kg)	1.5E-05	(mg/kg-day)	NA	---	NA	4.1E-05	(mg/kg-day)	NA	---	NA
			Ingestion Total								2.5E-03					45
Total Knoxville Creek Carp											2.5E-03					45
Largemouth Bass																
Fish	Fish Tissue	Knoxville Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	(mg/kg)	1.4E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.8E-05	3.8E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.55
				PCB Dioxin-like Congener TEQ	3.50E-06	(mg/kg)	8.4E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.1E-04	2.3E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	3.2
				PCB-1260	1.20E-01	(mg/kg)	2.9E-05	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	5.8E-05	7.8E-05	(mg/kg-day)	NA	---	NA
				Chromium	6.70E-01	(mg/kg)	1.6E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	8.1E-05	4.3E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.14
				Mercury	2.90E-01	(mg/kg)	7.0E-05	(mg/kg-day)	NA	---	NA	1.9E-04	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.9
			Ingestion Total								2.7E-04					6
Total Knoxville Creek Largemouth Bass											2.7E-04					6
All Species																
Fish	Fish Tissue	Knoxville Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	5.0E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	6.6E-05	1.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	1.9
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	1.1E-08	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.4E-03	3.0E-08	(mg/kg-day)	7.0E-10	(mg/kg-day)	43
				PCB-1260	1.30E+00	(mg/kg)	4.3E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	8.7E-04	1.2E-03	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	1.3E-05	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	2.0E-05	3.6E-05	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.12
				Chromium	4.86E-01	(mg/kg)	1.2E-04	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	5.8E-05	3.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.10
				Lead	6.30E-02	(mg/kg)	1.5E-05	(mg/kg-day)	NA	---	NA	4.1E-05	(mg/kg-day)	NA	---	NA
				Mercury	1.65E-01	(mg/kg)	4.0E-05	(mg/kg-day)	NA	---	NA	1.1E-04	(mg/kg-day)	1.0E-04	(mg/kg-day)	1.1
			Ingestion Total								2.4E-03					45
Total Knoxville Creek All Species											2.4E-03					45

Table E-32
Calculation of COPC Cancer Risks and Noncancer Hazards - Adult Angler - Fish Tissue Exposure
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculation					Non-Cancer Hazard Calculation				
							Intake Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake Exposure Concentration		RfD/RfC		Hazard Quotient
					slope	Unit	slope	Unit	slope	Unit		slope	Unit	slope	Unit	
Carp																
Fish	Fish Tissue	Knoxville Creek Carp	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	1.3E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.6E-05	3.4E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.49
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	2.8E-09	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	3.6E-04	7.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	11
				PCB-1260	1.30E+00	(mg/kg)	1.1E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	2.2E-04	2.9E-04	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	3.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	5.0E-06	8.9E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.030
				Chromium	9.50E-01	(mg/kg)	5.7E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	2.9E-05	1.5E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.051
				Lead	6.30E-02	(mg/kg)	3.8E-06	(mg/kg-day)	NA	---	NA	1.0E-05	(mg/kg-day)	NA	---	NA
			Ingestion Total								6.3E-04					11
Total Knoxville Creek Carp											6.3E-04					11
Largemouth Bass																
Fish	Fish Tissue	Knoxville Creek Largemouth Bass	Ingestion	2,3,7,8-TCDD TEQ	5.90E-07	(mg/kg)	3.5E-11	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	4.6E-06	9.5E-11	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.14
				PCB Dioxin-like Congener TEQ	3.50E-06	(mg/kg)	2.1E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	2.7E-05	5.7E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.81
				PCB-1260	1.20E-01	(mg/kg)	7.2E-06	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	1.4E-05	1.9E-05	(mg/kg-day)	NA	---	NA
				Chromium	6.70E-01	(mg/kg)	4.0E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	2.0E-05	1.1E-04	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.036
				Mercury	2.90E-01	(mg/kg)	1.7E-05	(mg/kg-day)	NA	---	NA	4.7E-05	(mg/kg-day)	1.0E-04	(mg/kg-day)	0.47
			Ingestion Total								6.7E-05					1.5
Total Knoxville Creek Largemouth Bass											6.7E-05					1.5
All Species																
Fish	Fish Tissue	Knoxville Creek All Species	Ingestion	2,3,7,8-TCDD TEQ	2.10E-06	(mg/kg)	1.3E-10	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	1.6E-05	3.4E-10	(mg/kg-day)	7.0E-10	(mg/kg-day)	0.49
				PCB Dioxin-like Congener TEQ	4.60E-05	(mg/kg)	2.8E-09	(mg/kg-day)	1.3E+05	(mg/kg-day)^-1	3.6E-04	7.4E-09	(mg/kg-day)	7.0E-10	(mg/kg-day)	11
				PCB-1260	1.30E+00	(mg/kg)	1.1E-04	(mg/kg-day)	2.0E+00	(mg/kg-day)^-1	2.2E-04	2.9E-04	(mg/kg-day)	NA	---	NA
				Arsenic	5.50E-02	(mg/kg)	3.3E-06	(mg/kg-day)	1.5E+00	(mg/kg-day)^-1	5.0E-06	8.9E-06	(mg/kg-day)	3.0E-04	(mg/kg-day)	0.030
				Chromium	4.80E-01	(mg/kg)	2.9E-05	(mg/kg-day)	5.0E-01	(mg/kg-day)^-1	1.5E-05	7.9E-05	(mg/kg-day)	3.0E-03	(mg/kg-day)	0.026
				Lead	6.30E-02	(mg/kg)	3.8E-06	(mg/kg-day)	NA	---	NA	1.0E-05	(mg/kg-day)	NA	---	NA
				Mercury	1.65E-01	(mg/kg)	9.9E-06	(mg/kg-day)	NA	---	NA	2.7E-05	(mg/kg-day)	1.0E-04	(mg/kg-day)	0.27
			Ingestion Total								6.1E-04					11
Total Knoxville Creek All Species											6.1E-04					11

Table E-33R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2 x 7 -TCDD TEQ	1.2E-06	NA	1.4E-07	1.3E-06	Developmental	0.04	NA	0.004	0.04
			Aluminum	NA	NA	NA	NA	Nervous system	0.04	NA	NA	0.04
			Arsenic	4.[illegible]E-06	NA	1.0E-06	5.[illegible]E-06	Skin	0.0[illegible]	NA	0.006	0.04
			Chromium	5.6E-06	NA	NA	5.6E-06	None observed	0.01	NA	NA	0.01
			Cobalt	NA	NA	NA	NA	Thyroid	0.05	NA	NA	0.05
			Copper	NA	NA	NA	NA	NA	0.00	NA	NA	0.00
			Iron	NA	NA	NA	NA	Gastrointestinal	0.05	NA	NA	0.05
			Manganese	NA	NA	NA	NA	Nervous system	0.05	NA	NA	0.05
			Thallium	NA	NA	NA	NA	Hair	0.05	NA	NA	0.05
			Vanadium	NA	NA	NA	NA	Kidney	0.007	NA	NA	0.007
			Zinc	NA	NA	NA	NA	Blood	0.002	NA	NA	0.002
			Chemical Total	1.2E-05	NA	1.1E-06	1.3E-05		0.[illegible]	NA	0.01	0.[illegible]
		On-Site Total					1.3E-05					0.[illegible]
	Surface Soil Total						1.3E-05					0.[illegible]
	Air	On-Site	2 x 7 -TCDD TEQ	NA	1.6E-11	NA	1.6E-11	Liver, Reproductive system, Developmental, Endocrine system	NA	0.000000003	NA	0.000000003
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.0004	NA	0.0004
			Arsenic	NA	1.1E-09	NA	1.1E-09	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000005	NA	0.000005
			Chromium	NA	4.5E-0[illegible]	NA	4.5E-0[illegible]	Respiratory system	NA	0.000001	NA	0.000001
			Cobalt	NA	2.[illegible]E-09	NA	2.[illegible]E-09	Respiratory system	NA	0.0001	NA	0.0001
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.001	NA	0.001
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.000002	NA	0.000002
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.[illegible]E-0[illegible]	NA	4.[illegible]E-0[illegible]		NA	0.002	NA	0.002
		On-Site Total					4.[illegible]E-0[illegible]					0.002
	Air Total						4.[illegible]E-0[illegible]					0.002
Total On-Site Soil							1.3E-05					0.[illegible]

Table E-33R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Floodplain Erosion	Benzo(a)anthracene	1.1E-10	NA	6.3E-09	1.1E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.2E-07	NA	1.2E-07	3.4E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.5E-11	NA	1.3E-11	3.8E-11	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.2E-09	NA	1.2E-09	3.4E-09	NA	NA	NA	NA	NA
			Chrysene	2.1E-10	NA	1.2E-10	3.3E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	3.9E-07	NA	4.9E-11	4.4E-07	Developmental	0.001	NA	0.0002	0.001
			Aluminum	NA	NA	NA	NA	Neurological	0.001	NA	NA	0.001
			Arsenic	4.7E-06	NA	5.3E-07	5.2E-06	Skin	0.03	NA	0.004	0.03
			Chromium	4.3E-06	NA	NA	4.3E-06	Non-specified	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.03	NA	NA	0.03
			Copper	NA	NA	NA	NA	Reproductive System	0.0003	NA	NA	0.0003
			Iron	NA	NA	NA	NA	Gastrointestinal	0.04	NA	NA	0.04
			Manganese	NA	NA	NA	NA	Neurological	0.0007	NA	NA	0.0007
			Thallium	NA	NA	NA	NA	Hair	0.09	NA	NA	0.09
			Chemical Total	9.0E-06	NA	7.7E-07	1.0E-05		0.2	NA	0.0005	0.2
		Floodplain Erosion Total					1.0E-05					0.2
	Surface Soil Total						1.0E-05					0.2

Table E-33R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emissions	Benzo(a)anthracene	NA	1E-14	NA	1E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.6E-12	NA	1.6E-12	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.[illegible]E-1[illegible]	NA	1.[illegible]E-1[illegible]	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.6E-1[illegible]	NA	1.6E-1[illegible]	NA	NA	NA	NA	NA
			Chrysene	NA	1.5E-14	NA	1.5E-14	NA Liver, Reproductive System	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	5.5E-12	NA	5.5E-12	Developmental, Endocrine System	NA	[illegible]	NA	[illegible]
			Aluminum	NA	NA	NA	NA	Neurological System Liver, Reproductive, Immune, Skin, Urinary System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	6.4E-10	NA	6.4E-10	Neurological System, Lung, Skin	NA	[illegible]	NA	[illegible]
			Chromium	NA	[illegible]4E-[illegible]	NA	[illegible]4E-[illegible]	Reproductive System	NA	[illegible]	NA	[illegible]
			Cobalt	NA	1.6E-[illegible]	NA	1.6E-[illegible]	Reproductive System	NA	[illegible]	NA	[illegible]
			Cyanide	NA	NA	NA	NA	Thyroid	NA	[illegible]	NA	[illegible]
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	[illegible]	NA	[illegible]
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	[illegible]E-[illegible]	NA	[illegible]E-[illegible]		NA	[illegible]	NA	[illegible]
		Fugitive Emissions Total					1.6E-05					[illegible]
	Air Total						[illegible]E-[illegible]					[illegible]
Total Fugitive Emissions Total							1.6E-05					[illegible]
Total Risk across all Media - On-Site							1.6E-05	Total Hazard across all Media - On-Site				[illegible]
Total Risk across all Media - Fugitive Emissions							1.6E-05	Total Hazard across all Media - Fugitive Emissions				[illegible]

Table E-34R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Receptor Time Period: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.4E-07	NA	5.6E-11	1.4E-07	Developmental	0.0001	NA	0.00004	0.0001
			Aluminum	NA	NA	NA	NA	Neurological Effects	0.0001	NA	NA	0.0001
			Arsenic	5.6E-07	NA	4.0E-11	5.6E-07	Skin	0.0007	NA	0.00005	0.0008
			Chromium	6.7E-07	NA	NA	6.7E-07	Hematological	0.0004	NA	NA	0.0004
			Cobalt	NA	NA	NA	NA	Thyroid	0.001	NA	NA	0.001
			Copper	NA	NA	NA	NA	NA	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.001	NA	NA	0.001
			Magnesium	NA	NA	NA	NA	Neurological Effects	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	High	0.001	NA	NA	0.001
			Vanadium	NA	NA	NA	NA	Kidney	0.0002	NA	NA	0.0002
			Zinc	NA	NA	NA	NA	Blood	0.00005	NA	NA	0.00005
			Chemical Total	1.4E-06	NA	4.6E-11	1.4E-06		0.00	NA	0.00004	0.00
		On-Site Total					1.4E-06					0.00
	Surface Soil Total						1.4E-06					0.00
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	1.9E-12	NA	1.9E-12	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.0000000007	NA	0.0000000007
			Aluminum	NA	NA	NA	NA	Neurological Effects	NA	0.00004	NA	0.00004
			Arsenic	NA	1.4E-10	NA	1.4E-10	Developmental Cardiovascular System Neurological Effects Lung Skin	NA	0.00001	NA	0.00001
			Chromium	NA	5.4E-07	NA	5.4E-07	Respiratory Effects	NA	0.0004	NA	0.0004
			Cobalt	NA	2.7E-10	NA	2.7E-10	Respiratory Effects	NA	0.0001	NA	0.0001
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Neurological Effects	NA	0.0001	NA	0.0001
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory Effects	NA	0.0004	NA	0.0004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	5.6E-07	NA	5.6E-07		NA	0.0004	NA	0.0004
		On-Site Total					5.6E-07					0.0004
	Air Total						5.6E-07					0.0004
Total On-Site Soil							1.4E-06					0.00

Table E-34R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=10 yrs Cancer Risk
Exposure Frequency=20 Days/Year
Exposure Age=Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Plantation Ecotech	Benzo(a)anthracene	1.4E-11	NA	2.5E-10	1.6E-11	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.7E-10	NA	4.8E-11	3.2E-10	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.0E-11	NA	5.4E-10	5.6E-11	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.7E-10	NA	4.8E-11	3.2E-10	NA	NA	NA	NA	NA
			Chrysene	2.0E-11	NA	4.0E-12	2.4E-11	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	4.7E-10	NA	2.0E-11	4.9E-10	Developmental	0.0004	NA	0.00001	0.0004
			Aluminum	NA	NA	NA	NA	Neurotoxicity	0.0004	NA	NA	0.0004
			Arsenic	5.0E-07	NA	2.4E-10	5.0E-07	Skin	0.0007	NA	0.00001	0.0007
			Chromium	5.1E-07	NA	NA	5.1E-07	Hematopoietic	0.0002	NA	NA	0.0002
			Cobalt	NA	NA	NA	NA	Thyroid	0.0004	NA	NA	0.0004
			Copper	NA	NA	NA	NA	Reproductive System	0.00004	NA	NA	0.00004
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0004	NA	NA	0.0004
			Magnesium	NA	NA	NA	NA	Neurotoxicity	0.0002	NA	NA	0.0002
			Thallium	NA	NA	NA	NA	Hair	0.002	NA	NA	0.002
			Chemical Total	1.2E-06	NA	4.1E-10	1.2E-06		0.006	NA	0.00004	0.006
		Plantation Ecotech Total					1.2E-06					0.006
	Surface Soil Total						1.2E-06					0.006

Table E-34R
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Air	Flenniken Branch	Benzo(a)anthracene	NA	9.1E-15	NA	9.1E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.9E-13	NA	1.9E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	2.1E-14	NA	2.1E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.9E-14	NA	1.9E-14	NA	NA	NA	NA	NA
			Chrysene	NA	1.1E-15	NA	1.1E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	6.6E-13	NA	6.6E-13	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	0.000000000002	NA	0.000000000002
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.000003	NA	0.000003
			Arsenic	NA	7.6E-11	NA	7.6E-11	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.000000007	NA	0.000000007
			Chromium	NA	4.1E-09	NA	4.1E-09	Respiratory System	NA	0.000000003	NA	0.000000003
			Cobalt	NA	1.9E-10	NA	1.9E-10	Respiratory System	NA	0.000002	NA	0.000002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.000000003	NA	0.000000003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.000002	NA	0.000002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.3E-09	NA	4.3E-09		NA	0.000003	NA	0.000003
		Flenniken Branch Total					1.2E-06					0.006
	Air Total						4.3E-09					0.000003
Total Flenniken Branch Soil							1.2E-06					0.006
						Total Risk Across All Media - On-Site	1.4E-06				Total Hazard Across All Media - On-Site	0.006
						Total Risk Across All Media - Flenniken Branch	1.2E-06				Total Hazard Across All Media - Flenniken Branch	0.006

Table E-35
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	1.2E-05	--	--	1.2E-05	Nervous System, Blood, Liver	0.054	--	--	0.054
			4,4'-DDD	5.9E-06	--	--	5.9E-06	--	--	--	--	--
			Benzene	4.7E-07	--	--	4.7E-07	Blood	0.0000	--	--	0.0000
			bis(2-Ethylhexyl)phthalate	2.5E-06	--	--	2.5E-06	Liver	0.025	--	--	0.025
			Bromodichloromethane	1.5E-07	--	--	1.5E-07	Kidney	0.00004	--	--	0.00004
			Bromomethane	--	--	--	--	Gastrointestinal	0.022	--	--	0.022
			Chloroform	2.2E-06	--	--	2.2E-06	Liver, Blood	0.019	--	--	0.019
			Dibenzofuran	--	--	--	--	Whole Body	0.004	--	--	0.004
			Dieldrin	4.2E-06	--	--	4.2E-06	Liver	0.015	--	--	0.015
			Ethylbenzene	1.6E-07	--	--	1.6E-07	Liver, Kidney	0.00041	--	--	0.00041
			Naphthalene	--	--	--	--	Body Weight	0.0034	--	--	0.0034
			Pentachlorophenol	9.2E-06	--	--	9.2E-06	Liver	0.013	--	--	0.013
			Phenol	--	--	--	--	Body Weight	0.011	--	--	0.011
			Tetrachloroethene	9.5E-06	--	--	9.5E-06	Nervous System	0.021	--	--	0.021
			Trichloroethene	7.0E-07	--	--	7.0E-07	Cardiovascular System	0.085	--	--	0.085
			1,1-Dichloropropene	--	--	--	--	Body Weight	0.00006	--	--	0.00006
			Aluminum	--	--	--	--	Nervous System	1.2	--	--	1.2
			Antimony	--	--	--	--	Blood	0.42	--	--	0.42
			Arsenic	1.6E-04	--	--	1.6E-04	Skin	1.0	--	--	1.0
			Beryllium	--	--	--	--	Gastrointestinal	0.11	--	--	0.11
			Cadmium	--	--	--	--	Kidney	0.10	--	--	0.10
			Chromium	1.2E-04	--	--	1.2E-04	None observed	0.22	--	--	0.22
			Cobalt	--	--	--	--	Thyroid	82	--	--	82
			Copper	--	--	--	--	--	0.15	--	--	0.15
			Cyanide	--	--	--	--	Reproductive System	0.38	--	--	0.38
			Iron	--	--	--	--	Gastrointestinal	0.073	--	--	0.073
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	62	--	--	62
			Mercury	--	--	--	--	Kidney	0.50	--	--	0.50
			Molybdenum	--	--	--	--	Blood	0.51	--	--	0.51
			Nickel	--	--	--	--	Body Weight	0.31	--	--	0.31
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.075	--	--	0.075
			Strontium	--	--	--	--	Bone	0.004	--	--	0.004
			Thallium	--	--	--	--	Hair	49	--	--	49
			Vanadium	--	--	--	--	Kidney	0.093	--	--	0.093
			Zinc	--	--	--	--	Blood	1.7	--	--	1.7
			Chemical Total	3.1E-04	--	--	3.1E-04		199	--	--	199
Total Shallow Groundwater							3.1E-04					199

Table E-35
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	1,2-Dichloroethane	8.3E-07	--	--	8.3E-07	Kidney	0.0043	--	--	0.0043
			2,4-Dinitrotoluene	3.0E-05	--	--	3.0E-05	Nervous System, Blood, Liver	0.14	--	--	0.14
			2,6-Dinitrotoluene	5.3E-05	--	--	5.3E-05	Spleen	0.33	--	--	0.33
			Benzene	3.6E-07	--	--	3.6E-07	Blood	0.0046	--	--	0.0046
			bis(2-Ethylhexyl)phthalate	7.2E-06	--	--	7.2E-06	Liver	0.072	--	--	0.072
			Bromomethane	--	--	--	--	Gastrointestinal	0.044	--	--	0.044
			Chloroform	4.8E-07	--	--	4.8E-07	Liver, Blood	0.0043	--	--	0.0043
			Dieldrin	4.3E-06	--	--	4.3E-06	Liver	0.015	--	--	0.015
			Heptachlorepoxide	3.8E-06	--	--	3.8E-06	Liver	0.039	--	--	0.039
			Naphthalene	--	--	--	--	Body Weight	0.0017	--	--	0.0017
			Pentachlorophenol	7.6E-06	--	--	7.6E-06	Liver	0.011	--	--	0.011
			Trichloroethene	2.0E-07	--	--	2.0E-07	Cardiovascular System	0.025	--	--	0.025
			Aluminum	--	--	--	--	Nervous System	0.083	--	--	0.083
			Arsenic	7.7E-05	--	--	7.7E-05	Skin	0.48	--	--	0.48
			Beryllium	--	--	--	--	Gastrointestinal	0.051	--	--	0.051
			Cadmium	--	--	--	--	Kidney	0.12	--	--	0.12
			Chromium	8.1E-05	--	--	8.1E-05	None Delivered	0.15	--	--	0.15
			Cobalt	--	--	--	--	Thyroid	1.1	--	--	1.1
			Copper	--	--	--	--	--	0.019	--	--	0.019
			Cyanide	--	--	--	--	Reproductive System	0.29	--	--	0.29
			Iron	--	--	--	--	Gastrointestinal	0.38	--	--	0.38
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	90	--	--	90
			Mercury	--	--	--	--	Kidney	0.011	--	--	0.011
			Molybdenum	--	--	--	--	Blood	0.36	--	--	0.36
			Nickel	--	--	--	--	Body Weight	0.052	--	--	0.052
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.15	--	--	0.15
			Strontium	--	--	--	--	Bone	0.31	--	--	0.31
			Thallium	--	--	--	--	Hair	37	--	--	37
			Vanadium	--	--	--	--	Kidney	0.12	--	--	0.12
			Zinc	--	--	--	--	Blood	0.0066	--	--	0.0066
			Chemical Total	2.7E-04	--	--	2.7E-04		132	--	--	132
Total Deep Groundwater							2.7E-04					132
			Total Risk Across All Media - Shallow Groundwater				3.1E-04	Total Hazard Across All Media - Shallow Groundwater				199
											Total Blood HI	2.7
											Total Liver HI	0.201
											Total Kidney HI	0.70
											Total Body Weight HI	0.62

Table E-35
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Nervous System HI	0.2
											Total Cardiovascular System HI	0.065
											Total Skin HI	1.1
											Total Gastrointestinal HI	0.21
											Total Thyroid HI	0.2
											Total Bone HI	0.004
											Total Whole Body HI	0.034
											Total Reproductive System HI	0.38
											Total Hair HI	49
			Total Risk Acro All Media - Deep Groundwater				2.7E-04	Total Hazard Acro All Media - Deep Groundwater				1.02
											Total Kidney HI	0.25
											Total Nervous System HI	90
											Total Skin HI	0.48
											Total Blood HI	1.2
											Total Liver HI	0.48
											Total Spleen HI	0.33
											Total Thyroid HI	1.1
											Total Reproductive System HI	0.39
											Total Gastrointestinal HI	0.48
											Total Cardiovascular HI	0.025
											Total Bone HI	0.31
											Total Hair HI	37
											Total Body Weight HI	0.053

