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Appendix T

Human Health Risk Assessment Report

December 13, 2011

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Project: Contract No. W912DQ-08-D-0018
Task Order No. 018
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Subject: Final Human Health Risk Assessment

Dear Ms. Mitchell:

CDM Federal Programs Corporation (CDM) is pleased to submit one hard copy of the Final Human Health Risk Assessment (HHRA) dated December 13, 2011, for the Raritan Bay Slag Superfund Site in Old Bridge and Sayreville, New Jersey. We have incorporated EPA's comments into this Report.

If there are questions concerning this submittal, please contact me at (703) 814-7325.

Very truly yours,

Frank Tsang, P.E., BCEE
Project Manager
CDM Federal Programs Corporation

cc: K. Stein, USACE (letter only)
Project File

US Army Corps of Engineers
Kansas City District

Human Health Risk Assessment

Remedial Investigation/ Feasibility Study
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

USACE Contract No. W912DQ-08-D-0018
Task Order No. 018

December 13, 2011

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Acronyms and Abbreviations

AF	absorption fraction
ALM	Adult Lead Model
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
CDC	Center for Disease Control
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Chromium III	trivalent chromium
Chromium VI	hexavalent chromium
COPC	chemical of potential concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSM	conceptual site model
CTE	central tendency exposure
%D	% difference
DBCP	1,2-dibromo-3-chloropropane
DESA	Division of Environmental Science and Assessment
DMA	dimethylarsinic acid
DO	dissolved oxygen
EDB	1,2-dibromoethane
EMPA	electron microprobe analysis
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
EPD	Effective Predictive Domain
ERT	Environmental Response Team
FDA	Food and Drug Administration
FS	feasibility study
GI	gastrointestinal
GSD	geometric standard deviation
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ICP	inductively coupled plasma
IEUBK	Integrated Exposure Uptake Biokinetic Model
IR	ingestion rate
IRIS	Integrated Risk Information System
IVBA	*in vitro* bioaccessibility
IUR	inhalation unit risk
K_P	permeability constant
MCL	maximum contaminant level
MMA	monomethylarsonic acid

NHANES	National Health and Nutrition Examination Survey
NIFES	National Institute of Nutrition and Seafood Research
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NOAEL	no-observed-adverse-effect level
OSWER	Office of Solid Waste and Emergency Response
PAH	polycyclic aromatic hydrocarbon
PbB	blood lead