Table E-36
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	1.4E-06	--	--	1.4E-06	Nervous System, Blood, Liver	0.014	--	--	0.014
			4,4'-DDD	7.0E-09	--	--	7.0E-09	--	--	--	--	--
			Benzene	5.6E-06	--	--	5.6E-06	Blood	0.0015	--	--	0.0015
			bis(2-Ethylhexyl)phthalate	3.0E-07	--	--	3.0E-07	Liver	0.00062	--	--	0.00062
			Bromodichloromethane	1.3E-06	--	--	1.3E-06	Kidney	0.0000066	--	--	0.0000066
			Bromomethane	--	--	--	--	Gastrointestinal	0.0055	--	--	0.0055
			Chloroform	2.6E-07	--	--	2.6E-07	Liver, Blood	0.0049	--	--	0.0049
			Dibenzofuran	--	--	--	--	Whole Body	0.0066	--	--	0.0066
			Dieldrin	5.0E-07	--	--	5.0E-07	Liver	0.0066	--	--	0.0066
			Ethylbenzene	1.9E-06	--	--	1.9E-06	Liver, Kidney	0.0000100	--	--	0.0000100
			Naphthalene	--	--	--	--	Body Weight	0.000064	--	--	0.000064
			Pentachlorophenol	1.1E-06	--	--	1.1E-06	Liver	0.0002	--	--	0.0002
			Phenol	--	--	--	--	Body Weight	0.0028	--	--	0.0028
			Tetrachloroethene	1.1E-06	--	--	1.1E-06	Nervous System	0.0050	--	--	0.0050
			Trichloroethene	8.4E-06	--	--	8.4E-06	Cardiovascular System	0.021	--	--	0.021
			1,1,1-Trichloroethane	--	--	--	--	Body Weight	0.000024	--	--	0.000024
			Aluminum	--	--	--	--	Nervous System	0.001	--	--	0.001
			Antimony	--	--	--	--	Blood	0.11	--	--	0.11
			Arsenic	1.9E-05	--	--	1.9E-05	Skin	0.25	--	--	0.25
			Beryllium	--	--	--	--	Gastrointestinal	0.028	--	--	0.028
			Cadmium	--	--	--	--	Kidney	0.025	--	--	0.025
			Chromium	1.4E-05	--	--	1.4E-05	None observed	0.056	--	--	0.056
			Cobalt	--	--	--	--	Thyroid	20	--	--	20
			Copper	--	--	--	--	--	0.007	--	--	0.007
			Cyanide	--	--	--	--	Reproductive System	0.095	--	--	0.095
			Iron	--	--	--	--	Gastrointestinal	0.019	--	--	0.019
			Lead	--	--	--	--	--	--	--	--	--
			Magnesium	--	--	--	--	Nervous System	15	--	--	15
			Mercury	--	--	--	--	Kidney	0.12	--	--	0.12
			Molybdenum	--	--	--	--	Blood	0.13	--	--	0.13
			Nickel	--	--	--	--	Body Weight	0.202	--	--	0.202
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.019	--	--	0.019
			Strontium	--	--	--	--	Bone	0.016	--	--	0.016
			Thallium	--	--	--	--	Hair	12	--	--	12
			Vanadium	--	--	--	--	Kidney	0.025	--	--	0.025
			Zinc	--	--	--	--	Blood	0.42	--	--	0.42
			Chemical Total	2.7E-05	--	--	2.7E-05		50	--	--	50
Total Shallow Groundwater							2.7E-05					50

Table E-36
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	1,2-Dichloroethane	1.0E-07	--	--	1.0E-07	Kidney	0.00107	--	--	0.00107
			2,4-Dinitrotoluene	3.7E-06	--	--	3.7E-06	Nervous System, Blood, Liver	0.034	--	--	0.034
			2,6-Dinitrotoluene	6.4E-06	--	--	6.4E-06	Spleen	0.063	--	--	0.063
			Benzene	4.3E-06	--	--	4.3E-06	Blood	0.0012	--	--	0.0012
			bis(2-Ethylhexyl)phthalate	8.6E-07	--	--	8.6E-07	Liver	0.016	--	--	0.016
			Bromomethane	--	--	--	--	Gastrointestinal	0.011	--	--	0.011
			Chloroform	5.7E-08	--	--	5.7E-08	Liver, Blood	0.0011	--	--	0.0011
			Dieldrin	5.1E-07	--	--	5.1E-07	Liver	0.0007	--	--	0.0007
			Heptachlorepoxide	4.5E-07	--	--	4.5E-07	Liver	0.022	--	--	0.022
			Naphthalene	--	--	--	--	Body Weight	0.00043	--	--	0.00043
			Pentachlorophenol	9.2E-07	--	--	9.2E-07	Liver	0.0027	--	--	0.0027
			Trichloroethene	2.4E-08	--	--	2.4E-08	Cardiovascular System	0.0002	--	--	0.0002
			Aluminum	--	--	--	--	Nervous System	0.021	--	--	0.021
			Arsenic	9.2E-06	--	--	9.2E-06	Skin	0.12	--	--	0.12
			Beryllium	--	--	--	--	Gastrointestinal	0.013	--	--	0.013
			Cadmium	--	--	--	--	Kidney	0.029	--	--	0.029
			Chromium	9.7E-06	--	--	9.7E-06	Not quantified	0.036	--	--	0.036
			Cobalt	--	--	--	--	Thyroid	0.27	--	--	0.27
			Copper	--	--	--	--	--	0.0047	--	--	0.0047
			Cyanide	--	--	--	--	Reproductive System	0.096	--	--	0.096
			Iron	--	--	--	--	Gastrointestinal	0.096	--	--	0.096
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	22	--	--	22
			Mercury	--	--	--	--	Kidney	0.0027	--	--	0.0027
			Molybdenum	--	--	--	--	Blood	0.21	--	--	0.21
			Nickel	--	--	--	--	Body Weight	0.013	--	--	0.013
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.007	--	--	0.007
			Strontium	--	--	--	--	Bone	0.077	--	--	0.077
			Thallium	--	--	--	--	Hair	9.3	--	--	9.3
			Vanadium	--	--	--	--	Kidney	0.020	--	--	0.020
			Zinc	--	--	--	--	Blood	0.0022	--	--	0.0022
			Chemical Total	3.2E-05	--	--	3.2E-05		33	--	--	33
Total Deep Groundwater							3.2E-05					33
			Total Risk Across All Media - Shallow Groundwater				3.7E-05	Total Hazard Across All Media - Shallow Groundwater				50
								Total Blood HI				0.09
								Total Liver HI				0.050
								Total Kidney HI				0.17
								Total Body Weight HI				0.21

Table E-36
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Nervous System HI	16
											Total Cardiovascular System HI	0.021
											Total Skin HI	0.27
											Total Gastrointestinal HI	0.053
											Total Thyroid HI	20
											Total Reproductive System HI	0.095
											Total Whole Body HI	0.0066
											Total Blood HI	0.67
											Total Bone HI	0.016
											Total Hair HI	12
			Total Risk Acro All Media - Deep Groundwater				3.2E-05	Total Hazard Acro All Media - Deep Groundwater				33
											Total Endocr. HI	0.063
											Total Nervous System HI	22
											Total Blood HI	0.29
											Total Liver HI	0.12
											Total Spleen HI	0.083
											Total Skin HI	0.12
											Total Thyroid HI	0.27
											Total Reproductive System HI	0.10
											Total Gastrointestinal HI	0.12
											Total Bone HI	0.077
											Total Cardiovascular HI	0.0062
											Total Hair HI	9.3
											Total Body Weight HI	0.013

Table E-37
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.3E-05	---	2.3E-05	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.071	---	0.071
			1,2-Dichloroethane	---	8.1E-04	---	8.1E-04	Nervous System	---	12	--	12
			Benzene	---	1.3E-06	---	1.3E-06	Blood	---	0.016	---	0.016
			Chloroform	---	2.3E-06	---	2.3E-06	Liver	---	0.0028	--	0.0028
			Chloromethane	---	---	---	--	Nervous System	---	2.5	---	2.5
			Ethylbenzene	---	6.5E-07	---	6.5E-07	Developmental	---	0.00073	--	0.00073
			Chemical Total	---	8.3E-04	---	8.3E-04		---	15	---	15
Total Indoor Air							8.3E-04					15
						Total Risk	8.3E-04				Total Hazard	15
											Total Developmental HI	0.00073
											Total Liver HI	0.0028
											Total Blood HI	0.087
											Total Nervous System HI	15

Table E-38
Summary of Receptor Risks and Hazards for COPCs - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.8E-06	---	2.8E-06	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.0006	--	0.0006
			1,2-Dichloroethane	---	9.7E-05	---	9.7E-05	Nervous System	---	1.5	--	1.5
			Benzene	---	1.6E-07	---	1.6E-07	Blood	---	0.0019	--	0.0019
			Chloroform	---	2.7E-07	---	2.7E-07	Liver	---	0.00004	--	0.00004
			Chloromethane	---	---	---	--	Nervous System	---	0.30	---	0.30
			Ethylbenzene	---	7.8E-06	---	7.8E-06	Developmental	---	0.000007	--	0.000007
			Chemical Total	---	1.0E-04	---	1.0E-04		---	1.8	---	1.8
Total Indoor Air							1.0E-04					1.8
						Total Risk	1.0E-04				Total Hazard	1.8
											Total Developmental HI	0.000007
											Total Liver HI	0.00004
											Total Blood HI	0.010
											Total Nervous System HI	1.8

Table E-39R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	3.4E-07	NA	4.2E-08	3.8E-07	Developmental	0.03	NA	0.003	0.03
			Aluminum	NA	NA	NA	NA	Nervous system	0.03	NA	NA	0.03
			Arsenic	1.4E-06	NA	2.9E-07	1.7E-06	Skin	0.02	NA	0.005	0.03
			Chromium	5.0E-06	NA	NA	5.0E-06	None considered	0.003	NA	NA	0.003
			Cobalt	NA	NA	NA	NA	Thyroid	0.04	NA	NA	0.04
			Copper	NA	NA	NA	NA	NA	0.006	NA	NA	0.006
			Iron	NA	NA	NA	NA	GI tract (oral)	0.03	NA	NA	0.03
			Manganese	NA	NA	NA	NA	Nervous system	0.04	NA	NA	0.04
			Thallium	NA	NA	NA	NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA	NA	Kidney	0.005	NA	NA	0.005
			Zinc	NA	NA	NA	NA	Blood	0.001	NA	NA	0.001
			Chemical Total	6.7E-06	NA	3.4E-07	7.1E-06		0.2	NA	0.01	0.3
		On-Site Total					7.1E-06					0.3
	Surface Soil Total						7.1E-06					0.3
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	1.3E-12	NA	1.3E-12	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000006	NA	0.000000006
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00007	NA	0.00007
			Arsenic	NA	9.1E-11	NA	9.1E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	1.1E-03	NA	1.1E-03	Respiratory system	NA	0.000003	NA	0.000003
			Cobalt	NA	1.9E-10	NA	1.9E-10	Respiratory system	NA	0.00002	NA	0.00002
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0002	NA	0.0002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.000003	NA	0.000003
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.1E-03	NA	1.1E-03		NA	0.0003	NA	0.0003
		On-Site Total					1.1E-03					0.0003
	Air Total						1.1E-03					0.0003
Total On-Site Soil							7.1E-06					0.3

Table E-39R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Flemmken Branch	Benzo(a)anthracene	1.0E-06	NA	5.4E-09	1.0E-06	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.0E-07	NA	1.1E-07	3.0E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.2E-06	NA	1.2E-06	3.3E-06	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.0E-09	NA	1.1E-09	3.0E-09	NA	NA	NA	NA	NA
			Chrysene	1.9E-10	NA	1.0E-10	2.9E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	1.2E-07	NA	1.4E-08	1.3E-07	Developmental	0.009	NA	0.001	0.01
			Aluminum	NA	NA	NA	NA	Nervous System	0.009	NA	NA	0.009
			Arsenic	1.4E-06	NA	1.7E-07	1.6E-06	Skin	0.02	NA	0.003	0.02
			Chromium	3.8E-06	NA	NA	3.8E-06	None Observed	0.006	NA	NA	0.006
			Cobalt	NA	NA	1.3E-10	1.3E-10	Thyroid	0.03	NA	0.00000	0.03
			Cyanide	NA	NA	NA	NA	Reproductive System	0.003	NA	NA	0.003
			Iron	NA	NA	NA	NA	GI tract (ulcer)	0.03	NA	NA	0.03
			Manganese	NA	NA	NA	NA	Nervous System	0.005	NA	NA	0.005
			Thallium	NA	NA	NA	NA	Hair	0.07	NA	NA	0.07
			Chemical Total	5.5E-06	NA	3.1E-07	5.8E-06		0.2	NA	0.004	0.2
		Flemmken Branch Total					5.8E-06					0.2
	Surface Soil Total						5.8E-06					0.2
	Air	Flemmken Branch	Benzo(a)anthracene	NA	2.0E-14	NA	2.0E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	4.0E-13	NA	4.0E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	4.4E-14	NA	4.4E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	4.0E-14	NA	4.0E-14	NA	NA	NA	NA	NA
			Chrysene	NA	3.8E-15	NA	3.8E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	4.5E-13	NA	4.5E-13	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	0.0000000002	NA	0.0000000002
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00002	NA	0.00002
			Arsenic	NA	5.3E-11	NA	5.3E-11	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	8.5E-09		8.5E-09	Respiratory System	NA	0.000002	NA	0.000002
			Cobalt	NA	1.3E-10	NA	1.3E-10	Respiratory System	NA	0.00002	NA	0.00002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.00000003	NA	0.00000003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0002	NA	0.0002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	8.7E-09	NA	8.7E-09		NA	0.0002	NA	0.0002
		Flemmken Branch Total					5.8E-06					0.2
	Air Total						8.7E-09					0.0002
Total Flemmken Branch Soil							5.9E-06					0.2
			Total Risk Across All Media - On-Site				7.1E-06		Total Hazard Across All Media - On-Site			0.3
			Total Risk Across All Media - Flemmken Branch				5.9E-06		Total Hazard Across All Media - Flemmken Branch			0.2

Table E-40R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route: Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route: Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	8.5E-08	NA	3.0E-09	8.8E-08	Developmental	0.007	NA	0.0002	0.007
			Aluminum	NA	NA	NA	NA	Nervous system	0.007	NA	NA	0.007
			Arsenic	3.6E-07	NA	2.1E-08	3.8E-07	Skin	0.006	NA	0.0003	0.006
			Chromium	1.2E-06	NA	NA	1.2E-06	None observed	0.002	NA	NA	0.002
			Cobalt	NA	NA	NA	NA	Thyroid	0.009	NA	NA	0.009
			Copper	NA	NA	NA	NA	NA	0.001	NA	NA	0.001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.009	NA	NA	0.009
			Manganese	NA	NA	NA	NA	Nervous system	0.009	NA	NA	0.009
			Thallium	NA	NA	NA	NA	Hair	0.01	NA	NA	0.01
			Vanadium	NA	NA	NA	NA	Kidney	0.001	NA	NA	0.001
			Zinc	NA	NA	NA	NA	Blood	0.0004	NA	NA	0.0004
		On-Site Total	Chemical Total	1.7E-06	NA	2.4E-08	1.7E-06		0.06	NA	0.0006	0.06
		On-Site Total					1.7E-06					0.06
	Surface Soil Total						1.7E-06					0.06
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	3.3E-13	NA	3.3E-13	Liver Reproductive system Developmental Endocrine system Respiratory system Blood	NA	0.000000002	NA	0.000000002
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00002	NA	0.00002
			Arsenic	NA	2.3E-11	NA	2.3E-11	Developmental Cardiovascular system Nervous system Lung Skin	NA	0.0000002	NA	0.0000002
			Chromium	NA	2.8E-09	NA	2.8E-09	Respiratory system	NA	0.00000008	NA	0.00000008
			Cobalt	NA	4.7E-11	NA	4.7E-11	Respiratory system	NA	0.0000006	NA	0.0000006
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00006	NA	0.00006
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.00000008	NA	0.00000008
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
		On-Site Total	Chemical Total	NA	2.8E-09	NA	2.8E-09		NA	0.00009	NA	0.00009
		On-Site Total					2.8E-09					0.00009
	Air Total						2.8E-09					0.00009
Total On-Site Soil							1.7E-06					0.06

Table E-40R
Summary of Receptor Risks and Hazards for COPCs - Trespasser
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route: Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route: Total
Soil	Surface Soil	Flemmken Branch	Benzo(a)anthracene	2.5E-09	NA	3.9E-10	2.9E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	5.0E-08	NA	7.6E-09	5.7E-08	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	5.4E-09	NA	8.4E-10	6.3E-09	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	5.0E-10	NA	7.6E-11	5.7E-10	NA	NA	NA	NA	NA
			Chrysene	4.8E-11	NA	7.3E-12	5.5E-11	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	2.9E-08	NA	1.0E-09	3.0E-08	Developmental	0.002	NA	0.00008	0.002
			Aluminum	NA	NA	NA	NA	Nervous system	0.002	NA	NA	0.002
			Arsenic	3.4E-07	NA	1.2E-08	3.6E-07	Skin	0.005	NA	0.00002	0.006
			Chromium	9.5E-07	NA	NA	9.5E-07	None observed	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.006	NA	NA	0.006
			Cyanide	NA	NA	NA	NA	Reproductive system	0.00006	NA	NA	0.00006
			Iron	NA	NA	NA	NA	Gastrointestinal	0.007	NA	NA	0.007
			Manganese	NA	NA	NA	NA	Nervous system	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.02	NA	NA	0.02
			Chemical Total	1.4E-06	NA	2.2E-08	1.4E-06		0.04	NA	0.00003	0.04
		Flemmken Branch Total					1.4E-06					0.04
	Surface Soil Total						1.4E-06					0.04
	Air	Flemmken Branch	Benzo(a)anthracene	NA	5.0E-15	NA	5.0E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	9.9E-14	NA	9.9E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.1E-14	NA	1.1E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	9.9E-15	NA	9.9E-15	NA	NA	NA	NA	NA
			Chrysene	NA	9.5E-16	NA	9.5E-16	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	1.1E-13	NA	1.1E-13	Liver Reproductive system Developmental Endocrine system Respiratory system Blood	NA	0.0000000005	NA	0.0000000005
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000006	NA	0.000006
			Arsenic	NA	1.3E-11	NA	1.3E-11	System Lung Skin	NA	0.000001	NA	0.000001
			Chromium	NA	2.1E-09	NA	2.1E-09	Respiratory system	NA	0.0000006	NA	0.0000006
			Cobalt	NA	3.3E-11	NA	3.3E-11	Respiratory system	NA	0.000004	NA	0.000004
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.0000000006	NA	0.0000000006
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00005	NA	0.00005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	2.2E-09	NA	2.2E-09		NA	0.00006	NA	0.00006
		Flemmken Branch Total					1.4E-06					0.04
	Air Total						2.2E-09					0.00006
Total Flemmken Branch Soil							1.4E-06					0.04
						Total Risk Across All Media - On-Site	1.7E-06				Total Hazard Across All Media - On-Site	0.06
						Total Risk Across All Media - Flemmken Branch	1.4E-06				Total Hazard Across All Media - Flemmken Branch	0.04

Table E-41R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.4E-06	NA	6.7E-08	1.4E-06	Developmental	0.2	NA	0.009	0.2
			Aluminum	NA	NA	NA	NA	Nervous system	0.2	NA	NA	0.2
			Arsenic	5.8E-06	NA	4.6E-07	6.2E-06	Skin	0.1	NA	0.01	0.2
			Chromium	3.6E-05	NA	NA	3.6E-05	None observed	0.05	NA	NA	0.05
			Cobalt	NA	NA	NA	NA	Thyroid	0.2	NA	NA	0.2
			Copper	NA	NA	NA	NA	NA	0.04	NA	NA	0.04
			Iron	NA	NA	NA	NA	Gastrointestinal	0.2	NA	NA	0.2
			Magnesium	NA	NA	NA	NA	Nervous system	0.2	NA	NA	0.2
			Thallium	NA	NA	NA	NA	Hair	0.3	NA	NA	0.3
			Vanadium	NA	NA	NA	NA	Kidney	0.03	NA	NA	0.03
			Zinc	NA	NA	NA	NA	Blood	0.01	NA	NA	0.01
			Chemical Total	4.3E-05	NA	5.3E-07	4.3E-05		2	NA	0.02	2
		On-Site Total					4.3E-05					2
	Surface Soil Total						4.3E-05					2
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	9.0E-13	NA	9.0E-13	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000007	NA	0.000000007
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00008	NA	0.00008
			Arsenic	NA	6.1E-11	NA	6.1E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	1.3E-08	NA	1.3E-08	Respiratory system	NA	0.0000003	NA	0.0000003
			Cobalt	NA	1.3E-10	NA	1.3E-10	Respiratory system	NA	0.00003	NA	0.00003
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Nervous system	NA	0.0003	NA	0.0003
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.0000004	NA	0.0000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.3E-08	NA	1.3E-08		NA	0.0004	NA	0.0004
		On-Site Total					1.3E-08					0.0004
	Air Total						1.3E-08					0.0004
Total On-Site Soil							4.3E-05					2

Table E-41R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Flennken Branch	Benzo(a)anthracene	7.3E-08	NA	2.6E-08	9.9E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	1.4E-06	NA	5.2E-07	1.9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1.6E-07	NA	5.7E-08	2.1E-07	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	1.4E-08	NA	5.2E-09	1.9E-08	NA	NA	NA	NA	NA
			Chrysene	1.4E-09	NA	5.0E-10	1.9E-09	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	4.7E-07	NA	2.3E-08	4.9E-07	Developmental	0.06	NA	0.003	0.06
			Aluminum	NA	NA	NA	NA	Nervous system	0.06	NA	NA	0.06
			Arsenic	3.4E-06	NA	2.7E-07	3.6E-06	Skin	0.09	NA	0.007	0.09
			Chromium	2.7E-05	NA	NA	2.7E-05	None observed	0.04	NA	NA	0.04
			Cobalt	NA	NA	NA	NA	Thyroid	0.2	NA	NA	0.2
			Cyanide	NA	NA	NA	NA	Reproductive system	0.02	NA	NA	0.02
			Iron	NA	NA	NA	NA	Gastrointestinal	0.2	NA	NA	0.2
			Manganese	NA	NA	NA	NA	Nervous system	0.03	NA	NA	0.03
			Thallium	NA	NA	NA	NA	Hair	0.5	NA	NA	0.5
			Chemical Total	3.3E-05	NA	9.0E-07	3.4E-05		1	NA	0.01	1
		Flennken Branch Total					3.4E-05					1
	Surface Soil Total						3.4E-05					1
	Air	Flennken Branch	Benzo(a)anthracene	NA	2.4E-14	NA	2.4E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	4.7E-13	NA	4.7E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	5.2E-14	NA	5.2E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	4.7E-14	NA	4.7E-14	NA	NA	NA	NA	NA
			Chrysene	NA	4.6E-15	NA	4.6E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	3.1E-13	NA	3.1E-13	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000002	NA	0.000000002
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.00003	NA	0.00003
			Arsenic	NA	3.6E-11	NA	3.6E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.0000006	NA	0.0000006
			Chromium	NA	1.0E-08	NA	1.0E-08	Respiratory system	NA	0.0000003	NA	0.0000003
			Cobalt	NA	8.9E-11	NA	8.9E-11	Respiratory system	NA	0.00002	NA	0.00002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.003	NA	0.003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0002	NA	0.0002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-08	NA	1.0E-08		NA	0.004	NA	0.004
		Flennken Branch Total					3.4E-05					1
	Air Total						1.0E-08					0.004
Total Flennken Branch Soil							3.4E-05					1
				Total Risk Across All Media - On-Site			4.3E-05	Total Hazard Across All Media - On-Site				2

Table E-41R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe Current/Future
Receptor Population Recreational User
Receptor Age Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Developmental HI	0.2
											Total Nervous System HI	0.4
											Total Skin HI	0.2
											Total Thyroid HI	0.2
											Total Gastrointestinal HI	0.2
											Total Heart HI	0.3
											Total Blood HI	0.01
											Total Liver HI	0.000000007
											Total Reproductive System HI	0.000000007
											Total Endocrine System HI	0.000000007
											Total Lung/Respiratory Tract HI	0.00004
											Total Cardiovascular System HI	0.00001
			Total Risk Across All Media - Flemmken Branch				3.4E-05	Total Hazard Across All Media - Flemmken Branch				1

Table E-42R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=0.5hr Cancer Risk
Exposure Frequency Recreational Use
Exposure Age Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.7E-07	NA	1.1E-07	1.[illegible]E-07	Developmental	0.0[illegible]	NA	0.0001	0.0[illegible]
			Aluminum	NA	NA	NA	NA	Neurological System	0.0[illegible]	NA	NA	0.0[illegible]
			Arsenic	7.1E-07	NA	7.7E-07	7.[illegible]E-07	Skin	0.0[illegible]	NA	0.0001	0.0[illegible]
			Chromium	4.4E-06	NA	NA	4.4E-06	Non-observed	0.000[illegible]	NA	NA	0.000[illegible]
			Cobalt	NA	NA	NA	NA	Thyroid	0.001	NA	NA	0.001
			Copper	NA	NA	NA	NA	NA	0.0005	NA	NA	0.0005
			Iron	NA	NA	NA	NA	Gastrointestinal	0.001	NA	NA	0.001
			Magnesium	NA	NA	NA	NA	Neurological System	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.001	NA	NA	0.001
			Vanadium	NA	NA	NA	NA	Fetus	0.0004	NA	NA	0.0004
			Zinc	NA	NA	NA	NA	Blood	0.0001	NA	NA	0.0001
			Chemical Total	5.4E-06	NA	E-06	5.4E-06		0.[illegible]	NA	0.0001	0.[illegible]
		On-Site Total					5.4E-06					0.[illegible]
	Surface Soil Total						5.4E-06					0.[illegible]
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	2.2E-14	NA	2.2E-14	Liver Reproductive System Developmental Endocrine System Reproductive System Blood	NA	0.000000000[illegible]	NA	0.000000000[illegible]
			Aluminum	NA	NA	NA	NA	Neurological System	NA	0.000001[illegible]	NA	0.000001[illegible]
			Arsenic	NA	1.5E-11	NA	1.5E-11	Developmental Cardiovascular System Neurological System Lung Skin	NA	0.000000004	NA	0.000000004
			Chromium	NA	4.4E-06	NA	4.4E-06	Respiratory System	NA	0.000000004[illegible]	NA	0.000000004[illegible]
			Cobalt	NA	4.2E-11	NA	4.2E-11	Respiratory System	NA	0.000000007	NA	0.000000007
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Neurological System	NA	0.000000007	NA	0.000000007
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.000000004[illegible]	NA	0.000000004[illegible]
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.4E-06	NA	4.4E-06		NA	0.0001	NA	0.0001
		On-Site Total					4.4E-06					0.0001
	Air Total						4.4E-06					0.0001
Total On-Site Soil							5.4E-06					0.[illegible]

Table E-42R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	9.0E-09	NA	2.6E-09	1.2E-0	NA	NA	NA	NA	NA
			Benzo(a)pyrene	1.[illegible]E-07	NA	5.1E-0	2.3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1.9E-0	NA	5.7E-09	2.5E-0	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	1.[illegible]E-09	NA	5.1E-10	2.3E-09	NA	NA	NA	NA	NA
			Chrysene	1.7E-10	NA	4.9E-11	2.2E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	5.[illegible]E-0	NA	3.[illegible]E-09	6.2E-0	Developmental	0.0007	NA	0.00005	0.000
			Aluminum	NA	NA	NA	NA	Nervous system	0.0007	NA	NA	0.0007
			Arsenic	4.2E-07	NA	4.5E-0	4.6E-07	Skin	0.001	NA	0.0001	0.001
			Chromium	3.4E-06	NA	NA	3.4E-06	None observed	0.0005	NA	NA	0.0005
			Cobalt	NA	NA	NA	NA	Thyroid	0.002	NA	NA	0.002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.002	NA	NA	0.002
			Manganese	NA	NA	NA	NA	Nervous system	0.0004	NA	NA	0.0004
			Thallium	NA	NA	NA	NA	Hair	0.006	NA	NA	0.006
			Chemical Total	4.1E-06	NA	1.1E-07	4.2E-06		0.1	NA	0.0002	0.1
		Flenniken Branch Total					4.2E-06					0.1
	Surface Soil Total						4.2E-06					0.1
	Air	Flenniken Branch	Benzo(a)anthracene	NA	6.0E-15	NA	6.0E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.2E-13	NA	1.2E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.3E-14	NA	1.3E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.2E-14	NA	1.2E-14	NA	NA	NA	NA	NA
			Chrysene	NA	1.1E-15	NA	1.1E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	7.6E-14	NA	7.6E-14	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000006	NA	0.000000000006
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000000007	NA	0.000000007
			Arsenic	NA	E-12	NA	E-12	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000000002	NA	0.000000002
			Chromium	NA	2.5E-09	NA	2.5E-09	Respiratory system	NA	0.000000007	NA	0.000000007
			Cobalt	NA	2.2E-11	NA	2.2E-11	Respiratory system	NA	0.000000005	NA	0.000000005
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.00009	NA	0.00009
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.000005	NA	0.000005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	2.6E-09	NA	2.6E-09		NA	0.00009	NA	0.00009
		Flenniken Branch Total					4.2E-06					0.1
	Air Total						2.6E-09					0.00009
Total Flenniken Branch Soil							4.2E-06					0.1

Table E-42R
Summary of Receptor Risks and Hazards for COPCs - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
						Total Risk Across All Media - On-Site	5.4E-06				Total Hazard Across All Media - On-Site	0.2
						Total Risk Across All Media - Flenniken Branch	4.2E-06				Total Hazard Across All Media - Flenniken Branch	0.1

Table E-43R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	4.3E-07	NA	5.5E-0[illegible]	4.9E-07	Developmental	0.02	NA	0.002	0.02
			Aluminum	NA	NA	NA	NA	Nervous system	0.02	NA	NA	0.02
			Arsenic	1.[illegible]E-06	NA	3.[illegible]E-07	2.2E-06	Skin	0.01	NA	0.003	0.02
			Chromium	2.1E-06	NA	NA	2.1E-06	None observed	0.005	NA	NA	0.005
			Cobalt	NA	NA	NA	NA	Thyroid	0.02	NA	NA	0.02
			Copper	NA	NA	NA	NA	NA	0.004	NA	NA	0.004
			Iron	NA	NA	NA	NA	Gastrointestinal	0.02	NA	NA	0.02
			Manganese	NA	NA	NA	NA	Nervous system	0.02	NA	NA	0.02
			Thallium	NA	NA	NA	NA	Hair	0.03	NA	NA	0.03
			Vanadium	NA	NA	NA	NA	Kidney	0.003	NA	NA	0.003
			Zinc	NA	NA	NA	NA	Blood	0.0009	NA	NA	0.0009
			Chemical Total	4.3E-06	NA	4.3E-07	4.[illegible]E-06		0.2	NA	0.005	0.2
		On-Site Total					4.[illegible]E-06					0.2
	Surface Soil Total						4.[illegible]E-06					0.2
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	3.0E-12	NA	3.0E-12	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000007	NA	0.000000000007
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000000	NA	0.000000
			Arsenic	NA	2.0E-10	NA	2.0E-10	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000001	NA	0.000001
			Chromium	NA	4E-09	NA	4E-09	Respiratory system	NA	0.000003	NA	0.000003
			Cobalt	NA	4.2E-10	NA	4.2E-10	Respiratory system	NA	0.000003	NA	0.000003
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.0003	NA	0.0003
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory system	NA	0.000004	NA	0.000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	5.0E-09	NA	5.0E-09		NA	0.0004	NA	0.0004
		On-Site Total					5.0E-09					0.0004
	Air Total						5.0E-09					0.0004
Total On-Site Soil							4.[illegible]E-06					0.2

Table E-43R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	4.3E-09	NA	2.3E-09	6.6E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4E-0	NA	4.6E-0	1.3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	9.2E-09	NA	5.0E-09	1.4E-0	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	4E-10	NA	4.6E-10	1.3E-09	NA	NA	NA	NA	NA
			Chrysene	0E-11	NA	4.4E-11	1.2E-10	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	1.5E-07	NA	1.9E-0	1.7E-07	Developmental	0.0006	NA	0.00007	0.0006
			Aluminum	NA	NA	NA	NA	Nervous system	0.0006	NA	NA	0.0006
			Arsenic	1.0E-06	NA	2.2E-07	1.3E-06	Skin	0.000	NA	0.0002	0.001
			Chromium	1.6E-06	NA	NA	1.6E-06	None observed	0.0004	NA	NA	0.0004
			Cobalt	NA	NA	NA	NA	Thyroid	0.002	NA	NA	0.002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.002	NA	NA	0.002
			Manganese	NA	NA	NA	NA	Nervous system	0.0003	NA	NA	0.0003
			Thallium	NA	NA	NA	NA	Hair	0.004	NA	NA	0.004
			Chemical Total	2.9E-06	NA	2.9E-07	3.2E-06		0.1	NA	0.0002	0.1
		Flenniken Branch Total					3.2E-06					0.1
	Surface Soil Total						3.2E-06					0.1
	Air	Flenniken Branch	Benzo(a)anthracene	NA	1.5E-14	NA	1.5E-14	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	3.0E-13	NA	3.0E-13	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	3.3E-14	NA	3.3E-14	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	3.0E-14	NA	3.0E-14	NA	NA	NA	NA	NA
			Chrysene	NA	2.9E-15	NA	2.9E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	1.0E-12	NA	1.0E-12	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000002	NA	0.000000000002
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000003	NA	0.000003
			Arsenic	NA	1.2E-10	NA	1.2E-10	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000000006	NA	0.000000006
			Chromium		6.4E-09	NA	6.4E-09	Respiratory system	NA	0.000000003		0.000000003
			Cobalt	NA	3.0E-10	NA	3.0E-10	Respiratory system	NA	0.000002	NA	0.000002
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.0003	NA	0.0003
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.00002	NA	0.00002
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	6.0E-09	NA	6.0E-09		NA	0.0004	NA	0.0004
		Flenniken Branch Total					3.2E-06					0.1
	Air Total						6.0E-09					0.0004
Total Flenniken Branch Soil							3.2E-06					0.1

Table E-43R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
						Total Risk Across All Media - On-Site	4 E-06				Total Hazard Across All Media - On-Site	0.2
						Total Risk Across All Media - Flenniken Branch	3.2E-06				Total Hazard Across All Media - Flenniken Branch	0.1

Table E-44R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=0.5hr Cancer=Future
Exposure Population Recreational User
Exposure Age Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	2.4E-10	NA	1.7E-09	2.0E-09	Developmental	0.00E+00	NA	0.00E+00	0.00E+00
			Aluminum	NA	NA	NA	NA	Nervous System	0.00E+00	NA	NA	0.00E+00
			Arsenic	1.0E-07	NA	1.2E-09	1.1E-07	Skin	0.00E+00	NA	0.00E+00	0.00E+00
			Chromium	1.2E-07	NA	NA	1.2E-07	Non-observed	0.00E+00	NA	NA	0.00E+00
			Cobalt	NA	NA	NA	NA	Thyroid	0.00E+00	NA	NA	0.00E+00
			Copper	NA	NA	NA	NA	NA	0.00E+00	NA	NA	0.00E+00
			Iron	NA	NA	NA	NA	Gastrointestinal	0.00E+00	NA	NA	0.00E+00
			Manganese	NA	NA	NA	NA	Nervous System	0.00E+00	NA	NA	0.00E+00
			Thallium	NA	NA	NA	NA	Hair	0.00E+00	NA	NA	0.00E+00
			Vanadium	NA	NA	NA	NA	Fetus	0.00E+00	NA	NA	0.00E+00
			Zinc	NA	NA	NA	NA	Blood	0.00E+00	NA	NA	0.00E+00
			Chemical Total	2.4E-07	NA	1.4E-09	2.5E-07		0.00E+00	NA	0.00E+00	0.00E+00
		On-Site Total					2.5E-07					0.00E+00
	Surface Soil Total						2.5E-07					0.00E+00
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	4.4E-14	NA	4.4E-14	Liver Reproductive System Developmental Endocrine System Reproductive System Blood	NA	0.00E+00	NA	0.00E+00
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00E+00	NA	0.00E+00
			Arsenic	NA	2.4E-11	NA	2.4E-11	Developmental Cardiovascular System Nervous System Lung Skin	NA	0.00E+00	NA	0.00E+00
			Chromium	NA	9.4E-10	NA	9.4E-10	Reproductive System	NA	0.00E+00	NA	0.00E+00
			Cobalt	NA	4.7E-11	NA	4.7E-11	Reproductive System	NA	0.00E+00	NA	0.00E+00
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.00E+00	NA	0.00E+00
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Reproductive System	NA	0.00E+00	NA	0.00E+00
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-09	NA	1.0E-09		NA	0.00E+00	NA	0.00E+00
		On-Site Total					1.0E-09					0.00E+00
	Air Total						1.0E-09					0.00E+00
Total On-Site Soil							2.5E-07					0.00E+00

Table E-44R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	2.4E-10	NA	7.5E-11	3.1E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4.7E-09	NA	1.5E-09	6.1E-09	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	5.1E-10	NA	1.6E-10	6.7E-10	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	4.7E-11	NA	1.5E-11	6.1E-11	NA	NA	NA	NA	NA
			Chrysene	4.5E-12	NA	1.4E-12	5.9E-12	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	2E-09	NA	5.9E-10	E-09	Developmental	0.00007	NA	0.000005	0.0000
			Aluminum	NA	NA	NA	NA	Nervous system	0.00007	NA	NA	0.00007
			Arsenic	5.0E-0	NA	7.0E-09	6.5E-0	Skin	0.0001	NA	0.00001	0.0001
			Chromium	9.0E-0	NA	NA	9.0E-0	None observed	0.00005	NA	NA	0.00005
			Cobalt	NA	NA	NA	NA	Thyroid	0.0002	NA	NA	0.0002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.00002	NA	NA	0.00002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0002	NA	NA	0.0002
			Manganese	NA	NA	NA	NA	Nervous system	0.00004	NA	NA	0.00004
			Thallium	NA	NA	NA	NA	Hair	0.0005	NA	NA	0.0005
			Chemical Total	1.6E-07	NA	9.4E-09	1.7E-07		0.001	NA	0.00002	0.001
		Flenniken Branch Total					1.7E-07					0.001
	Surface Soil Total						1.7E-07					0.001
	Air	Flenniken Branch	Benzo(a)anthracene	NA	1.7E-15	NA	1.7E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	3.3E-14	NA	3.3E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	3.7E-15	NA	3.7E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	3.3E-15	NA	3.3E-15	NA	NA	NA	NA	NA
			Chrysene	NA	3.2E-16	NA	3.2E-16	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	1.1E-13	NA	1.1E-13	Liver, Reproductive system, Developmental, Endocrine system, Respiratory system, Blood	NA	0.000000000006	NA	0.000000000006
			Aluminum	NA	NA	NA	NA	Nervous system	NA	0.000007	NA	0.000007
			Arsenic	NA	1.3E-11	NA	1.3E-11	Developmental, Cardiovascular system, Nervous system, Lung, Skin	NA	0.000002	NA	0.000002
			Chromium	NA	7.1E-10	NA	7.1E-10	Respiratory system	NA	0.000007	NA	0.000007
			Cobalt	NA	3.3E-11	NA	3.3E-11	Respiratory system	NA	0.000005	NA	0.000005
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.00009	NA	0.00009
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous system	NA	0.000005	NA	0.000005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	7.6E-10	NA	7.6E-10		NA	0.00009	NA	0.00009
		Flenniken Branch Total					1.7E-07					0.001
	Air Total						7.6E-10					0.00009
Total Flenniken Branch Soil							1.7E-07					0.001

Table E-44R
Summary of Receptor Risks and Hazards for COPCs - Recreational Adult User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
						Total Risk Across All Media - On-Site	2.6E-07				Total Hazard Across All Media - On-Site	0.02
						Total Risk Across All Media - Flenniken Branch	1.7E-07				Total Hazard Across All Media - Flenniken Branch	0.01

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Total Soil	On-Site	Benzo(a)anthracene	2.4E-09	NA	9.1E-10	3.4E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.7E-08	NA	1.1E-08	3.8E-08	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.0E-09	NA	1.2E-09	4.2E-09	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.7E-10	NA	1.1E-10	3.8E-10	NA	NA	NA	NA	NA
			Chrysene	2.0E-11	NA	1.2E-11	4.2E-11	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.0E-09	NA	8.3E-10	2.8E-09	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	1.5E-07	NA	1.4E-08	1.7E-07	Developmental	0.1	NA	0.001	0.1
			PCB-1242	4.4E-08	NA	1.9E-08	6.3E-08	Immune System	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	0.004	NA	NA	0.004
			Arsenic	6.2E-07	NA	9.1E-08	7.1E-07	Skin	0.1	NA	0.002	0.1
			Chromium	7.5E-07	NA	NA	7.5E-07	Non-specified	0.004	NA	NA	0.004
			Cobalt	NA	NA	NA	NA	Thyroid	0.2	NA	NA	0.2
			Copper	NA	NA	NA	NA	NA	0.002	NA	NA	0.002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.2	NA	NA	0.2
			Magnesium	NA	NA	NA	NA	Nervous System	0.2	NA	NA	0.2
			Thallium	NA	NA	NA	NA	Hair	0.2	NA	NA	0.2
			Vanadium	NA	NA	NA	NA	Kidney	0.002	NA	NA	0.002
			Zinc	NA	NA	NA	NA	Blood	0.000	NA	NA	0.000
			Chemical Total	1.0E-06	NA	1.8E-07	1.2E-06		0.4	NA	0.002	1
		On-Site Total					1.2E-06					1
	Total Soil Total						1.2E-06					1

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	On-Site	Benzo(a)anthracene	NA	5.2E-15	NA	5.2E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	5.[illegible]E-14	NA	5.[illegible]E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	[illegible].4E-15	NA	[illegible].4E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	5.[illegible]E-15	NA	5.[illegible]E-15	NA	NA	NA	NA	NA
			Chrysene	NA	[illegible].4E-1[illegible]	NA	[illegible].4E-1[illegible]	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	NA	4.4E-15	NA	4.4E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	[illegible].4E-1[illegible]	NA	[illegible].4E-1[illegible]	Liver, Reproductive System, Developmental, Endocrine System, Reproductive System, Blood	NA	[illegible]	NA	[illegible]
			PCB-1254	NA	1.2E-[illegible]	NA	1.2E-[illegible]	NA	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	4.[illegible]E-11	NA	4.[illegible]E-11	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	[illegible]5	NA	[illegible]5
			Chromium	NA	1.[illegible]E-[illegible]	NA	1.[illegible]E-[illegible]	Respiratory System	NA	[illegible]2	NA	[illegible]2
			Cobalt	NA	[illegible].2E-11	NA	[illegible].2E-11	Respiratory System	NA	[illegible]1	NA	[illegible]1
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	[illegible]1	NA	[illegible]1
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	[illegible]2	NA	[illegible]2
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.4E-[illegible]	NA	1.4E-[illegible]		NA	[illegible]2	NA	[illegible]2
		On-Site Total					1.4E-[illegible]					[illegible]2
	Air Total						1.4E-[illegible]					[illegible]2
Total On-Site Soil							1.[illegible]E-[illegible]					1

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Total Soil	Floodplain Erosion	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1.5E-09	NA	6.2E-10	2.1E-09	NA	NA	NA	NA	NA
			1,2,3,7,8-Pentachlorodibenzo-p-dioxin	2.0E-10	NA	1.2E-10	4.2E-10	NA	NA	NA	NA	NA
			1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	4.2E-09	NA	1.4E-09	4.6E-09	NA	NA	NA	NA	NA
			1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	2.0E-10	NA	1.2E-10	4.2E-10	NA	NA	NA	NA	NA
			Chrysene	2.1E-11	NA	1.2E-11	4.0E-11	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	5.2E-09	NA	4.0E-09	5.7E-09	Developmental	0.004	NA	0.0004	0.004
			Aluminum	NA	NA	NA	NA	Nervous System	0.004	NA	NA	0.004
			Arsenic	4.7E-07	NA	5.1E-08	4.4E-07	Skin	0.006	NA	0.0001	0.007
			Chromium	5.7E-07	NA	NA	5.7E-07	Non-specified	0.004	NA	NA	0.004
			Cobalt	NA	NA	NA	NA	Thyroid	0.1	NA	NA	0.1
			Copper	NA	NA	NA	NA	Reproductive System	0.001	NA	NA	0.001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.1	NA	NA	0.1
			Magnesium	NA	NA	NA	NA	Nervous System	0.002	NA	NA	0.002
			Thallium	NA	NA	NA	NA	Hair	0.4	NA	NA	0.4
			Chemical Total	1.0E-06	NA	7.7E-08	1.1E-06		0.7	NA	0.001	0
		Floodplain Erosion Total					1.1E-06					0
	Total Soil Total						1.1E-06					0

Table E-45R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Exposure Future
Exposure Frequency Construction Worker
Exposure Age Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	4.4E-15	NA	4.4E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	6.4E-14	NA	6.4E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	7.0E-15	NA	7.0E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	6.4E-15	NA	6.4E-15	NA	NA	NA	NA	NA
			Chrysene	NA	6.1E-16	NA	6.1E-16	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	2.2E-14	NA	2.2E-14	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	[illegible]	NA	[illegible]
			Aluminum	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	2.5E-11	NA	2.5E-11	Developmental, Cardiovascular, Nervous System, Lung, Skin	NA	[illegible]	NA	[illegible]
			Chromium		1.4E-04		1.4E-04	Respiratory System	NA	[illegible]	NA	[illegible]
			Cobalt	NA	6.4E-11	NA	6.4E-11	Respiratory System	NA	[illegible]	NA	[illegible]
			Copper	NA	NA	NA	NA	Thyroid	NA	[illegible]	NA	[illegible]
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.4E-04	NA	1.4E-04		NA	[illegible]	NA	[illegible]
		Fugitive Emission Total					1.4E-04					[illegible]
	Air Total						1.4E-04					[illegible]
Total Fugitive Emission Soil							1.1E-06					0
Total Risk Across All Media - One Site							1.1E-06	Total Hazard Across All Media - One Site				1
Total Developmental HI												0.1
Total Nervous System HI												0.1
Total Skin HI												0.1
Total Thyroid HI												0.2
Total Gastrointestinal HI												0.2
Total Hair HI												0.2
Total Blood HI												[illegible]
Total Liver HI												[illegible]
Total Reproductive System HI												[illegible]
Total Endocrine System HI												[illegible]
Total Lung/Respiratory Tract HI												[illegible]
Total Cardiovascular System HI												[illegible]
Total Risk Across All Media - Fugitive Emission							1.1E-06	Total Hazard Across All Media - Fugitive Emission				0

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Total Soil	On-Site	Benzo(a)anthracene	1.[illegible]E-10	NA	1.0E-10	4.4E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.0E-11	NA	1.[illegible]E-11	4.0E-11	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.2E-10	NA	2.0E-10	4.2E-10	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.0E-11	NA	1.[illegible]E-11	4.0E-11	NA	NA	NA	NA	NA
			Chrysene	2.2E-12	NA	2.0E-12	4.2E-12	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.5E-10	NA	1.4E-10	2.9E-10	NA	NA	NA	NA	NA
			2,4,7,8-TCDD (TEQ)	1.2E-11	NA	2.4E-11	1.4E-11	Developmental	[illegible]	NA	[illegible]	[illegible]
			PCB-1242	4.4E-11	NA	4.2E-11	8.5E-11	Ex: Immune System	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	[illegible]	NA	NA	[illegible]
			Arsenic	4.7E-11	NA	1.0E-11	5.4E-11	Skin	[illegible]	NA	[illegible]	[illegible]
			Chromium	5.7E-11	NA	NA	5.7E-11	Nervous System	[illegible]	NA	NA	[illegible]
			Cobalt	NA	NA	NA	NA	Thyroid	[illegible]	NA	NA	[illegible]
			Copper	NA	NA	NA	NA	NA	[illegible]	NA	NA	[illegible]
			Iron	NA	NA	NA	NA	Gastrointestinal	[illegible]	NA	NA	[illegible]
			Manganese	NA	NA	NA	NA	Nervous System	[illegible]	NA	NA	[illegible]
			Thallium	NA	NA	NA	NA	Hair	[illegible]	NA	NA	[illegible]
			Vanadium	NA	NA	NA	NA	Kidney	[illegible]	NA	NA	[illegible]
			Zinc	NA	NA	NA	NA	Blood	[illegible]	NA	NA	[illegible]
			Chemical Total	1.2E-07	NA	2.4E-07	1.5E-07		[illegible]	NA	[illegible]	[illegible]
		On-Site Total					1.5E-07					[illegible]
	Total Soil Total						1.5E-07					[illegible]

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	On-Site	Benzo(a)anthracene	NA	1.4E-15	NA	1.4E-15	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.5E-14	NA	1.5E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1.6E-15	NA	1.6E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.5E-15	NA	1.5E-15	NA	NA	NA	NA	NA
			Chrysene	NA	1.6E-16	NA	1.6E-16	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	NA	1.1E-15	NA	1.1E-15	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	1.6E-14	NA	1.6E-14	Liver, Reproductive System, Developmental Endocrine System, Respiratory System, Blood	NA	**********	NA	**********
			PCB-1242	NA	4.0E-11	NA	4.0E-11	NA	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Arsenic	NA	1.1E-11	NA	1.1E-11	Developmental, Cardiovascular System Nervous System, Lung, Skin	NA	*******	NA	*******
			Chromium	NA	4.5E-10	NA	4.5E-10	Respiratory System	NA	********	NA	********
			Cobalt	NA	2.4E-11	NA	2.4E-11	Respiratory System	NA	*******	NA	*******
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	********	NA	********
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.5E-10	NA	4.5E-10		NA	*******	NA	*******
		On-Site Total					4.5E-10					*******
	Air Total						4.5E-10					*******
Total On-Site Soil							1.5E-07					*****

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Total Soil	Flenniken Branch	Benzo(a)anthracene	1.1E-10	NA	1.0E-10	2.2E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.2E-09	NA	2.0E-09	4.2E-09	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.5E-10	NA	2.2E-10	4.7E-10	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.2E-11	NA	2.0E-11	4.2E-11	NA	NA	NA	NA	NA
			Chrysene	2.1E-12	NA	1.9E-12	4.1E-12	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	3.9E-09	NA	2E-10	4.1E-09	Developmental	0.0003	NA	0.00006	0.0004
			Aluminum	NA	NA	NA	NA	Nervous system	0.0003	NA	NA	0.0003
			Arsenic	2.1E-0	NA	9.7E-09	3.1E-0	Skin	0.0004	NA	0.0002	0.0006
			Chromium	4.3E-0		NA	4.3E-0	None observed	0.0002	NA	NA	0.0002
			Cobalt	NA	NA	NA	NA	Thyroid	0.1	NA	NA	0.1
			Cyanide	NA	NA	NA	NA	Reproductive system	0.00009	NA	NA	0.0001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0009	NA	NA	0.0009
			Manganese	NA	NA	NA	NA	Nervous system	0.0002	NA	NA	0.0002
			Thallium	NA	NA	NA	NA	Hair	0.02	NA	NA	0.02
			Chemical Total	7.7E-0	NA	1.3E-0	9.0E-0		0.2	NA	0.0002	0.2
		Flenniken Branch Total					9.0E-0					0.2
	Total Soil Total						9.0E-0					0.2

Table E-46R
Summary of Receptor Risks and Hazards for COPCs - Construction Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Construction Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Dust	Benzo(a)anthracene	NA	1E-10	NA	1E-10	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.6E-14	NA	1.6E-14	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	1 E-15	NA	1 E-15	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.6E-15	NA	1.6E-15	NA	NA	NA	NA	NA
			Chrysene	NA	1.5E-10	NA	1.5E-10	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	NA	5.5E-14	NA	5.5E-14	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	**********	NA	**********
			Aluminum	NA	NA	NA	NA	Nervous System, Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	*******	NA	*******
			Arsenic	NA	6.4E-12	NA	6.4E-12		NA	*********	NA	*********
			Chromium	NA	4.4E-10	NA	4.4E-10	Respiratory System	NA	*********	NA	*********
			Cobalt	NA	1.6E-11	NA	1.6E-11	Respiratory System	NA	*******	NA	*******
			Cyanide	NA	NA	NA	NA	Thyroid	NA	****	NA	****
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	4.6E-10	NA	4.6E-10		NA	****	NA	****
		Fugitive Dust Total					4.6E-10					****
	Air Total						4.6E-10					****
Total Fugitive Dust Soil							4.6E-10					**
Total PAH Across All Media - One Chemical							1.5E-09	Total Hazard Across All Media - One Chemical				****
Total PAH Across All Media - Fugitive Dust							4.6E-10	Total Hazard Across All Media - Fugitive Dust				**

Table E-47R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	5.4E-06	NA	4.6E-07	5.8E-06	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Arsenic	2.2E-05	NA	2.5E-06	2.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	Non-specified	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	Thyroid	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	Gastrointestinal	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Kidney	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	Blood	NA	NA	NA	NA
			Chemical Total	1.6E-04	NA	4.7E-06	1.6E-04		NA	NA	NA	NA
		On-Site Total					1.6E-04					NA
	Total Soil Total						1.6E-04					NA
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	7.0E-11	NA	7.0E-11	Liver; Reproductive System; Developmental; Endocrine System; Reproductive System; Blood	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System; Developmental; Cardiovascular System; Nervous System; Lung; Skin	NA	NA	NA	NA
			Arsenic	NA	4.7E-04	NA	4.7E-04		NA	NA	NA	NA
			Chromium	NA	5.4E-07	NA	5.4E-07	Respiratory System	NA	NA	NA	NA
			Cobalt	NA	1.0E-10	NA	1.0E-10	Respiratory System	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-04	NA	5.1E-07		NA	NA	NA	NA
		On-Site Total					5.1E-07					NA
	Air Total						5.1E-07					NA
Total On-Site Soil							1.6E-04					NA

Table E-47R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	2.4E-07	NA	6.0E-0[illegible]	3.0E-07	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4.[illegible]E-06	NA	1.2E-06	5.9E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	5.2E-07	NA	1.3E-07	6.5E-07	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	4.[illegible]E-0[illegible]	NA	1.2E-0[illegible]	5.9E-0[illegible]	NA	NA	NA	NA	NA
			Chrysene	4.6E-09	NA	1.1E-09	5.7E-09	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	1.9E-06	NA	1.2E-07	2.0E-06	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous system	NA	NA	NA	NA
			Arsenic	1.3E-05	NA	1.5E-06	1.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	NA	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Cyanide	NA	NA	NA	NA	Reproductive system	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Chemical Total	1.4E-04	NA	3.0E-06	1.4E-04		NA	NA	NA	NA
		Flenniken Branch Total					1.4E-04					NA
	Surface Soil Total						1.4E-04					NA

Table E-47R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Air	Flenniken Branch	Benzo(a)anthracene	NA	9.1E-13	NA	9.1E-13	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	1.9E-11	NA	1.9E-11	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	2.1E-12	NA	2.1E-12	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	1.9E-12	NA	1.9E-12	NA	NA	NA	NA	NA
			Chrysene	NA	1.1E-13	NA	1.1E-13	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	2.4E-11	NA	2.4E-11	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Arsenic	NA	2.1E-09	NA	2.1E-09	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	NA	NA	NA
			Chromium	NA	5.4E-07	NA	5.4E-07	NA	NA	NA	NA	NA
			Cobalt	NA	6.9E-09	NA	6.9E-09	NA	NA	NA	NA	NA
			Cyanide	NA	NA	NA	NA	Thyroid	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	5.5E-07	NA	5.5E-07		NA	NA	NA	NA
		Flenniken Branch Total					5.5E-07					NA
	Air Total						5.5E-07					NA
Total Flenniken Branch Soil							1.4E-04					NA
						Total Risk Across All Media - On-Site	1.5E-04				Total Hazard Across All Media - On-Site	NA
						Total Risk Across All Media - Flenniken Branch	1.4E-04				Total Hazard Across All Media - Flenniken Branch	NA

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.5	NA	0.004	0.5
			Aluminum	NA	NA	NA	NA	Nervous System	0.0	NA	NA	0.0
			Arsenic	NA	NA	NA	NA	Skin	0.7	NA	0.00	0
			Chromium	NA	NA	NA	NA	Hematopoietic	0.2	NA	NA	0.2
			Cobalt	NA	NA	NA	NA	Thyroid	0.7	NA	NA	0.7
			Copper	NA	NA	NA	NA	NA	0.1	NA	NA	0.1
			Iron	NA	NA	NA	NA	Gastrointestinal	0.7	NA	NA	0.7
			Manganese	NA	NA	NA	NA	Nervous System	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	0	NA	NA	0
			Vanadium	NA	NA	NA	NA	Kidney	0.1	NA	NA	0.1
			Zinc	NA	NA	NA	NA	Blood	0.004	NA	NA	0.004
			Chemical Total	NA	NA	NA	NA		5.	NA	0.004	5.
		On-Site Total					NA					5.
	Surface Soil Total						NA					5.
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.00000001	NA	0.00000001
			Aluminum	NA	NA	NA	NA	Nervous System Developmental Cardiovascular System Nervous System Lung Skin	NA	0.0001	NA	0.0001
			Arsenic	NA	NA	NA	NA		NA	0.00002	NA	0.00002
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.00000.	NA	0.00000.
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.00005	NA	0.00005
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0005	NA	0.0005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.00007	NA	0.00007
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0007	NA	0.0007
		On-Site Total					NA					0.0007
	Air Total						NA					0.0007
Total On-Site Soil							NA					5.

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	Floodplain Erosion	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.2	NA	0.0004	0.2
			Aluminum	NA	NA	NA	NA	Nervous System	0.2	NA	NA	0.2
			Arsenic	NA	NA	NA	NA	Skin	0.4	NA	0.004	0.5
			Chromium	NA	NA	NA	NA	Non-noticeable	0.1	NA	NA	0.1
			Cobalt	NA	NA	NA	NA	Thyroid	0.5	NA	NA	0.5
			Copper	NA	NA	NA	NA	Reproductive System	0.005	NA	NA	0.005
			Iron	NA	NA	NA	NA	Gastrointestinal	0.0	NA	NA	0.0
			Manganese	NA	NA	NA	NA	Nervous System	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	1	NA	NA	1
			Chemical Total	NA	NA	NA	NA		4	NA	0.04	4
		Floodplain Erosion Total					NA					4
	Surface Soil Total						NA					4

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Reproductive System, Blood	NA	0.000000004	NA	0.000000004
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00005	NA	0.00005
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	NA	NA	NA	Reproductive System	NA	0.000005	NA	0.000005
			Cobalt	NA	NA	NA	NA	Reproductive System	NA	0.00001		0.00001
			Copper	NA	NA	NA	NA	Thyroid	NA	0.0001	NA	0.0001
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0007	NA	0.01
		Fugitive Emission Total					NA					0.01
	Air Total						NA					0.01
Total Fugitive Emission Soil							NA					4

Table E-48R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Total PAH Across All Media - On-Site							NA	Total Hazard Across All Media - On-Site				5
Total Lung/Respiratory Tract HI												0.0007
Total Cardiopulmonary HI												0.0
Total Nervous System HI												0.7
Total Skin HI												0
Total Thyroid HI												0.7
Total Gastrointestinal HI												0.7
Total Hair HI												0
Total Blood HI												0.004
Total Liver HI												0.0000001
Total Reproductive System HI												0.0000001
Total Endocrine System HI												0.0000001
Total Cardiovascular System HI												0.0000
Total PAH Across All Media - Flood-to-Ecorisk							NA	Total Hazard Across All Media - Flood-to-Ecorisk				4
Total Cardiopulmonary HI												0.2
Total Nervous System HI												0.4
Total Skin HI												0.5
Total Thyroid HI												0.0
Total Reproductive System HI												0.05
Total Hair HI												1
Total Liver HI												0.0000004
Total Respiratory System HI												0.05
Total Endocrine System HI												0.0000004
Total Blood HI												0.0000004
Total Cardiovascular System HI												0.0000

Table E-49R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.005	NA	0.0000	0.005
			Aluminum	NA	NA	NA	NA	Neurological System	0.05	NA	NA	0.05
			Arsenic	NA	NA	NA	NA	Skin	0.07	NA	0.0004	0.07
			Chromium	NA	NA	NA	NA	Hematological	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.07	NA	NA	0.07
			Copper	NA	NA	NA	NA	NA	0.001	NA	NA	0.001
			Iron	NA	NA	NA	NA	Gastrointestinal	0.07	NA	NA	0.07
			Manganese	NA	NA	NA	NA	Neurological System	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.01	NA	NA	0.01
			Vanadium	NA	NA	NA	NA	Kidney	0.0004	NA	NA	0.0004
			Zinc	NA	NA	NA	NA	Blood	0.0004	NA	NA	0.0004
			Chemical Total	NA	NA	NA	NA		0.4	NA	0.02	0.4
		On-Site Total					NA					0.4
	Surface Soil Total						NA					0.4
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.0000001	NA	0.0000001
			Aluminum	NA	NA	NA	NA	Neurological System	NA	0.001	NA	0.001
			Arsenic	NA	NA	NA	NA	Developmental Cardiovascular System Neurological System Lung Skin	NA	0.00002	NA	0.00002
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.0000	NA	0.0000
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.00005	NA	0.00005
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	0.0005	NA	0.0005
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.00007	NA	0.00007
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.007	NA	0.007
		On-Site Total					NA					0.007
	Air Total						NA					0.007
Total On-Site Soil							NA					0.5

Table E-49R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.002	NA	0.0002	0.002
			Aluminum	NA	NA	NA	NA	Nervous system	0.002	NA	NA	0.002
			Arsenic	NA	NA	NA	NA	Skin	0.004	NA	0.0005	0.005
			Chromium	NA	NA	NA	NA	None observed	0.001	NA	NA	0.001
			Cobalt	NA	NA	NA	NA	Thyroid	0.005	NA	NA	0.005
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0005	NA	NA	0.0005
			Iron	NA	NA	NA	NA	Gastrointestinal	0.005	NA	NA	0.005
			Manganese	NA	NA	NA	NA	Nervous system	0.001	NA	NA	0.001
			Thallium	NA	NA	NA	NA	Hair	0.1	NA	NA	0.1
			Chemical Total	NA	NA	NA	NA		0.3	NA	0.0007	0.3
		Flenniken Branch Total					NA					0.3
	Surface Soil Total						NA					0.3

Table E-49R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Air	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	0.000000004	NA	0.000000004
			Aluminum	NA	NA	NA	NA	Nervous System	NA	0.00005	NA	0.00005
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	0.00001	NA	0.00001
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.00005	NA	0.00005
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.00003	NA	0.00003
			Cyanide	NA	NA	NA	NA	Thyroid	NA	0.006	NA	0.006
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.007	NA	0.007
		Flenniken Branch Total					NA					0.3
	Air Total						NA					0.1
Total Flenniken Branch Soil							NA					0.4
						Total Risk Across All Media - On-Site	NA				Total Hazard Across All Media - On-Site	0.5
						Total Risk Across All Media - Flenniken Branch	NA				Total Hazard Across All Media - Flenniken Branch	0.4

Table E-50R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Future
Exposure Frequency=Resident
Exposure Age=Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	2.4E-06	NA	7.7E-07	3.2E-06	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Arsenic	9.7E-06	NA	5.4E-07	1.0E-05	Skin	NA	NA	NA	NA
			Chromium	5.4E-05	NA	NA	5.4E-05	Non-specified	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	Thyroid	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	Gastrointestinal	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Kidney	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	Blood	NA	NA	NA	NA
			Chemical Total	6.0E-05	NA	6.0E-07	6.2E-05		NA	NA	NA	NA
		On-Site Total					6.2E-05					NA
	Surface Soil Total						6.2E-05					NA
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	2.7E-11	NA	2.7E-11	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Arsenic	NA	1.[illegible]E-04	NA	1.[illegible]E-04	Developmental Cardiovascular System Neurological System Lung Skin	NA	NA	NA	NA
			Chromium	NA	1.0E-07	NA	1.0E-07	Respiratory System	NA	NA	NA	NA
			Cobalt	NA	4.[illegible]E-04	NA	4.[illegible]E-04	Respiratory System	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Neurological System	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	NA	NA	NA
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	1.0E-07	NA	1.0E-07		NA	NA	NA	NA
		On-Site Total					1.0E-07					NA
	Air Total						1.0E-07					NA
Total On-Site Soil							6.2E-05					NA

Table E-50R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	1.1E-07	NA	1.4E-09	1.1E-07	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2.2E-06	NA	9.4E-09	2.2E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2.4E-07	NA	1.1E-0	2.5E-07	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	2.2E-0	NA	9.4E-09	3.1E-0	NA	NA	NA	NA	NA
			Chrysene	2.1E-09	NA	2.7E-09	4.[illegible]E-09	NA	NA	NA	NA	NA
			2,3,7,8-TCDD/TEQ	0E-07	NA	2.6E-0	3E-07	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous system	NA	NA	NA	NA
			Arsenic	5.7E-06	NA	3.1E-07	6.0E-06	Skin	NA	NA	NA	NA
			Chromium	4.2E-05	NA	NA	4.2E-05	NA	NA	NA	NA	NA
			Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Cyanide	NA	NA	NA	NA	Reproductive system	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Chemical Total	5.1E-05	NA	3.7E-07	5.1E-05		NA	NA	NA	NA
		Flenniken Branch Total					5.1E-05					NA
	Total Soil Total						5.1E-05					NA

Table E-50R
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Frequency: Resident
Exposure Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PEF				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Dust	2,3,7,8-Tetrachlorodibenzo-p-dioxin	NA	2.4E-14	NA	2.4E-14	NA	NA	NA	NA	NA
			1,2,3,7,8-Pentachlorodibenzo-p-dioxin	NA	6.7E-12	NA	6.7E-12	NA	NA	NA	NA	NA
			1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	NA	7.4E-14	NA	7.4E-14	NA	NA	NA	NA	NA
			1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	NA	6.7E-14	NA	6.7E-14	NA	NA	NA	NA	NA
			Chromium	NA	6.5E-14	NA	6.5E-14	NA	NA	NA	NA	NA
			2,4,7,8-TCDD TEQ	NA	9.2E-12	NA	9.2E-12	Developmental	NA	NA	NA	NA
			Aluminum	NA	NA	NA	NA	Nervous System	NA	NA	NA	NA
			Arsenic	NA	1.1E-04	NA	1.1E-04	Skin	NA	NA	NA	NA
			Chromium	NA	1.4E-07	NA	1.4E-07	NA	NA	NA	NA	NA
			Cobalt	NA	2.4E-04	NA	2.4E-04	NA	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	Reproductive System	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Hair	NA	NA	NA	NA
			Chemical Total	NA	1.5E-07	NA	1.5E-07		NA	NA	NA	NA
		Fugitive Dust Total					1.5E-07					NA
	Air Total						1.5E-07					NA
Total Fugitive Dust Soil							5.1E-05					NA
Total Risk Across All Media - Cancer Risk							6.7E-05	Total Hazard Across All Media - Cancer Risk				NA
Total Risk Across All Media - Fugitive Dust							5.1E-05	Total Hazard Across All Media - Fugitive Dust				NA

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time=Future
Exposure Frequency=Resident
Exposure Age=Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.4	NA	0.001	0.4
			Aluminum	NA	NA	NA	NA	Nervous System	0.4	NA	NA	0.4
			Arsenic	NA	NA	NA	NA	Skin	0.4	NA	0.001	0.4
			Chromium	NA	NA	NA	NA	Non-specified	0.1	NA	NA	0.1
			Cobalt	NA	NA	NA	NA	Thyroid	0.4	NA	NA	0.4
			Copper	NA	NA	NA	NA	NA	0.1	NA	NA	0.1
			Iron	NA	NA	NA	NA	Gastrointestinal	0.4	NA	NA	0.4
			Manganese	NA	NA	NA	NA	Nervous System	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	0.4	NA	NA	0.4
			Vanadium	NA	NA	NA	NA	Kidney	0.005	NA	NA	0.005
			Zinc	NA	NA	NA	NA	Blood	0.001	NA	NA	0.001
			Chemical Total	NA	NA	NA	NA		2	NA	0.002	2
		On-Site Total					NA					2
	Surface Soil Total						NA					2
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver Reproductive System Developmental Endocrine System Respiratory System Blood	NA	0.0000000000	NA	0.0000000000
			Aluminum	NA	NA	NA	NA	Nervous System Developmental Cardiovascular System Nervous System Lung Skin	NA	0.0001	NA	0.0001
			Arsenic	NA	NA	NA	NA		NA	0.000001	NA	0.000001
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.000004	NA	0.000004
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.000004	NA	0.000004
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.000004	NA	0.000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0005	NA	0.0005
		On-Site Total					NA					0.0005
	Air Total						NA					0.0005
Total On-Site Soil							NA					2

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	NA	NA	NA	Developmental	0.00[illegible]	NA	0.000[illegible]	0.00[illegible]
			Aluminum	NA	NA	NA	NA	Nervous system	0.00[illegible]	NA	NA	0.00[illegible]
			Arsenic	NA	NA	NA	NA	Skin	0.2	NA	0.000[illegible]	0.2
			Chromium	NA	NA	NA	NA	None observed	0.00[illegible]	NA	NA	0.00[illegible]
			Cobalt	NA	NA	NA	NA	Thyroid	0.[illegible]	NA	NA	0.[illegible]
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0[illegible]	NA	NA	0.0[illegible]
			Iron	NA	NA	NA	NA	Gastrointestinal	0.[illegible]	NA	NA	0.[illegible]
			Manganese	NA	NA	NA	NA	Nervous system	0.05	NA	NA	0.05
			Thallium	NA	NA	NA	NA	Hair	0.7	NA	NA	0.7
			Chemical Total	NA	NA	NA	NA		2	NA	0.001	2
		Flenniken Branch Total					NA					2
	Total Soil Total						NA					2

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Respiratory System, Blood	NA	**********	NA	**********
			Aluminum	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	*******	NA	*******
			Chromium	NA	NA	NA	NA	Respiratory System	NA	*******	NA	*******
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	*******	NA	*******
			Copper	NA	NA	NA	NA	Thyroid	NA	****	NA	****
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	*******	NA	*******
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	****	NA	****
		Fugitive Emission Total					NA					****
	Air Total						NA					****
Total Fugitive Emission Soil							NA					2

Table E-51R
Summary of Receptor Risks and Hazards for COPCs - Child Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
							Total Risk Across All Media - On-Site	NA				Total Hazard Across All Media - On-Site	2
												Total Lung/Respiratory Tract HI	0.0005
												Total Developmental HI	0.3
												Total Nervous System HI	0.3
												Total Skin HI	0.4
												Total Thyroid HI	0.4
												Total Gastrointestinal HI	0.3
												Total Hair HI	0.4
												Total Blood HI	0.01
												Total Liver HI	0.00000001
												Total Reproductive System HI	0.00000001
												Total Endocrine System HI	0.00000001
												Total Cardiovascular System HI	0.0001
							Total Risk Across All Media - Flenniken Branch	NA				Total Hazard Across All Media - Flenniken Branch	2
												Total Developmental HI	0.1
												Total Nervous System HI	0.1
												Total Skin HI	0.2
												Total Thyroid HI	0.3
												Total Reproductive System HI	0.03
												Total Hair HI	1
												Total Liver HI	0.000000003
												Total Reproductive System HI	0.03
												Total Endocrine System HI	0.000000003
												Total Blood HI	0.000000003
												Total Cardiovascular System HI	0.0001

Table E-52R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Population: Resident
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.02	NA	0.00001	0.02
			Aluminum	NA	NA	NA	NA	Nervous System	0.04	NA	NA	0.04
			Arsenic	NA	NA	NA	NA	Skin	0.04	NA	0.0001	0.04
			Chromium	NA	NA	NA	NA	Hematological	0.0007	NA	NA	0.0007
			Cobalt	NA	NA	NA	NA	Thyroid	0.04	NA	NA	0.04
			Copper	NA	NA	NA	NA	NA	0.0006	NA	NA	0.0006
			Iron	NA	NA	NA	NA	Gastrointestinal	0.04	NA	NA	0.04
			Manganese	NA	NA	NA	NA	Nervous System	0.0006	NA	NA	0.0006
			Thallium	NA	NA	NA	NA	Hair	0.04	NA	NA	0.04
			Vanadium	NA	NA	NA	NA	Kidney	0.0005	NA	NA	0.0005
			Zinc	NA	NA	NA	NA	Blood	0.0001	NA	NA	0.0001
			Chemical Total	NA	NA	NA	NA		0.02	NA	0.00002	0.02
		On-Site Total					NA					0.02
	Surface Soil Total						NA					0.02
	Air	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Lower Respiratory System Developmental Endocrine System Reproductive System Blood	NA	0.00000000	NA	0.00000000
			Aluminum	NA	NA	NA	NA	Nervous System Developmental Cardiovascular System Nervous System Lung Skin	NA	0.0001	NA	0.0001
			Arsenic	NA	NA	NA	NA		NA	0.0000001	NA	0.0000001
			Chromium	NA	NA	NA	NA	Respiratory System	NA	0.0000004	NA	0.0000004
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	0.0000004	NA	0.0000004
			Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	0.0004	NA	0.0004
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	NA	NA	Respiratory System	NA	0.0000004	NA	0.0000004
			Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	0.0005	NA	0.0005
		On-Site Total					NA					0.0005
	Air Total						NA					0.0005
Total On-Site Soil							NA					0.02

Table E-52R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Flenniken Branch	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD(TEQ)	NA	NA	NA	NA	Developmental	0.000	NA	0.00004	0.0009
			Aluminum	NA	NA	NA	NA	Nervous system	0.000	NA	NA	0.000
			Arsenic	NA	NA	NA	NA	Skin	0.002	NA	0.00007	0.002
			Chromium	NA	NA	NA	NA	None observed	0.0006	NA	NA	0.0006
			Cobalt	NA	NA	NA	NA	Thyroid	0.002	NA	NA	0.002
			Cyanide	NA	NA	NA	NA	Reproductive system	0.0002	NA	NA	0.0002
			Iron	NA	NA	NA	NA	Gastrointestinal	0.004	NA	NA	0.004
			Manganese	NA	NA	NA	NA	Nervous system	0.0005	NA	NA	0.0005
			Thallium	NA	NA	NA	NA	Hair	0.007	NA	NA	0.007
			Chemical Total	NA	NA	NA	NA		0.02	NA	0.0001	0.02
		Flenniken Branch Total					NA					0.02
	Total Soil Total						NA					0.02

Table E-52R
Summary of Receptor Risks and Hazards for COPCs - Adult Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Future
Exposure Frequency: Present
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PEF				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Air	Fugitive Emission	Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Liver, Reproductive System, Developmental, Endocrine System, Reproductive System, Blood	NA	[illegible]	NA	[illegible]
			Aluminum	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Arsenic	NA	NA	NA	NA	Developmental, Cardiovascular System, Nervous System, Lung, Skin	NA	[illegible]	NA	[illegible]
			Chromium	NA	NA	NA	NA	Respiratory System	NA	[illegible]	NA	[illegible]
			Cobalt	NA	NA	NA	NA	Respiratory System	NA	[illegible]	NA	[illegible]
			Copper	NA	NA	NA	NA	Thyroid	NA	[illegible]	NA	[illegible]
			Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Nervous System	NA	[illegible]	NA	[illegible]
			Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	NA	NA	NA	NA		NA	[illegible]	NA	[illegible]
		Fugitive Emission Total					NA					[illegible]
	Air Total						NA					[illegible]
Total Fugitive Emission Soil							NA					[illegible]
Total PEF Access All Media - Cancer							NA	Total HQ Access All Media - Cancer				[illegible]
Total PEF Access All Media - Fugitive Emission							NA	Total HQ Access All Media - Fugitive Emission				[illegible]

Table E-53
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	2.0E-05	--	1.2E-06	2.1E-05	--	--	--	--	--
			4,4'-DDD	9.9E-08	--	9.5E-07	1.0E-06	--	--	--	--	--
			Benzene	7.9E-07	--	1.2E-07	9.1E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	4.1E-06	--	2.8E-04	2.9E-04	--	--	--	--	--
			Bromodichloromethane	2.5E-07	--	1.8E-08	2.7E-07	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	3.6E-06	--	3.3E-07	3.9E-06	--	--	--	--	--
			Dibenzofuran	--	--	--	--	--	--	--	--	--
			Dieldrin	7.0E-06	--	1.3E-05	2.0E-05	--	--	--	--	--
			Ethylbenzene	2.7E-07	--	1.6E-07	4.3E-07	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	1.5E-05	--	6.0E-05	7.5E-05	--	--	--	--	--
			Phenol	--	--	--	--	--	--	--	--	--
			Tetrachloroethene	1.6E-07	--	9.4E-08	2.5E-07	--	--	--	--	--
			Trichloroethene	1.7E-06	--	2.8E-07	2.0E-06	--	--	--	--	--
			1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Antimony	--	--	--	--	--	--	--	--	--
			Arsenic	2.7E-04	--	1.5E-06	2.7E-04	--	--	--	--	--
			Beryllium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	5.6E-04	--	1.4E-04	7.0E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--
			Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Silver	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	8.6E-04	--	5.0E-04	1.4E-03		--	--	--	--

Table E-53
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
		Shallow Groundwater Total					1.4E-03					--
	Total Shallow Groundwater Total						1.4E-03					--
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			Benzene	--	9.6E-11	--	9.6E-11	--	--	--	--	--
			Bromodichloromethane	--	8.6E-11	--	8.6E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	1.9E-09	--	1.9E-09	--	--	--	--	--
			Chlorobenzene	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	4.7E-11	--	4.7E-11	--	--	--	--	--
			Naphthalene	--	6.3E-10	--	6.3E-10	--	--	--	--	--
			Tetrachloroethene	--	1.2E-11	--	1.2E-11	--	--	--	--	--
			Trichloroethene	--	7.2E-11	--	7.2E-11	--	--	--	--	--
			m-,o-,p-Xylene	--	--	--	--	--	--	--	--	--
			Chemical Total	--	2.3E-09	--	2.3E-09		--	--	--	--
		Shallow Groundwater Total					2.3E-09					--
	Air Total						2.3E-09					--
Total Shallow Groundwater							1.4E-03					--
Groundwater	Groundwater	Deep	1,2-Dichloroethane	1.4E-06	--	6.8E-06	1.5E-06	--	--	--	--	--
			2,4-Dinitrotoluene	5.1E-05	--	3.1E-06	5.4E-05	--	--	--	--	--
			2,6-Dinitrotoluene	9.0E-05	--	6.6E-06	9.6E-05	--	--	--	--	--
			Benzene	6.1E-07	--	9.1E-08	7.0E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	1.2E-05	--	8.3E-04	8.4E-04	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	8.0E-07	--	7.2E-08	8.7E-07	--	--	--	--	--
			Dieldrin	7.2E-06	--	1.3E-05	2.1E-05	--	--	--	--	--
			Heptachlor epoxide	6.3E-06	--	7.8E-06	1.4E-05	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	1.3E-05	--	5.0E-05	6.3E-05	--	--	--	--	--
			Trichloroethene	4.9E-07	--	8.1E-08	5.7E-07	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Arsenic	1.3E-04	--	7.1E-07	1.3E-04	--	--	--	--	--
			Beryllium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	3.8E-04	--	9.3E-05	4.7E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--

Table E-53
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Strontium	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	6.9E-04	--	1.0E-03	1.7E-03		--	--	--	--
		Deep Groundwater Total					1.7E-03					--
	Total Deep Groundwater Total						1.7E-03					--
Groundwater	Air	Deep	1,2-Dichloroethane	--	2.7E-10	--	2.7E-10	--	--	--	--	--
			Benzene	--	7.4E-11	--	7.4E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	4.1E-10	--	4.1E-10	--	--	--	--	--
			Naphthalene	--	3.2E-10	--	3.2E-10	--	--	--	--	--
			Trichloroethene	--	2.1E-11	--	2.1E-11	--	--	--	--	--
			Chemical Total	--	1.1E-09	--	1.1E-09		--	--	--	--
		Deep Groundwater Total					1.1E-09					--
	Air Total						1.1E-09					--
Total Deep Groundwater							1.7E-03					--
			Total Risk Across All Media - Shallow Groundwater				1.4E-03	Total Hazard Across All Media - Shallow Groundwater				--
			Total Risk Across All Media - Deep Groundwater				1.7E-03	Total Hazard Across All Media - Deep Groundwater				--

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.13	--	0.0093	0.14
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.014	--	0.0028	0.017
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.057	--	4.8	4.8
			Bromodichloromethane	--	--	--	--	Kidney	0.00080	--	0.000068	0.00087
			Bromomethane	--	--	--	--	Gastrointestinal	0.052	--	0.0021	0.054
			Chloroform	--	--	--	--	Liver, Blood	0.045	--	0.0049	0.050
			Dibenzofuran	--	--	--	--	Whole Body	0.080	--	0.17	0.25
			Dieldrin	--	--	--	--	Liver	0.034	--	0.076	0.11
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.00096	--	0.00069	0.0017
			Naphthalene	--	--	--	--	Body Weight	0.0078	--	0.0062	0.014
			Pentachlorophenol	--	--	--	--	Liver	0.030	--	0.14	0.17
			Phenol	--	--	--	--	Body Weight	0.026	--	0.0016	0.028
			Tetrachloroethene	--	--	--	--	Nervous System	0.049	--	0.035	0.084
			Trichloroethene	--	--	--	--	Cardiovascular System	0.20	--	0.040	0.24
			(m-and/or p-)xylene	--	--	--	--	Body Weight	0.0022	--	0.0017	0.0040
			Aluminum	--	--	--	--	Nervous System	2.8	--	0.012	2.8
			Antimony	--	--	--	--	Blood	1.0	--	0.029	1.0
			Arsenic	--	--	--	--	Skin	2.3	--	0.010	2.3
			Beryllium	--	--	--	--	Gastrointestinal	0.26	--	0.16	0.42
			Cadmium	--	--	--	--	Kidney	0.23	--	0.021	0.25
			Chromium	--	--	--	--	None observed	0.52	--	0.092	0.61
			Cobalt	--	--	--	--	Thyroid	190	--	0.34	190
			Copper	--	--	--	--	--	0.35	--	0.0015	0.35
			Cyanide	--	--	--	--	Reproductive System	0.89	--	0.0039	0.89
			Iron	--	--	--	--	Gastrointestinal	0.18	--	0.00080	0.18
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	143	--	16	159
			Mercury	--	--	--	--	Kidney	1.2	--	0.073	1.2
			Molybdenum	--	--	--	--	Blood	1.2	--	0.0053	1.2
			Nickel	--	--	--	--	Body Weight	1.9	--	0.042	1.9
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.17	--	0.00077	0.17
			Strontium	--	--	--	--	Bone	0.15	--	0.00066	0.15
			Thallium	--	--	--	--	Hair	113	--	0.5	114
			Vanadium	--	--	--	--	Kidney	0.23	--	0.039	0.27
			Zinc	--	--	--	--	Blood	3.9	--	0.010	3.9
			Chemical Total	--	--	--	--		465	--	22	487
		Shallow Groundwater Total					--					487

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					487
Total Shallow Groundwater							--					487
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.010	--	0.000061	0.011
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.32	--	0.024	0.34
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.78	--	0.069	0.84
			Benzene	--	--	--	--	Blood	0.011	--	0.0022	0.013
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.17	--	14	14
			Bromomethane	--	--	--	--	Cardiovascular	0.10	--	0.0042	0.107
			Chloroform	--	--	--	--	Liver, Blood	0.010	--	0.0011	0.011
			Dieldrin	--	--	--	--	Liver	0.035	--	0.079	0.11
			Heptachlorepoxide	--	--	--	--	Liver	0.21	--	0.31	0.52
			Naphthalene	--	--	--	--	Body Weight	0.0040	--	0.003	0.007
			Pentachlorophenol	--	--	--	--	Liver	0.025	--	0.12	0.14
			Trichloroethene	--	--	--	--	Cardiovascular System	0.058	--	0.012	0.069
			Aluminum	--	--	--	--	Nervous System	0.19	--	0.000085	0.19
			Arsenic	--	--	--	--	Skin	1.1	--	0.0049	1.1
			Barium	--	--	--	--	Cardiovascular	0.12	--	0.075	0.20
			Cadmium	--	--	--	--	Kidney	0.27	--	0.02	0.30
			Chromium	--	--	--	--	None observed	0.35	--	0.062	0.41
			Cobalt	--	--	--	--	Thyroid	2.5	--	0.0045	2.5
			Copper	--	--	--	--	--	0.043	--	0.000019	0.044
			Cyanide	--	--	--	--	Reproductive System	0.91	--	0.0040	0.92
			Iron	--	--	--	--	Gastrointestinal	0.89	--	0.0009	0.90
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	209	--	23	232
			Mercury	--	--	--	--	Kidney	0.026	--	0.0016	0.027
			Molybdenum	--	--	--	--	Blood	2.0	--	0.0068	2.0
			Nickel	--	--	--	--	Body Weight	0.12	--	0.0027	0.12
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.34	--	0.0015	0.34
			Strontium	--	--	--	--	Bone	0.71	--	0.0012	0.72
			Thallium	--	--	--	--	Hair	87	--	0.38	87
			Vanadium	--	--	--	--	Kidney	0.28	--	0.047	0.33
			Zinc	--	--	--	--	Blood	0.021	--	0.000055	0.021
			Chemical Total	--	--	--	--		307	--	38	345
		Deep Groundwater Total					--					345
	Total Deep Groundwater Total						--					345
Total Deep Groundwater							--					345
			Total Risk Across All Media - Shallow Groundwater				--	Total Hazard Across All Media - Shallow Groundwater				487

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Blood HI	6.5
											Total Liver HI	5.5
											Total Kidney HI	1.3
											Total Body Weight HI	2.0
											Total Whole Body HI	0.25
											Total Nervous System HI	16.3
											Total Cardiovascular System HI	0.24
											Total Skin HI	2.3
											Total Gastrointestinal HI	0.66
											Total Thyroid HI	190
											Total Reproductive System HI	0.37
											Total Bone HI	0.15
											Total Hair HI	114
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				345
											Total Kidney HI	0.66
											Total Nervous System HI	233
											Total Blood HI	0.09
											Total Liver HI	16
											Total Spleen HI	0.34
											Total Skin HI	1.5
											Total Bone HI	0.72
											Total Cardiovascular System HI	0.009
											Total Gastrointestinal HI	1.2
											Total Thyroid HI	2.5
											Total Reproductive System HI	0.92
											Total Hair HI	87
											Total Body Weight HI	0.13

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.076	--	0.0043	0.0801
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.0084	--	0.0012	0.009
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.034	--	2.2	2.3
			Bromodichloromethane	--	--	--	--	Kidney	0.000043	--	0.000032	0.000051
			Bromomethane	--	--	--	--	Gastrointestinal	0.031	--	0.00094	0.0399
			Chloroform	--	--	--	--	Liver, Blood	0.027	--	0.0023	0.030
			Dibenzofuran	--	--	--	--	Whole Body	0.043	--	0.079	0.13
			Dieldrin	--	--	--	--	Liver	0.0204	--	0.0358	0.056
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.000053	--	0.000032	0.000085
			Naphthalene	--	--	--	--	Body Weight	0.0047	--	0.0029	0.007
			Pentachlorophenol	--	--	--	--	Liver	0.013	--	0.05	0.064
			Phenol	--	--	--	--	Body Weight	0.01	--	0.00072	0.01
			Tetrachloroethene	--	--	--	--	Nervous System	0.029	--	0.01	0.04
			Trichloroethene	--	--	--	--	Cardiovascular System	0.12	--	0.019	0.14
			1,2,3-trichloropropane	--	--	--	--	Body Weight	0.0013	--	0.00081	0.0022
			Aluminum	--	--	--	--	Nervous System	1.7	--	0.010	1.7
			Antimony	--	--	--	--	Blood	0.59	--	0.024	0.62
			Arsenic	--	--	--	--	Skin	1.4	--	0.0063	1.4
			Barium	--	--	--	--	Gastrointestinal	0.15	--	0.13	0.29
			Cadmium	--	--	--	--	Kidney	0.14	--	0.017	0.16
			Chromium	--	--	--	--	None observed	0.31	--	0.074	0.39
			Cobalt	--	--	--	--	Thyroid	114	--	0.27	114
			Copper	--	--	--	--	--	0.21	--	0.0012	0.21
			Cyanide	--	--	--	--	Reproductive System	0.53	--	0.0012	0.54
			Iron	--	--	--	--	Gastrointestinal	0.11	--	0.00065	0.11
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	86	--	13	99
			Mercury	--	--	--	--	Kidney	0.70	--	0.059	0.76
			Molybdenum	--	--	--	--	Blood	0.72	--	0.004	0.72
			Nickel	--	--	--	--	Body Weight	1.1	--	0.004	1.2
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.105	--	0.00062	0.11
			Strontium	--	--	--	--	Bone	0.090	--	0.00055	0.09
			Thallium	--	--	--	--	Hair	0.6	--	0.40	0.8
			Vanadium	--	--	--	--	Kidney	0.14	--	0.031	0.17
			Zinc	--	--	--	--	Blood	2.3	--	0.0063	2.3
			Chemical Total	--	--	--	--		279	--	16	296
		Shallow Groundwater Total					--					296

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					2%
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	Blood	--	0.000000.4	--	0.000000.4
			Benzene	--	--	--	--	Blood	--	0.000001.2	--	0.000001.2
			Bromodichloromethane	--	--	--	--	--	--	--	--	--
			Bromomethane	--	--	--	--	Respiratory System	--	0.000003.6	--	0.000003.6
			Chloroform	--	--	--	--	Liver	--	0.000002.4	--	0.000002.4
			Dibenzofuran	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	--	--	--	Developmental	--	0.000000005.4	--	0.000000005.4
			Naphthalene	--	--	--	--	Respiratory System	--	0.000001.8	--	0.000001.8
			Tetrachloroethene	--	--	--	--	Nervous System	--	0.000000.4	--	0.000000.4
			Trichloroethene	--	--	--	--	Immune System	--	0.000002.6	--	0.000002.6
			Trichlorofluoromethane	--	--	--	--	Nervous System	--	0.000000.25	--	0.000000.25
			Chemical Total	--	--	--	--		--	0.000006.3	--	0.000006.3
		Shallow Groundwater Total					--					0.000006.3
	Air Total						--					0.000006.3
Total Shallow Groundwater							--					2%
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.000.0	--	0.00027	0.000.3
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.19	--	0.011	0.20
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.47	--	0.032	0.50
			Benzene	--	--	--	--	Blood	0.006.5	--	0.001	0.007.4
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.10	--	6.5	6.6
			Bromomethane	--	--	--	--	Gastrointestinal	0.062	--	0.0019	0.064
			Chloroform	--	--	--	--	Liver, Blood	0.006.04	--	0.0005	0.006.6
			Dieldrin	--	--	--	--	Liver	0.021	--	0.037	0.058
			Heptachlorepoxide	--	--	--	--	Liver	0.12	--	0.15	0.27
			Naphthalene	--	--	--	--	Body Weight	0.0024	--	0.0015	0.0039
			Pentachlorophenol	--	--	--	--	Liver	0.015	--	0.055	0.070
			Trichloroethene	--	--	--	--	Cardiovascular System	0.035	--	0.0054	0.0402
			Aluminum	--	--	--	--	Nervous System	0.12	--	0.000009	0.12
			Arsenic	--	--	--	--	Skin	0.67	--	0.0040	0.67
			Barium	--	--	--	--	Gastrointestinal	0.072	--	0.061	0.13
			Cadmium	--	--	--	--	Kidney	0.16	--	0.020	0.18
			Chromium	--	--	--	--	Nonspecified	0.21	--	0.050	0.26
			Cobalt	--	--	--	--	Thyroid	1.5	--	0.006	1.5
			Copper	--	--	--	--	--	0.026	--	0.000015	0.026
			Cyanide	--	--	--	--	Reproductive System	0.55	--	0.0003	0.55
			Iron	--	--	--	--	Gastrointestinal	0.54	--	0.0002	0.54
			Lead	--	--	--	--	--	--	--	--	--

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Manganese	--	--	--	--	Nervous System	1.25	--	1.9	1.44
			Mercury	--	--	--	--	Kidney	0.015	--	0.0013	0.017
			Molybdenum	--	--	--	--	Blood	1.2	--	0.0071	1.2
			Nickel	--	--	--	--	Body Weight	0.072	--	0.0021	0.075
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.21	--	0.0012	0.21
			Strontium	--	--	--	--	Bone	0.43	--	0.0025	0.43
			Thallium	--	--	--	--	Hair	52	--	0.0100	53
			Vanadium	--	--	--	--	Kidney	0.17	--	0.0033	0.21
			Zinc	--	--	--	--	Blood	0.012	--	0.0000	0.012
			Chemical Total	--	--	--	--		185	--	26	211
		Deep Groundwater Total					--					211
	Total Deep Groundwater Total						--					211
Groundwater	Air	Deep	1,2-Dichloroethane	--	--	--	--	Nervous System	--	0.0000043	--	0.0000043
			Benzene	--	--	--	--	Blood	--	0.00000092	--	0.00000092
			Bromomethane	--	--	--	--	Reproductive System	--	0.000017	--	0.000017
			Chloroform	--	--	--	--	Liver	--	0.00000053	--	0.00000053
			Naphthalene	--	--	--	--	Reproductive System	--	0.0000092	--	0.0000092
			Tetrachloroethene	--	--	--	--	Immune System	--	0.0000074	--	0.0000074
			Chemical Total	--	--	--	--		--	0.0000040	--	0.0000040
		Deep Groundwater Total					--					0.0000040
	Air Total						--					0.0000040
Total Deep Groundwater							--					211
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				26
Total Blood HI												3.9
Total Liver HI												2.6
Total Kidney HI												0.16
Total Body Weight HI												1.2
Total Nervous System HI												101
Total Cardiovascular System HI												0.14
Total Skin HI												1.5
Total Gastrointestinal HI												0.43
Total Thyroid HI												114
Total Reproductive System HI												0.54
Total Bone HI												0.090
Total Hair HI												53
Total Developmental HI												0.000000054
Total Respiratory System HI												0.000027

Table E-55
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Total Immune System HI												0.000026
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				211
Total Kidney HI												0.41
Total Nervous System HI												145
Total Blood HI												16
Total Liver HI												7.4
Total Spleen HI												0.50
Total Gastrointestinal HI												0.74
Total Cardiovascular System HI												0.040
Total Skin HI												0.33
Total Bone HI												0.43
Total Hair HI												53
Total Thyroid HI												1.5
Total Reproductive System HI												0.55
Total Body Weight HI												0.073

Table E-56
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	6.4E-06	--	5.6E-07	6.9E-06	--	--	--	--	--
			4,4'-DDD	3.1E-06	--	4.4E-07	4.7E-07	--	--	--	--	--
			Benzene	2.5E-07	--	5.4E-08	3.0E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	1.3E-06	--	1.3E-04	1.3E-04	--	--	--	--	--
			Bromodichloromethane	8.1E-08	--	8.2E-09	8.9E-08	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	1.1E-06	--	1.5E-07	1.3E-06	--	--	--	--	--
			Chlorodibromo	--	--	--	--	--	--	--	--	--
			Dieldrin	2.2E-06	--	6.0E-06	8.2E-06	--	--	--	--	--
			Ethylbenzene	8.6E-08	--	7.4E-08	1.6E-07	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	4.9E-06	--	2.8E-05	3.2E-05	--	--	--	--	--
			Phenol	--	--	--	--	--	--	--	--	--
			Tetrachloroethene	5.0E-08	--	4.3E-08	9.3E-08	--	--	--	--	--
			Trichloroethene	5.5E-07	--	1.3E-07	6.8E-07	--	--	--	--	--
			Trichlorofluoromethane	--	--	--	--	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Antimony	--	--	--	--	--	--	--	--	--
			Arsenic	8.5E-05	--	4.7E-07	8.6E-05	--	--	--	--	--
			Barium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	2.0E-04	--	--	2.0E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--
			Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Strontium	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	3.0E-04	--	1.6E-04	4.6E-04		--	--	--	--
		Shallow Groundwater Total					4.6E-04					--

Table E-56
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						4.6E-04					--
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			Benzene	--	3.6E-11	--	3.6E-11	--	--	--	--	--
			Bromodichloromethane	--	3.2E-11	--	3.2E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	6.9E-10	--	6.9E-10	--	--	--	--	--
			Dibenzofuran	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	1.7E-11	--	1.7E-11	--	--	--	--	--
			Naphthalene	--	2.4E-10	--	2.4E-10	--	--	--	--	--
			Tetrachloroethene	--	4.6E-12	--	4.6E-12	--	--	--	--	--
			Trichloroethene	--	2.7E-11	--	2.7E-11	--	--	--	--	--
			Trimethylbenzene	--	--	--	--	--	--	--	--	--
			Chemical Total	--	1.0E-09	--	1.0E-09		--	--	--	--
		Shallow Groundwater Total					1.0E-09					--
	Air Total						1.0E-09					--
Total Shallow Groundwater							4.6E-04					--
Groundwater	Groundwater	Deep	1,2-Dichloroethane	4.4E-07	--	3.1E-06	4.7E-07	--	--	--	--	--
			2,4-Dinitrotoluene	1.6E-05	--	1.4E-06	1.8E-05	--	--	--	--	--
			2,6-Dinitrotoluene	2.8E-05	--	3.0E-06	3.1E-05	--	--	--	--	--
			Benzene	1.9E-07	--	4.2E-08	2.3E-07	--	--	--	--	--
			bis(2-Ethylhexyl)phthalate	3.8E-06	--	3.8E-04	3.8E-04	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	2.5E-07	--	3.3E-08	2.9E-07	--	--	--	--	--
			Dieldrin	2.3E-06	--	6.1E-06	8.4E-06	--	--	--	--	--
			Heptachlorepoxide	2.0E-06	--	3.6E-06	5.6E-06	--	--	--	--	--
			Naphthalene	--	--	--	--	--	--	--	--	--
			Pentachlorophenol	4.1E-06	--	2.3E-05	2.7E-05	--	--	--	--	--
			Trichloroethene	1.6E-07	--	3.8E-08	2.0E-07	--	--	--	--	--
			Aluminum	--	--	--	--	--	--	--	--	--
			Arsenic	4.1E-05	--	2.2E-07	4.1E-05	--	--	--	--	--
			Beryllium	--	--	--	--	--	--	--	--	--
			Cadmium	--	--	--	--	--	--	--	--	--
			Chromium	1.3E-04	--	--	1.3E-04	--	--	--	--	--
			Cobalt	--	--	--	--	--	--	--	--	--
			Copper	--	--	--	--	--	--	--	--	--
			Cyanide	--	--	--	--	--	--	--	--	--
			Iron	--	--	--	--	--	--	--	--	--

Table E-56
Summary of Receptor Risks and Hazards for COPCs - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	--	--	--	--
			Mercury	--	--	--	--	--	--	--	--	--
			Molybdenum	--	--	--	--	--	--	--	--	--
			Nickel	--	--	--	--	--	--	--	--	--
			Selenium	--	--	--	--	--	--	--	--	--
			Strontium	--	--	--	--	--	--	--	--	--
			Thallium	--	--	--	--	--	--	--	--	--
			Vanadium	--	--	--	--	--	--	--	--	--
			Zinc	--	--	--	--	--	--	--	--	--
			Chemical Total	2.3E-04	--	4.2E-04	6.5E-04		--	--	--	--
		Deep Groundwater Total					6.5E-04					--
	Total Deep Groundwater Total						6.5E-04					--
Groundwater	Air	Deep	1,2-Dichloroethane	--	1.0E-10	--	1.0E-10	--	--	--	--	--
			Benzene	--	2.8E-11	--	2.8E-11	--	--	--	--	--
			Bromomethane	--	--	--	--	--	--	--	--	--
			Chloroform	--	1.5E-10	--	1.5E-10	--	--	--	--	--
			Naphthalene	--	1.2E-10	--	1.2E-10	--	--	--	--	--
			Trichloroethene	--	7.8E-12	--	7.8E-12	--	--	--	--	--
			Chemical Total	--	4.1E-10	--	4.1E-10		--	--	--	--
		Deep Groundwater Total					4.1E-10					--
	Air Total						4.1E-10					--
Total Deep Groundwater							6.5E-04					--
						Total Risk Across All Media - Shallow Groundwater	4.6E-04				Total Hazard Across All Media - Shallow Groundwater	--
						Total Risk Across All Media - Deep Groundwater	6.5E-04				Total Hazard Across All Media - Deep Groundwater	--

Table E-67
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.063	--	0.00066	0.070
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.0070	--	0.0016	0.0086
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.029	--	3.4	3.4
			Bromodichloromethane	--	--	--	--	Kidney	0.000040	--	0.000046	0.00045
			Bromomethane	--	--	--	--	Gastrointestinal	0.026	--	0.0014	0.027
			Chloroform	--	--	--	--	Liver, Blood	0.023	--	0.0035	0.026
			Dibromochloromethane	--	--	--	--	Whole Body	0.040	--	0.12	0.16
			Dieldrin	--	--	--	--	Liver	0.017	--	0.054	0.071
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.000046	--	0.000049	0.00097
			Naphthalene	--	--	--	--	Body Weight	0.0029	--	0.0044	0.0063
			Pentachlorophenol	--	--	--	--	Liver	0.015	--	0.10	0.11
			Phenol	--	--	--	--	Body Weight	0.013	--	0.0011	0.0141
			Tetrachloroethene	--	--	--	--	Nervous System	0.024	--	0.025	0.049
			Trichloroethene	--	--	--	--	Cardiovascular System	0.10	--	0.028	0.127
			Trichlorofluoromethane	--	--	--	--	Body Weight	0.00011	--	0.00012	0.00023
			Aluminum	--	--	--	--	Nervous System	1.4	--	0.00062	1.4067
			Antimony	--	--	--	--	Blood	0.50	--	0.015	0.510
			Arsenic	--	--	--	--	Skin	1.2	--	0.0051	1.169
			Barium	--	--	--	--	Gastrointestinal	0.13	--	0.081	0.210
			Cadmium	--	--	--	--	Kidney	0.12	--	0.0100	0.1267
			Chromium	--	--	--	--	None observed	0.26	--	0.046	0.307
			Cobalt	--	--	--	--	Thyroid	95	--	0.17	95.16
			Copper	--	--	--	--	--	0.17	--	0.00077	0.17529
			Cyanide	--	--	--	--	Reproductive System	0.44	--	0.0020	0.4450
			Iron	--	--	--	--	Gastrointestinal	0.090	--	0.000040	0.091
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	72	--	7.9	80
			Mercury	--	--	--	--	Kidney	0.56	--	0.007	0.62
			Molybdenum	--	--	--	--	Blood	0.60	--	0.0026	0.60
			Nickel	--	--	--	--	Body Weight	0.74	--	0.021	0.76
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.087	--	0.000038	0.087
			Strontium	--	--	--	--	Bone	0.075	--	0.000003	0.075
			Thallium	--	--	--	--	Hair	57	--	0.25	57
			Vanadium	--	--	--	--	Kidney	0.11	--	0.019	0.13
			Zinc	--	--	--	--	Blood	1.9	--	0.0051	1.9
			Chemical Total	--	--	--	--		232	--	12	245
		Shallow Groundwater Total					--					245

Table E-67
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					245
Total Shallow Groundwater							--					245
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.0050	--	0.000061	0.0056
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.16	--	0.024	0.18
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.39	--	0.067	0.46
			Benzene	--	--	--	--	Blood	0.0054	--	0.0022	0.0075
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.064	--	14	14
			Bromomethane	--	--	--	--	Gastrointestinal	0.052	--	0.0042	0.056
			Chloroform	--	--	--	--	Liver, Blood	0.0050	--	0.0011	0.0061
			Dieldrin	--	--	--	--	Liver	0.017	--	0.079	0.096
			Heptachlorepoxide	--	--	--	--	Liver	0.10	--	0.31	0.42
			Naphthalene	--	--	--	--	Body Weight	0.0020	--	0.0031	0.0051
			Pentachlorophenol	--	--	--	--	Liver	0.012	--	0.12	0.13
			Tetrachloroethene	--	--	--	--	Gastrointestinal System	0.029	--	0.012	0.040
			Aluminum	--	--	--	--	Nervous System	0.096	--	0.00013	0.097
			Arsenic	--	--	--	--	Skin	0.55	--	0.0024	0.56
			Barium	--	--	--	--	Gastrointestinal	0.060	--	0.033	0.093
			Cadmium	--	--	--	--	Kidney	0.14	--	0.012	0.15
			Chromium	--	--	--	--	None observed	0.18	--	0.031	0.21
			Cobalt	--	--	--	--	Thyroid	1.3	--	0.0022	1.3
			Copper	--	--	--	--	--	0.022	--	0.000010	0.022
			Cyanide	--	--	--	--	Reproductive System	0.46	--	0.0020	0.46
			Iron	--	--	--	--	Gastrointestinal	0.45	--	0.0020	0.45
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	104	--	12	116
			Mercury	--	--	--	--	Kidney	0.013	--	0.0006	0.014
			Molybdenum	--	--	--	--	Blood	1.0	--	0.0044	1.0
			Nickel	--	--	--	--	Body Weight	0.060	--	0.0013	0.062
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.17	--	0.000076	0.17
			Strontium	--	--	--	--	Bone	0.36	--	0.0016	0.36
			Thallium	--	--	--	--	Hair	43	--	0.19	44
			Vanadium	--	--	--	--	Kidney	0.14	--	0.024	0.16
			Zinc	--	--	--	--	Blood	0.010	--	0.000027	0.010
			Chemical Total	--	--	--	--		154	--	26	180
		Deep Groundwater Total					--					180
	Total Deep Groundwater Total						--					180
Total Deep Groundwater							--					180
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				245

Table E-67
Summary of Receptor Risks and Hazards for COPCs - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Blood HI	3.2
											Total Liver HI	3.8
											Total Kidney HI	0.88
											Total Body Weight HI	1.0
											Total Nervous System HI	31
											Total Cardiovascular System HI	0.15
											Total Skin HI	1.3
											Total Gastrointestinal HI	0.33
											Total Thyroid HI	95
											Total Reproductive System HI	0.45
											Total Bone HI	0.075
											Total Whole Body HI	0.2
											Total Hair HI	57
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				130
											Total Kidney HI	0.3
											Total Nervous System HI	1.6
											Total Blood HI	1.4
											Total Liver HI	15
											Total Spleen HI	0.46
											Total Skin HI	0.73
											Total Thyroid HI	1.3
											Total Gastrointestinal HI	0.50
											Total Bone HI	0.36
											Total Hair HI	44
											Total Cardiovascular System HI	0.040
											Total Reproductive System HI	0.46
											Total Body Weight HI	0.067

Table E-58
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	--
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.038	--	0.0029	0.041
			4,4'-DDD	--	--	--	--	--	--	--	--	--
			Benzene	--	--	--	--	Blood	0.0042	--	0.00078	0.0050
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.017	--	1.5	1.5
			Bromodichloromethane	--	--	--	--	Kidney	0.00024	--	0.000021	0.00026
			Bromomethane	--	--	--	--	Gastrointestinal	0.016	--	0.00061	0.016
			Chloroform	--	--	--	--	Liver, Blood	0.014	--	0.0015	0.015
			Dibenzofuran	--	--	--	--	Whole Body	0.024	--	0.052	0.076
			Dieldrin	--	--	--	--	Liver	0.0102	--	0.023	0.034
			Ethylbenzene	--	--	--	--	Liver, Kidney	0.00029	--	0.00021	0.00050
			Naphthalene	--	--	--	--	Body Weight	0.0024	--	0.0019	0.0042
			Pentachlorophenol	--	--	--	--	Liver	0.0090	--	0.043	0.052
			Phenol	--	--	--	--	Body Weight	0.0078	--	0.00047	0.0083
			Tetrachloroethene	--	--	--	--	Nervous System	0.015	--	0.011	0.026
			Trichloroethene	--	--	--	--	Cardiovascular System	0.060	--	0.012	0.072
			(m-and/or p-)xylene	--	--	--	--	Body Weight	0.00067	--	0.00053	0.0012
			Aluminum	--	--	--	--	Nervous System	0.84	--	0.0051	0.85
			Antimony	--	--	--	--	Blood	0.30	--	0.012	0.31
			Arsenic	--	--	--	--	Skin	0.70	--	0.0042	0.70
			Beryllium	--	--	--	--	Gastrointestinal	0.077	--	0.067	0.14
			Cadmium	--	--	--	--	Kidney	0.070	--	0.0084	0.078
			Chromium	--	--	--	--	None observed	0.16	--	0.038	0.19
			Cobalt	--	--	--	--	Thyroid	57	--	0.14	57
			Copper	--	--	--	--	--	0.10	--	0.00063	0.11
			Cyanide	--	--	--	--	Reproductive System	0.27	--	0.0016	0.27
			Iron	--	--	--	--	Gastrointestinal	0.054	--	0.00033	0.055
			Lead	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	Nervous System	43	--	6.5	50
			Mercury	--	--	--	--	Kidney	0.35	--	0.030	0.38
			Molybdenum	--	--	--	--	Blood	0.36	--	0.0022	0.36
			Nickel	--	--	--	--	Body Weight	0.57	--	0.017	0.58
			Selenium	--	--	--	--	Liver, Blood, Skin, Nervous System	0.052	--	0.00031	0.053
			Strontium	--	--	--	--	Bone	0.045	--	0.00027	0.045
			Thallium	--	--	--	--	Hair	34	--	0.20	34
			Vanadium	--	--	--	--	Kidney	0.069	--	0.016	0.085
			Zinc	--	--	--	--	Blood	1.2	--	0.0042	1.2
			Chemical Total	--	--	--	--		140	--	8.7	148
		Shallow Groundwater Total					--					148

Table E-68
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
	Total Shallow Groundwater Total						--					148
Groundwater	Air	Shallow	1,2,4-Trimethylbenzene	--	--	--	--	Blood	--	0.000000.4	--	0.000000.4
			Benzene	--	--	--	--	Blood	--	0.0000012	--	0.0000012
			Bromodichloromethane	--	--	--	--	--	--	--	--	--
			Bromomethane	--	--	--	--	Respiratory System	--	0.000003.6	--	0.000003.6
			Chloroform	--	--	--	--	Liver	--	0.0000024	--	0.0000024
			Dibromochloromethane	--	--	--	--	--	--	--	--	--
			Ethylbenzene	--	--	--	--	Developmental	--	0.000000054	--	0.000000054
			Naphthalene	--	--	--	--	Respiratory System	--	0.000018	--	0.000018
			Tetrachloroethene	--	--	--	--	Nervous System	--	0.0000004	--	0.0000004
			Trichloroethene	--	--	--	--	Immune System	--	0.000002.6	--	0.000002.6
			Trichlorofluoromethane	--	--	--	--	Nervous System	--	0.0000025	--	0.0000025
			Chemical Total	--	--	--	--		--	0.000006.3	--	0.000006.3
		Shallow Groundwater Total					--					0.000006.3
	Air Total						--					0.000006.3
Total Shallow Groundwater							--					148
Groundwater	Groundwater	Deep	1,2-Dichloroethane	--	--	--	--	Kidney	0.0020	--	0.00027	0.0023
			2,4-Dinitrotoluene	--	--	--	--	Nervous System, Blood, Liver	0.096	--	0.011	0.11
			2,6-Dinitrotoluene	--	--	--	--	Spleen	0.23	--	0.032	0.27
			Benzene	--	--	--	--	Blood	0.0032	--	0.000091	0.0041
			bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	0.050	--	6.5	6.6
			Bromomethane	--	--	--	--	Gastrointestinal	0.031	--	0.0019	0.033
			Chloroform	--	--	--	--	Liver, Blood	0.0030	--	0.00051	0.0035
			Dieldrin	--	--	--	--	Liver	0.010	--	0.037	0.047
			Heptachlorepoxide	--	--	--	--	Liver	0.062	--	0.15	0.21
			Naphthalene	--	--	--	--	Body Weight	0.0012	--	0.0015	0.0027
			Pentachlorophenol	--	--	--	--	Liver	0.0075	--	0.055	0.062
			Trichloroethene	--	--	--	--	Cardiovascular System	0.017	--	0.0054	0.023
			Aluminum	--	--	--	--	Nervous System	0.053	--	0.000035	0.053
			Arsenic	--	--	--	--	Skin	0.33	--	0.0020	0.34
			Beryllium	--	--	--	--	Gastrointestinal	0.026	--	0.031	0.057
			Cadmium	--	--	--	--	Kidney	0.082	--	0.010	0.092
			Chromium	--	--	--	--	None observed	0.11	--	0.025	0.13
			Cobalt	--	--	--	--	Thyroid	0.76	--	0.0018	0.76
			Copper	--	--	--	--	--	0.013	--	0.000073	0.013
			Cyanide	--	--	--	--	Reproductive System	0.27	--	0.0017	0.28
			Iron	--	--	--	--	Gastrointestinal	0.27	--	0.0016	0.27
			Lead	--	--	--	--	--	--	--	--	--

Table E-68
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Deep	Manganese	--	--	--	--	Nervous System	0.3	--	9.4	72
			Mercury	--	--	--	--	Kidney	0.0077	--	0.00006	0.0084
			Molybdenum	--	--	--	--	Blood	0.0	--	0.0006	0.0
			Nickel	--	--	--	--	Body Weight	0.006	--	0.0011	0.007
			Selenium	--	--	--	--	Liver Blood Skin Nervous System	0.10	--	0.00002	0.10
			Strontium	--	--	--	--	Bone	0.21	--	0.0013	0.22
			Thallium	--	--	--	--	Hair	26	--	0.16	26
			Vanadium	--	--	--	--	Kidney	0.064	--	0.019	0.10
			Zinc	--	--	--	--	Blood	0.00002	--	0.000022	0.00002
			Chemical Total	--	--	--	--		92	--	16	109
		Deep Groundwater Total					--					109
	Total Deep Groundwater Total						--					109
Groundwater	Air	Deep	1,2-Dichloroethane	--	--	--	--	Nervous System	--	0.0000043	--	0.0000043
			Benzene	--	--	--	--	Blood	--	0.00000092	--	0.00000092
			Bromomethane	--	--	--	--	Reproductive System	--	0.000017	--	0.000017
			Chloroform	--	--	--	--	Liver	--	0.00000053	--	0.00000053
			Naphthalene	--	--	--	--	Reproductive System	--	0.0000092	--	0.0000092
			Trichloroethene	--	--	--	--	Immune System	--	0.0000074	--	0.0000074
			Chemical Total	--	--	--	--		--	0.0000040	--	0.0000040
		Deep Groundwater Total					--					0.0000040
	Air Total						--					0.0000040
Total Deep Groundwater							--					109
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				145
Total Blood HI												2.0
Total Liver HI												1.7
Total Kidney HI												0.54
Total Body Weight HI												0.0
Total Nervous System HI												51
Total Gastrointestinal System HI												0.072
Total Skin HI												0.76
Total Cardiovascular HI												0.21
Total Thyroid HI												57
Total Reproductive System HI												0.27
Total Whole Body HI												0.076
Total Bone HI												0.045
Total Hair HI												24
Total Developmental HI												0.000000054

Table E-68
Summary of Receptor Risks and Hazards for COPCs - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
											Total Respiratory System HI	0.000027
											Total Immune System HI	0.000026
			Total Risk Across All Media - Deep Groundwater				--	Total Hazard Across All Media - Deep Groundwater				10[illegible]
											Total Endocrine HI	0.10
											Total Nervous System HI	72
											Total Blood HI	0.33
											Total Liver HI	7.1
											Total Spleen HI	0.27
											Total Skin HI	0.44
											Total Thyroid HI	0.76
											Total Reproductive System HI	0.38
											Total Gastrointestinal HI	0.37
											Total Cardiovascular System HI	0.023
											Total Bone HI	0.22
											Total Hair HI	26
											Total Respiratory System HI	0.000026
											Total Immune System HI	0.0000074
											Total Body Weight HI	0.040

Table E-59
Summary of Receptor Risks and Hazards for COPCs - Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	1.0E-04	---	1.0E-04	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.30	---	0.30
			1,2-Dichloroethane	---	3.5E-03	---	3.5E-03	Nervous System	---	52	--	52
			Benzene	---	5.8E-06	---	5.8E-06	Blood	---	0.067	---	0.067
			Chloroform	---	9.8E-06	---	9.8E-06	Liver	---	0.012	---	0.012
			Chloromethane	---	---	---	--	Nervous System	---	11	---	11
			Ethylbenzene	---	2.8E-06	---	2.8E-06	Developmental	---	0.0030	--	0.0030
			Chemical Total	---	3.6E-03	---	3.6E-03		---	63	---	63
Total Indoor Air							3.6E-03					63
						Total Risk	3.6E-03				Total Hazard	63
											Total Developmental HI	0.0030
											Total Liver HI	0.012
											Total Blood HI	0.37
											Total Nervous System HI	63

Table E-60
Summary of Receptor Risks and Hazards for COPCs - Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	3.9E-05	---	3.9E-05	---	---	--	--	--
			1,2,4-Trimethylbenzene	---	---	---	--	Blood	---	0.12	---	0.12
			1,2-Dichloroethane	---	1.4E-03	---	1.4E-03	Nervous System	---	20	--	20
			Benzene	---	2.2E-06	---	2.2E-06	Blood	---	0.026	---	0.026
			Chloroform	---	3.8E-06	---	3.8E-06	Liver	---	0.0045	--	0.0045
			Chloromethane	---	---	---	--	Nervous System	---	4.1	---	4.1
			Ethylbenzene	---	1.1E-06	---	1.1E-06	Developmental	---	0.0012	--	0.0012
			Chemical Total	---	1.4E-03	---	1.4E-03		---	24	---	24
Total Indoor Air							1.4E-03					24
						Total Risk	1.4E-03				Total Hazard	24
											Total Developmental HI	0.0012
											Total Liver HI	0.0045
											Total Blood HI	0.14
											Total Nervous System HI	24

Table E-61
Summary of Receptor Risks and Hazards for COPCs - Child Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	--	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	0.32	--	---	0.32
			Chromium	3.7E-04	---	---	3.7E-04	None quantified	0.55	--	--	0.55
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	1.8E-03	---	---	1.8E-03		119	--	---	119
Total Knob Creek Carp							1.8E-03					119
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.1E-05	---	---	1.1E-05	Developmental	1.5	--	---	1.5
			PCB Dioxin-like Congener TEQ	6.7E-05	---	---	6.7E-05	Developmental	8.6	--	--	8.6
			PCB-1260	3.6E-05	---	---	3.6E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	2.6E-04	---	---	2.6E-04	None quantified	0.39	--	--	0.39
			Mercury	---	---	---	--	Kidney	5.0	--	---	5.0
			Chemical Total	3.8E-04	---	---	3.8E-04		15	--	---	15
Total Knob Creek Largemouth Bass							3.8E-04					15
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	---	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	0.32	--	---	0.32
			Chromium	1.9E-04	---	---	1.9E-04	None quantified	0.28	--	--	0.28
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	2.8	--	---	2.8
			Chemical Total	1.7E-03	---	---	1.7E-03		122	--	---	122
Total Knob Creek All Species							1.7E-03					122
Total Risk - Carp							1.8E-03	Total Hazard - Carp				119
								Total Developmental HI				119
								Total Skin HI				0.32
Total Risk - Largemouth Bass							3.8E-04	Total Hazard - Largemouth Bass				15
								Total Developmental HI				10
								Total Kidney HI				5.0
Total Risk - All Species							1.7E-03	Total Hazard - All Species				122
								Total Developmental HI				119
								Total Skin HI				0.32
								Total Kidney HI				2.8

Table E-62
Summary of Receptor Risks and Hazards for COPCs - Child Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	--	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	26	--	--	26
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye - Immune System	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	0.079	--	---	0.079
			Chromium	9.4E-05	---	---	9.4E-05	None Quotient	0.14	--	--	0.14
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	4.6E-04	---	---	4.6E-04		30	--	---	30
Total Knob Creek Carp							4.6E-04					30
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	2.8E-06	---	---	2.8E-06	Developmental	0.36	--	---	0.36
			PCB Dioxin-like Congener TEQ	1.7E-05	---	---	1.7E-05	Developmental	2.2	--	--	2.2
			PCB-1260	8.9E-06	---	---	8.9E-06	Eye - Immune System	---	--	---	--
			Chromium	6.6E-05	---	---	6.6E-05	None Quotient	0.096	--	--	0.096
			Mercury	---	---	---	--	Kidney	1.3	--	---	1.3
			Chemical Total	9.5E-05	---	---	9.5E-05		3.9	--	---	3.9
Total Knob Creek Largemouth Bass							9.5E-05					3.9
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	---	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	26	--	--	26
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye - Immune System	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	0.079	--	---	0.079
			Chromium	4.8E-05	---	---	4.8E-05	None Quotient	0.070	--	--	0.070
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	0.71	--	---	0.71
			Chemical Total	4.2E-04	---	---	4.2E-04		31	--	---	31
Total Knob Creek All Species							4.2E-04					31
						Total Fish - Carp	4.6E-04				Total Hazard - Carp	30
											Total Developmental HI	30
											Total Skin HI	0.079
						Total Fish - Largemouth Bass	9.5E-05				Total Hazard - Largemouth Bass	3.9
											Total Developmental HI	2.5
											Total Kidney HI	1.3
						Total Fish - All Species	4.2E-04				Total Hazard - All Species	31
											Total Developmental HI	30
											Total Skin HI	0.079
											Total Kidney HI	0.71

Table E-63
Summary of Receptor Risks and Hazards for COPCs - Adult Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	--	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	0.12	--	---	0.12
			Chromium	1.1E-04	---	---	1.1E-04	None quantified	0.20	--	--	0.20
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	2.5E-03	---	---	2.5E-03		45	--	---	45
Total Knob Creek Carp							2.5E-03					45
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.8E-05	---	---	1.8E-05	Developmental	0.55	--	---	0.55
			PCB Dioxin-like Congener TEQ	1.1E-04	---	---	1.1E-04	Developmental	3.2	--	--	3.2
			PCB-1260	5.8E-05	---	---	5.8E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	8.1E-05	---	---	8.1E-05	None quantified	0.14	--	--	0.14
			Mercury	---	---	---	--	Kidney	1.9	--	---	1.9
			Chemical Total	2.7E-04	---	---	2.7E-04		6	--	---	6
Total Knob Creek Largemouth Bass							2.7E-04					6
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	---	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	0.12	--	---	0.12
			Chromium	5.8E-05	---	---	5.8E-05	None quantified	0.10	--	--	0.10
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	1.1	--	---	1.1
			Chemical Total	2.4E-03	---	---	2.4E-03		46	--	---	46
Total Knob Creek All Species							2.4E-03					46
						Total Risk - Carp	2.5E-03				Total Hazard - Carp	45
											Total Developmental HI	44
											Total Skin HI	0.12
						Total Risk - Largemouth Bass	2.7E-04				Total Hazard - Largemouth Bass	6.8
											Total Developmental HI	3.8
											Total Kidney HI	1.9
						Total Risk - All Species	2.4E-03				Total Hazard - All Species	46
											Total Developmental HI	44
											Total Skin HI	0.12
											Total Kidney HI	1.1

Table E-64
Summary of Receptor Risks and Hazards for COPCs - Adult Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	0.49	--	--	0.49
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye - Immune System	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	0.030	--	---	0.030
			Chromium	2.9E-05	---	---	2.9E-05	None quantified	0.051	--	--	0.051
			Lead	---	---	---	--	---	---	--	---	--
			Chemical Total	4.3E-04	---	---	4.3E-04		11	--	---	11
Total Knob Creek Carp							4.3E-04					11
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	4.6E-06	---	---	4.6E-06	Developmental	0.14	--	---	0.14
			PCB Dioxin-like Congener TEQ	2.7E-05	---	---	2.7E-05	Developmental	0.81	--	--	0.81
			PCB-1260	1.4E-05	---	---	1.4E-05	Eye - Immune System	---	--	---	--
			Chromium	2.0E-05	---	---	2.0E-05	None quantified	0.036	--	--	0.036
			Mercury	---	---	---	--	Kidney	0.47	--	---	0.47
			Chemical Total	4.7E-05	---	---	4.7E-05		1.5	--	---	1.5
Total Knob Creek Largemouth Bass							4.7E-05					1.5
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	0.49	--	---	0.49
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye - Immune System	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	0.030	--	---	0.030
			Chromium	1.5E-05	---	---	1.5E-05	None quantified	0.026	--	--	0.026
			Lead	---	---	---	--	---	---	--	---	--
			Mercury	---	---	---	--	Kidney	0.27	--	---	0.27
			Chemical Total	4.1E-04	---	---	4.1E-04		11	--	---	11
Total Knob Creek All Species							4.1E-04					11
						Total Risk - Carp	4.3E-04				Total Hazard - Carp	11
											Total Developmental HI	11
											Total Skin HI	0.030
						Total Risk - Largemouth Bass	4.7E-05				Total Hazard - Largemouth Bass	1.5
											Total Developmental HI	0.95
											Total Kidney HI	0.47
						Total Risk - All Species	4.1E-04				Total Hazard - All Species	11
											Total Developmental HI	11
											Total Skin HI	0.030
											Total Kidney HI	0.27

Table E-65R
Risk Summary - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-frame: Current Future
Exposed Population: On-Site Worker
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.2E-06	NA	1.4E-07	1.3E-06	Developmental	0.0004	NA	0.00004	0.0004
			Arsenic	4.3E-06	NA	1.0E-06	5.3E-06	Skin	0.003	NA	0.00003	0.003
			Chromium	5.6E-06	NA	NA	5.6E-06	Non-observed	0.001	NA	NA	0.001
			Chemical Total	1.2E-05	NA	1.1E-06	1.3E-05		0.3	NA	0.001	0.3
		On-Site Total					1.3E-05					0.3
	Surface Soil Total						1.3E-05					0.3
Total On-Site Soil							1.3E-05					0.3
Soil	Surface Soil	Floodplain Ecorisk	Arsenic	4.7E-06	NA	5.3E-07	5.2E-06	Skin	0.003	NA	0.00004	0.003
			Chromium	4.9E-06	NA	NA	4.9E-06	Non-observed	0.001	NA	NA	0.001
			Chemical Total	9.6E-06	NA	7.7E-07	1.0E-05		0.2	NA	0.00005	0.2
		Floodplain Ecorisk Total					1.0E-05					0.2
	Surface Soil Total						1.0E-05					0.2
Total Floodplain Ecorisk Soil							1.0E-05					0.2
Total Risk across all Media - On-Site							1.3E-05	Total Hazard across all Media - On-Site				0.3
Total Risk across all Media - Floodplain Ecorisk							1.0E-05	Total Hazard across all Media - Floodplain Ecorisk				0.2

Table E-66
Risk Summary - On-Site Worker - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	1.2E-05	--	--	1.2E-05	Nervous System, Blood, Liver	--	--	--	--
			bis(2-Ethylhexyl)phthalate	2.5E-06	--	--	2.5E-06	Liver	--	--	--	--
			Chloroform	2.2E-06	--	--	2.2E-06	Liver, Blood	--	--	--	--
			Dieldrin	4.2E-06	--	--	4.2E-06	Liver	--	--	--	--
			Pentachlorophenol	9.2E-06	--	--	9.2E-06	Liver	--	--	--	--
			Aluminum	--	--	--	--	Nervous System	1.2	--	--	1.2
			Arsenic	1.6E-04	--	--	1.6E-04	Skin	--	--	--	--
			Chromium	1.2E-04	--	--	1.2E-04	None Observed	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	8.2	--	--	8.2
			Manganese	--	--	--	--	Nervous System	6.2	--	--	6.2
			Thallium	--	--	--	--	Hair	49	--	--	49
			Zinc	--	--	--	--	Blood	1.7	--	--	1.7
			Chemical Total	3.1E-04	--	--	3.1E-04		195	--	--	195
Total Shallow Groundwater							3.1E-04					195
Groundwater	Groundwater	Deep	2,4-Dinitrotoluene	3.0E-05	--	--	3.0E-05	Nervous System, Blood, Liver	--	--	--	--
			2,6-Dinitrotoluene	5.3E-05	--	--	5.3E-05	Spleen	--	--	--	--
			bis(2-Ethylhexyl)phthalate	7.2E-06	--	--	7.2E-06	Liver	--	--	--	--
			Dieldrin	4.3E-06	--	--	4.3E-06	Liver	--	--	--	--
			Heptachlor epoxide	3.8E-06	--	--	3.8E-06	Liver	--	--	--	--
			Pentachlorophenol	7.6E-06	--	--	7.6E-06	Liver	--	--	--	--
			Arsenic	7.7E-05	--	--	7.7E-05	Skin	--	--	--	--
			Chromium	8.1E-05	--	--	8.1E-05	None Observed	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	1.1	--	--	1.1
			Manganese	--	--	--	--	Nervous System	90	--	--	90
			Thallium	--	--	--	--	Hair	37	--	--	37
			Chemical Total	2.6E-04	--	--	2.6E-04		128	--	--	128
Total Deep Groundwater							2.6E-04					128
Total Risk Across All Media - Shallow Groundwater							3.1E-04	Total Hazard Across All Media - Shallow Groundwater				195
Total Risk Across All Media - Deep Groundwater							2.6E-04	Total Hazard Across All Media - Deep Groundwater				128

Table E-67
Risk Summary - On-Site Worker - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	1.4E-06	--	--	1.4E-06	Nervous System, Blood, Liver	--	--	--	--
			Pentachlorophenol	1.1E-06	--	--	1.1E-06	Liver	--	--	--	--
			Arsenic	1.9E-05	--	--	1.9E-05	Skin	--	--	--	--
			Chromium	1.4E-05	--	--	1.4E-05	None observed	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	20	--	--	20
			Manganese	--	--	--	--	Nervous System	15	--	--	15
			Thallium	--	--	--	--	Hair	12	--	--	12
			Chemical Total	3.6E-05	--	--	3.6E-05		48	--	--	48
Total Shallow Groundwater							3.6E-05					48
			2,4-Dinitrotoluene	3.7E-06	--	--	3.7E-06	Nervous System, Blood, Liver	--	--	--	--
			2,6-Dinitrotoluene	6.4E-06	--	--	6.4E-06	Spleen	--	--	--	--
			Arsenic	9.2E-06	--	--	9.2E-06	Skin	--	--	--	--
			Chromium	9.7E-06	--	--	9.7E-06	None observed	--	--	--	--
			Manganese	--	--	--	--	Nervous System	22	--	--	22
			Thallium	--	--	--	--	Hair	9.0	--	--	9.0
			Chemical Total	2.9E-05	--	--	2.9E-05		32	--	--	32
Total Deep Groundwater							2.9E-05					32
Total Risk Across All Media - Shallow Groundwater							3.6E-05	Total Hazard Across All Media - Shallow Groundwater				48
Total Risk Across All Media - Deep Groundwater							2.9E-05	Total Hazard Across All Media - Deep Groundwater				32

Table E-68
Risk Summary - On-Site Worker
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.3E-05	---	2.3E-05	---	---	--	--	--
			1,2-Dichloroethane	---	8.1E-04	---	8.1E-04	Nervous System	---	12	--	12
			Benzene	---	1.3E-06	---	1.3E-06	Blood	---	--	---	--
			Chloroform	---	2.3E-06	---	2.3E-06	Liver	---	--	---	--
			Chloromethane	---	---	---	--	Nervous System	---	2.5	---	2.5
			Chemical Total	---	8.3E-04	---			---	15	---	15
Total Indoor Air							8.3E-04					15
						Total Risk	8.3E-04				Total Hazard	15

Table E-69
Risk Summary - On-Site Worker
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: On-Site Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	2.8E-06	---	2.8E-06	---	---	--	--	--
			1,2-Dichloroethane	---	9.7E-05	---	9.7E-05	Nervous System	---	1.5	--	1.5
			Chemical Total	---	9.9E-05	---	9.9E-05		---	1.5	---	1.5
Total Indoor Air							9.9E-05					1.5
						Total Risk	9.9E-05				Total Hazard	1.5

Table E-70R
Risk Summary - Trespasser
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Trespasser
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	Arsenic	1.4E-06	NA	2.9E-07	1.7E-06	Skin	0.02	NA	0.005	0.03
			Chromium	5.0E-06	NA	NA	5.0E-06	None Considered	0.003	NA	NA	0.003
			Chemical Total	6.7E-06	NA	2.9E-07	7.1E-06		0.2	NA	0.01	0.3
		On-Site Total					7.1E-06					0.3
	Surface Soil Total						7.1E-06					0.3
Total On-Site Soil							7.1E-06					0.3
Soil	Surface Soil	Fleemiken Branch	Arsenic	1.4E-06	NA	1.7E-07	1.6E-06	Skin	0.02	NA	0.003	0.02
			Chromium	3.8E-06	NA	NA	3.8E-06	None Considered	0.006	NA	NA	0.006
			Chemical Total	5.5E-06	NA	2.1E-07	5.8E-06		0.2	NA	0.004	0.2
		Fleemiken Branch Total					5.8E-06					0.2
	Surface Soil Total						5.8E-06					0.2
Total Fleemiken Branch Soil							5.9E-06					0.2
						Total Risk Across All Media - On-Site	7.1E-06				Total Hazard Across All Media - On-Site	0.3
						Total Risk Across All Media - Fleemiken Branch	5.9E-06				Total Hazard Across All Media - Fleemiken Branch	0.2

Table E-71R
Risk Summary - Trespasser
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time (hours): Current/Future
Exposure Frequency: Trespasser
Exposure Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	Chromium	1.2E-11	NA	NA	1.2E-11	None identified	0.0002	NA	NA	0.0002
			Chemical Total	1.7E-11	NA	2.4E-11	1.7E-11		0.1	NA	0.000	0.1
		On-Site Total					1.7E-11					0.1
	Surface Soil Total						1.7E-11					0.1
Total On-Site Soil							1.7E-11					0.00
Total Risk Across All Media - On-Site							1.7E-11	Total Hazard Across All Media - On-Site				0.00

Table E-72R
Risk Summary - Recreational Child User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Current/Future
Exposure Population: Recreational User
Exposure Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	1.4E-06	NA	6.7E-07	1.4E-06	Developmental	0.2	NA	0.0001	0.2
			Arsenic	5.[illegible]E-06	NA	4.6E-07	6.2E-06	Skin	0.1	NA	0.001	0.2
			Chromium	4.6E-05	NA	NA	4.6E-05	Non-cancer	0.05	NA	NA	0.05
			Chemical Total	4.[illegible]E-05	NA	5.4E-07	4.[illegible]E-05		2	NA	0.002	2
		On-Site Total					4.[illegible]E-05					2
	Surface Soil Total						4.[illegible]E-05					2
Total On-Site Soil							4.[illegible]E-05					2
Soil	Surface Soil	Floodplain Beach	Benzo(a)pyrene	1.4E-06	NA	5.2E-07	1.9E-06	NA	NA	NA	NA	NA
			Arsenic	4.4E-06	NA	2.7E-07	4.6E-06	Skin	0.004	NA	0.0007	0.004
			Chromium	2.7E-05	NA	NA	2.7E-05	Non-cancer	0.04	NA	NA	0.04
			Chemical Total	4.4E-05	NA	0.0E+00	4.4E-05		1	NA	0.001	1
		Floodplain Beach Total					4.4E-05					1
	Surface Soil Total						4.4E-05					1
Total Floodplain Beach Soil							4.4E-05					1
Total Risk Across All Media - On-Site							4.4E-05	Total Hazard Across All Media - On-Site				2
Total Risk Across All Media - Floodplain Beach							4.4E-05	Total Hazard Across All Media - Floodplain Beach				1

Table E-73R
Risk Summary - Recreational Child User
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Recreational User
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	Chromium	4.4E-06	NA	NA	4.4E-06	None observed	0.006	NA	NA	0.006
			Chemical Total	5.3E-06	NA	E-0	5.4E-06		0.2	NA	0.00	0.2
		On-Site Total					5.4E-06					0.2
	Surface Soil Total						5.4E-06					0.2
Total On-Site Soil							5.4E-06					0.2
Soil	Surface Soil	Flenniken Branch	Chromium	3.4E-06	NA	NA	3.4E-06	None observed	0.005	NA	NA	0.005
			Chemical Total	4.1E-06	NA	1.1E-07	4.2E-06		0.1	NA	0.002	0.1
		Flenniken Branch Total					4.2E-06					0.1
	Surface Soil Total						4.2E-06					0.1
Total Flenniken Branch Soil							4.2E-06					0.1
						Total Risk Across All Media - On-Site	5.4E-06				Total Hazard Across All Media - On-Site	0.2
						Total Risk Across All Media - Flenniken Branch	4.2E-06				Total Hazard Across All Media - Flenniken Branch	0.1

Table E-74R
Risk Summary - Recreational Adult User
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Exposure Time-Frame: Current/Future
Exposure Population: Recreational User
Exposure Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Surface Soil	On-Site	Arsenic	1.[illegible]E-07	NA	4.[illegible]E-07	2.[illegible]E-07	None	0.001	NA	0.0004	0.002
			Chromium	2.1E-07	NA	NA	2.1E-07	Not quantified	0.0005	NA	NA	0.0005
			Chemical Total	4.[illegible]E-07	NA	4.[illegible]E-07	4.[illegible]E-07		0.002	NA	0.001	0.002
		On-Site Total					4.[illegible]E-07					0.002
	Surface Soil Total						4.[illegible]E-07					0.002
Total On-Site Soil							4.[illegible]E-07					0.002
Soil	Surface Soil	Floodplain Beach	Arsenic	1.0E-07	NA	2.2E-07	1.[illegible]E-07	None	0.000	NA	0.0002	0.001
			Chromium	1.0E-07	NA	NA	1.0E-07	Not quantified	0.0004	NA	NA	0.0004
			Chemical Total	2.0E-07	NA	2.2E-07	4.[illegible]E-07		0.1	NA	0.0002	0.1
		Floodplain Beach Total					4.[illegible]E-07					0.1
	Surface Soil Total						4.[illegible]E-07					0.1
Total Floodplain Beach Soil							4.[illegible]E-07					0.1
Total PAH Across All Media - On-Site							4.[illegible]E-07	Total Hazard Across All Media - On-Site				0.2
Total PAH Across All Media - Floodplain Beach							4.[illegible]E-07	Total Hazard Across All Media - Floodplain Beach				0.1

Table E-75R
Risk Summary - Age-Adjusted Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD/TEQ	5.4E-06	NA	3.6E-07	5.7E-06	Developmental	NA	NA	NA	NA
			Arsenic	2.2E-05	NA	2.5E-06	2.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	None observed	NA	NA	NA	NA
			Chemical Total	1.6E-04	NA	4.7E-06	1.5E-04		NA	NA	NA	NA
		On-Site Total					1.5E-04					NA
	Total Soil Total						1.5E-04					NA
Total On-Site Soil							1.5E-04					NA
Soil	Surface Soil	Flenniken Branch	Benzo(a)pyrene	4.1E-06	NA	1.2E-06	5.9E-06	NA	NA	NA	NA	NA
			2,3,7,8-TCDD/TEQ	1.9E-06	NA	1.2E-07	2.0E-06	Developmental	NA	NA	NA	NA
			Arsenic	1.3E-05	NA	1.5E-06	1.5E-05	Skin	NA	NA	NA	NA
			Chromium	1.2E-04	NA	NA	1.2E-04	NA	NA	NA	NA	NA
			Chemical Total	1.4E-04	NA	3.0E-06	1.4E-04		NA	NA	NA	NA
		Flenniken Branch Total					1.4E-04					NA
	Surface Soil Total						1.4E-04					NA
Total Flenniken Branch Soil							1.4E-04					NA
						Total Risk Across All Media - On-Site	1.5E-04				Total Hazard Across All Media - On-Site	NA
						Total Risk Across All Media - Flenniken Branch	1.4E-04				Total Hazard Across All Media - Flenniken Branch	NA

Table E-76R
Risk Summary - Child Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.5	NA	0.04	0.6
			Aluminum	NA	NA	NA	NA	Nervous system	0.6	NA	NA	0.6
			Arsenic	NA	NA	NA	NA	Skin	0.7	NA	0.06	0
			Chromium	NA	NA	NA	NA	None observed	0.2	NA	NA	0.2
			Cobalt	NA	NA	NA	NA	Thyroid	0.7	NA	NA	0.7
			Copper	NA	NA	NA	NA	NA	0.1	NA	NA	0.1
			Iron	NA	NA	NA	NA	Gastrointestinal	0.7	NA	NA	0.7
			Manganese	NA	NA	NA	NA	Nervous system	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	0	NA	NA	0
			Vanadium	NA	NA	NA	NA	Kidney	0.1	NA	NA	0.1
			Chemical Total	NA	NA	NA	NA		5	NA	0.09	5
		On-Site Total					NA					5
	Surface Soil Total						NA					5
Total On-Site Soil							NA					5
Soil	Surface Soil	Flenniken Branch	2,3,7,8-TCDD TEQ	NA	NA	NA	NA	Developmental	0.2	NA	0.009	0.2
			Aluminum	NA	NA	NA	NA	Nervous system	0.2	NA	NA	0.2
			Arsenic	NA	NA	NA	NA	Skin	0.4	NA	0.04	0.5
			Chromium	NA	NA	NA	NA	None observed	0.1	NA	NA	0.1
			Cobalt	NA	NA	NA	NA	Thyroid	0.5	NA	NA	0.5
			Iron	NA	NA	NA	NA	Gastrointestinal	0.6	NA	NA	0.6
			Manganese	NA	NA	NA	NA	Nervous system	0.1	NA	NA	0.1
			Thallium	NA	NA	NA	NA	Hair	1	NA	NA	1
			Chemical Total	NA	NA	NA	NA		4	NA	0.04	4
		Flenniken Branch Total					NA					4
	Surface Soil Total						NA					4
Total Flenniken Branch Soil							NA					4
						Total Risk Across All Media - On-Site	NA				Total Hazard Across All Media - On-Site	5
						Total Risk Across All Media - Flenniken Branch	NA				Total Hazard Across All Media - Flenniken Branch	4

Table E-77R
Risk Summary - Age-Adjusted Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	On-Site	2,3,7,8-TCDD/TEQ	2.4E-06	NA	7.7E-0[illegible]	2.4E-06	Developmental	NA	NA	NA	NA
			Arsenic	9.7E-06	NA	5.3E-07	1.0E-05	Skin	NA	NA	NA	NA
			Chromium	5.4E-05	NA	NA	5.4E-05	None observed	NA	NA	NA	NA
			Chemical Total	6.6E-05	NA	6.0E-07	6.7E-05		NA	NA	NA	NA
		On-Site Total					6.7E-05					NA
	Surface Soil Total						6.7E-05					NA
Total On-Site Soil							6.7E-05					NA
Soil	Surface Soil	Flenniken Branch	Benzo(a)pyrene	2.2E-06	NA	9.4E-09	2.2E-06	NA	NA	NA	NA	NA
			Arsenic	5.7E-06	NA	3.1E-07	6.0E-06	Skin	NA	NA	NA	NA
			Chromium	4.2E-05	NA	NA	4.2E-05	NA	NA	NA	NA	NA
			Chemical Total	5.1E-05	NA	3.7E-07	5.1E-05		NA	NA	NA	NA
		Flenniken Branch Total					5.1E-05					NA
	Total Soil Total						5.1E-05					NA
Total Flenniken Branch Soil							5.1E-05					NA
						Total Risk Across All Media - On-Site	6.7E-05				Total Hazard Across All Media - On-Site	NA
						Total Risk Across All Media - Flenniken Branch	5.1E-05				Total Hazard Across All Media - Flenniken Branch	NA

Table E-78
Risk Summary - Age-Adjusted Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	2.0E-05	---	1.2E-06	2.1E-05	---	---	--	--	--
			bis(2-Ethylhexyl)phthalate	4.1E-06	---	2.8E-04	2.9E-04	---	---	--	--	--
			Chloroform	3.6E-06	---	---	3.6E-06	---	---	--	---	--
			Dieldrin	7.0E-06	---	1.3E-05	2.0E-05	---	---	--	---	--
			Pentachlorophenol	1.5E-05	---	6.0E-05	7.5E-05	---	---	--	--	--
			Tetrachloroethene	1.7E-06	---	---	1.7E-06	---	---	--	---	--
			Arsenic	2.7E-04	---	1.5E-06	2.7E-04	---	---	--	---	--
			Chromium	5.6E-04	---	1.4E-04	7.0E-04	---	---	--	---	--
			Chemical Total	8.6E-04	---	5.0E-04	1.4E-03		---	--	---	--
		Shallow Groundwater Total					1.4E-03					--
	Total Shallow Groundwater Total						1.4E-03					--
Total Shallow Groundwater							1.4E-03					--
Groundwater	Groundwater	Deep	1,2-Dichloroethane	1.4E-06	---	---	1.4E-06	---	---	--	--	--
			2,4-Dinitrotoluene	5.1E-05	---	3.1E-06	5.4E-05	---	---	--	--	--
			2,6-Dinitrotoluene	9.0E-05	---	6.6E-06	9.6E-05	---	---	--	--	--
			bis(2-Ethylhexyl)phthalate	1.2E-05	---	8.3E-04	8.4E-04	---	---	--	--	--
			Dieldrin	7.2E-06	---	1.3E-05	2.1E-05	---	---	--	---	--
			Heptachlor epoxide	6.3E-06	---	7.8E-06	1.4E-05	---	---	--	--	--
			Pentachlorophenol	1.3E-05	---	5.0E-05	6.3E-05	---	---	--	--	--
			Arsenic	1.3E-04	---	---	1.3E-04	---	---	--	---	--
			Chromium	3.8E-04	---	9.3E-05	4.7E-04	---	---	--	---	--
			Chemical Total	6.9E-04	---	1.0E-03	1.7E-03		---	--	---	--
		Deep Groundwater Total					1.7E-03					--
	Total Deep Groundwater Total						1.7E-03					--
Total Deep Groundwater							1.7E-03					--
Total Risk Across All Media - Shallow Groundwater							1.4E-03	Total Hazard Across All Media - Shallow Groundwater				--
Total Risk Across All Media - Deep Groundwater							1.7E-03	Total Hazard Across All Media - Deep Groundwater				--

Table E-79
Risk Summary - Child Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	4.8	4.8
			Aluminum	--	--	--	--	Nervous system	2.8	--	--	2.8
			Arsenic	--	--	--	--	Skin	2.3	--	--	2.3
			Cobalt	--	--	--	--	Thyroid	190	--	--	190
			Manganese	--	--	--	--	Nervous system	143	--	16	159
			Mercury	--	--	--	--	Kidney	1.2	--	--	1.2
			Molybdenum	--	--	--	--	Blood	1.2	--	--	1.2
			Nickel	--	--	--	--	Body Weight	1.9	--	--	1.9
			Thallium	--	--	--	--	Hair	113	--	--	113
			Zinc	--	--	--	--	Blood	3.9	--	--	3.9
			Chemical Total	--	--	--	--		480	--	21	480
		Shallow Groundwater Total					--					480
	Total Shallow Groundwater Total						--					480
Total Shallow Groundwater							--					480
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	14	14
			Arsenic	--	--	--	--	Skin	1.1	--	--	1.1
			Cobalt	--	--	--	--	Thyroid	2.5	--	--	2.5
			Manganese	--	--	--	--	Nervous system	209	--	23	232
			Molybdenum	--	--	--	--	Blood	2.0	--	--	2.0
			Thallium	--	--	--	--	Hair	87	--	--	87
			Chemical Total	--	--	--	--		301	--	37	338
		Deep Groundwater Total					--					338
	Total Deep Groundwater Total						--					338
Total Deep Groundwater							--					338
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				480
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				338

Table E-80
Risk Summary - Adult Resident - Groundwater
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Noncarcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	2.2	2.2
			Aluminum	--	--	--	--	Nervous System	1.7	--	--	1.7
			Arsenic	--	--	--	--	Skin	1.4	--	--	1.4
			Cobalt	--	--	--	--	Thyroid	114	--	--	114
			Manganese	--	--	--	--	Nervous System	86	--	13	99
			Nickel	--	--	--	--	Body Weight	1.1	--	--	1.1
			Thallium	--	--	--	--	Hair	0.8	--	--	0.8
			Zinc	--	--	--	--	Blood	2.3	--	--	2.3
			Chemical Total	--	--	--	--		275	--	15	290
		Shallow Groundwater Total					--					290
	Total Shallow Groundwater Total						--					290
Total Shallow Groundwater							--					290
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	0.5	0.5
			Cobalt	--	--	--	--	Thyroid	152	--	--	152
			Manganese	--	--	--	--	Nervous System	125	--	19	144
			Molybdenum	--	--	--	--	Blood	1.2	--	--	1.2
			Thallium	--	--	--	--	Hair	52	--	--	52
			Chemical Total	--	--	--	--		180	--	25	205
		Deep Groundwater Total					--					205
	Total Deep Groundwater Total						--					205
Total Deep Groundwater							--					205
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				290
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				205

Table E-81
Risk Summary - Age-Adjusted Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organs	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Shallow	2,4-Dinitrotoluene	6.4E-06	...	...	6.4E-06	...	...	...	...	...
			bis(2-Ethylhexyl)phthalate	1.3E-06	...	1.3E-04	1.3E-04	...	...	...	...	...
			Chloroform	1.1E-06	...	...	1.1E-06	...	...	...	...	...
			Dieldrin	2.2E-06	...	6.0E-06	2E-06	...	...	...	...	...
			Pentachlorophenol	4.9E-06	...	2.[illegible]E-05	3.2E-05	...	...	...	...	...
			Arsenic	5E-05	...	...	5E-05	...	...	...	...	...
			Chemical Total	2.9E-04	...	1.6E-04	4.6E-04		...	...	...	...
		Shallow Groundwater Total					4.6E-04					...
	Total Shallow Groundwater Total						4.6E-04					...
Total Shallow Groundwater							4.6E-04					...
Groundwater	Groundwater	Deep	2,4-Dinitrotoluene	1.6E-05	...	1.4E-06	1.[illegible]E-05	...	...	...	...	...
			2,6-Dinitrotoluene	2.[illegible]E-05	...	3.0E-06	3.1E-05	...	...	...	...	...
			bis(2-Ethylhexyl)phthalate	3.[illegible]E-06	...	3.[illegible]E-04	3.[illegible]E-04	...	...	...	...	...
			Dieldrin	2.3E-06	...	6.1E-06	4E-06	...	...	...	...	...
			Heptachlorepoxide	2.0E-06	...	3.6E-06	5.6E-06	...	...	...	...	...
			Pentachlorophenol	4.1E-06	...	2.3E-05	2.7E-05	...	...	...	...	...
			Arsenic	4.1E-05	...	...	4.1E-05	...	...	...	...	...
			Chemical Total	2.3E-04	...	4.2E-04	6.5E-04		...	...	...	...
		Deep Groundwater Total					6.5E-04					...
	Total Deep Groundwater Total						6.5E-04					...
Total Deep Groundwater							6.5E-04					...
Total Risk Across All Media - Shallow Groundwater							4.6E-04	Total Hazard Across All Media - Shallow Groundwater				...
Total Risk Across All Media - Deep Groundwater							6.5E-04	Total Hazard Across All Media - Deep Groundwater				...

Table E-82
Risk Summary - Child Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic PAH				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	3.4	3.4
			Manganese	--	--	--	--	Nervous System	72	--	7.9	79.7
			Chemical Total	--	--	--	--		232	--	11	244
		Shallow Groundwater Total					--					244
	Total Shallow Groundwater Total						--					244
Total Shallow Groundwater							--					244
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	14	14
			Cobalt	--	--	--	--	Thyroid	1.3	--	--	1.3
			Manganese	--	--	--	--	Nervous System	104	--	12	116
			Thallium	--	--	--	--	Hair	43	--	--	43
			Chemical Total	--	--	--	--		149	--	25	174
		Deep Groundwater Total					--					174
	Total Deep Groundwater Total						--					174
Total Deep Groundwater							--					174
Total PAH Risk - All Media - Shallow Groundwater							--	Total Hazard Index - All Media - Shallow Groundwater				244
Total PAH Risk - All Media - Deep Groundwater							--	Total Hazard Index - All Media - Deep Groundwater				174

Table E-83
Risk Summary - Adult Resident - Groundwater
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Groundwater	Groundwater	Shallow	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	1.5	1.5
			Cobalt	--	--	--	--	Thyroid	57	--	--	57
			Manganese	--	--	--	--	Nervous System	43	--	6.5	50
			Thallium	--	--	--	--	Hair	34	--	--	34
			Zinc	--	--	--	--	Blood	1.2	--	--	1.2
			Chemical Total	--	--	--	--		135	--	8	143
		Shallow Groundwater Total					--					143
	Total Shallow Groundwater Total						--					143
Total Shallow Groundwater							--					143
Groundwater	Groundwater	Deep	bis(2-Ethylhexyl)phthalate	--	--	--	--	Liver	--	--	6.5	6.5
			Manganese	--	--	--	--	Nervous System	63	--	9	72
			Thallium	--	--	--	--	Hair	26	--	--	26
			Chemical Total	--	--	--	--		89	--	16	105
		Deep Groundwater Total					--					105
	Total Deep Groundwater Total						--					105
Total Deep Groundwater							--					105
Total Risk Across All Media - Shallow Groundwater							--	Total Hazard Across All Media - Shallow Groundwater				143
Total Risk Across All Media - Deep Groundwater							--	Total Hazard Across All Media - Deep Groundwater				105

Table E-84
Risk Summary - Resident
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	1.0E-04	---	1.0E-04	---	---	--	--	--
			1,2-Dichloroethane	---	3.5E-03	---	3.5E-03	Nervous System	---	52	--	52
			Benzene	---	5.8E-06	---	5.8E-06	Blood	---	--	---	--
			Chloroform	---	9.8E-06	---	9.8E-06	Liver	---	--	---	--
			Chloromethane	---	---	---	--	Nervous System	---	11	---	11
			Ethylbenzene	---	2.8E-06	---	2.8E-06	Developmental	---	--	--	--
			Chemical Total	---	3.6E-03	---	3.6E-03		---	63	---	63
Total Indoor Air							3.6E-03					63
						Total Risk	3.6E-03				Total HI	63

Table E-85
Risk Summary - Resident
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Air	Indoor Air	Site	1,1-Dichloroethane	---	3.9E-05	---	3.9E-05	---	---	--	--	--
			1,2-Dichloroethane	---	1.4E-03	---	1.4E-03	Nervous System	---	20	--	20
			Benzene	---	2.2E-06	---	2.2E-06	Blood	---	--	---	--
			Chloroform	---	3.8E-06	---	3.8E-06	Liver	---	--	---	--
			Chloromethane	---	---	---	--	Nervous System	---	4.1	---	4.1
			Ethylbenzene	---	1.1E-06	---	1.1E-06	Developmental	---	--	--	--
			Chemical Total	---	1.4E-03	---	1.4E-03		---	24	---	24
Total Indoor Air							1.4E-03					24
						Total Risk	1.4E-03				Total Hazard	24

Table E-86
Risk Summary - Child Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Gap	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	--	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	---	--	---	--
			Chromium	3.7E-04	---	---	3.7E-04	None observed	---	--	--	--
			Chemical Total	1.8E-03	---	---	1.8E-03		119	--	---	119
Total Knob Creek Gap							1.8E-03					119
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.1E-05	---	---	1.1E-05	Developmental	1.5	--	---	1.5
			PCB Dioxin-like Congener TEQ	6.7E-05	---	---	6.7E-05	Developmental	8.6	--	--	8.6
			PCB-1260	3.6E-05	---	---	3.6E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	2.6E-04	---	---	2.6E-04	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	5.0	--	---	5.0
			Chemical Total	3.8E-04	---	---	3.8E-04		15	--	---	15
Total Knob Creek Largemouth Bass							3.8E-04					15
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	4.0E-05	---	---	4.0E-05	Developmental	5.2	--	---	5.2
			PCB Dioxin-like Congener TEQ	8.8E-04	---	---	8.8E-04	Developmental	110	--	--	110
			PCB-1260	5.3E-04	---	---	5.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	1.2E-05	---	---	1.2E-05	Skin	---	--	---	--
			Chromium	1.9E-04	---	---	1.9E-04	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	2.8	--	---	2.8
			Chemical Total	1.7E-03	---	---	1.7E-03		121	--	---	121
Total Knob Creek All Species							1.7E-03					121
Total Risk - Gap							1.8E-03	Total Hazard - Gap				119
Total Risk - Largemouth Bass							3.8E-04	Total Hazard - Largemouth Bass				15
Total Risk - All Species							1.7E-03	Total Hazard - All Species				121

Table E-87
Risk Summary - Child Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	--	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	28	--	--	28
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	---	--	---	--
			Chromium	9.4E-05	---	---	9.4E-05	None quantified	---	--	--	--
			Chemical Total	4.6E-04	---	---	4.6E-04		30	--	---	30
Total Knob Creek Carp							4.6E-04					30
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	2.8E-06	---	---	2.8E-06	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	1.7E-05	---	---	1.7E-05	Developmental	2.2	--	--	2.2
			PCB-1260	8.9E-06	---	---	8.9E-06	Eye, Immune, Liver	---	--	---	--
			Chromium	6.6E-05	---	---	6.6E-05	None quantified	---	--	--	--
			Mercury	---	---	---	--	Kidney	1.3	--	---	1.3
			Chemical Total	9.5E-05	---	---	9.5E-05		3.4	--	---	3.4
Total Knob Creek Largemouth Bass							9.5E-05					3.4
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.0E-05	---	---	1.0E-05	Developmental	1.3	--	---	1.3
			PCB Dioxin-like Congener TEQ	2.2E-04	---	---	2.2E-04	Developmental	28	--	--	28
			PCB-1260	1.3E-04	---	---	1.3E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	3.1E-06	---	---	3.1E-06	Skin	---	--	---	--
			Chromium	4.8E-05	---	---	4.8E-05	None quantified	---	--	--	--
			Chemical Total	4.2E-04	---	---	4.2E-04		30	--	---	30
Total Knob Creek All Species							4.2E-04					30
Total Risk - Carp							4.6E-04	Total Hazard - Carp				30
Total Risk - Largemouth Bass							9.5E-05	Total Hazard - Largemouth Bass				3.4
Total Risk - All Species							4.2E-04	Total Hazard - All Species				30

Table E-88
Risk Summary - Adult Angler
Reasonable Maximum Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	--	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	---	--	---	--
			Chromium	1.1E-04	---	---	1.1E-04	None observed	---	--	--	--
			Chemical Total	2.5E-03	---	---	2.5E-03		44	--	---	44
Total Knob Creek Carp							2.5E-03					44
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	1.8E-05	---	---	1.8E-05	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	1.1E-04	---	---	1.1E-04	Developmental	3.2	--	--	3.2
			PCB-1260	5.8E-05	---	---	5.8E-05	Eye, Immune, Liver	---	--	---	--
			Chromium	8.1E-05	---	---	8.1E-05	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	1.9	--	---	1.9
			Chemical Total	2.7E-04	---	---	2.7E-04		5	--	---	5
Total Knob Creek Largemouth Bass							2.7E-04					5
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	6.6E-05	---	---	6.6E-05	Developmental	1.9	--	---	1.9
			PCB Dioxin-like Congener TEQ	1.4E-03	---	---	1.4E-03	Developmental	43	--	--	43
			PCB-1260	8.7E-04	---	---	8.7E-04	Eye, Immune, Liver	---	--	---	--
			Arsenic	2.0E-05	---	---	2.0E-05	Skin	---	--	---	--
			Chromium	5.8E-05	---	---	5.8E-05	None observed	---	--	--	--
			Mercury	---	---	---	--	Kidney	1.1	--	---	1.1
			Chemical Total	2.4E-03	---	---	2.4E-03		46	--	---	46
Total Knob Creek All Species							2.4E-03					46
Total Risk - Carp							2.5E-03	Total Hazard - Carp				44
Total Risk - Largemouth Bass							2.7E-04	Total Hazard - Largemouth Bass				5
Total Risk - All Species							2.4E-03	Total Hazard - All Species				46

Table E-89
Risk Summary - Adult Angler
Central Tendency Exposure
Smokey Mountain Smelters
Knoxville, Tennessee

Scenario Timeframe: Current/Future
Receptor Population: Angler
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Route Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Route Total
Fish	Fish Tissue	Knob Creek Carp	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	---	--	--	--
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye, Immune system	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	---	--	---	--
			Chromium	2.9E-05	---	---	2.9E-05	None observed	---	--	--	--
			Chemical Total	6.3E-04	---	---	6.3E-04		11	--	---	11
Total Knob Creek Carp							6.3E-04					11
Fish	Fish Tissue	Knob Creek Largemouth Bass	2,3,7,8-TCDD TEQ	4.6E-06	---	---	4.6E-06	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	2.7E-05	---	---	2.7E-05	Developmental	---	--	--	--
			PCB-1260	1.4E-05	---	---	1.4E-05	Eye, Immune system	---	--	---	--
			Chromium	2.0E-05	---	---	2.0E-05	None observed	---	--	--	--
			Chemical Total	6.7E-05	---	---	6.7E-05		---	--	---	--
Total Knob Creek Largemouth Bass							6.7E-05					--
Fish	Fish Tissue	Knob Creek All Species	2,3,7,8-TCDD TEQ	1.6E-05	---	---	1.6E-05	Developmental	---	--	---	--
			PCB Dioxin-like Congener TEQ	3.6E-04	---	---	3.6E-04	Developmental	11	--	--	11
			PCB-1260	2.2E-04	---	---	2.2E-04	Eye, Immune system	---	--	---	--
			Arsenic	5.0E-06	---	---	5.0E-06	Skin	---	--	---	--
			Chromium	1.5E-05	---	---	1.5E-05	None observed	---	--	--	--
			Chemical Total	6.1E-04	---	---	6.1E-04		11	--	---	11
Total Knob Creek All Species							6.1E-04					11
Total Fish - Carp							6.3E-04	Total Hazard - Carp				11
Total Fish - Largemouth Bass							6.7E-05	Total Hazard - Largemouth Bass				--
Total Fish - All Species							6.1E-04	Total Hazard - All Species				11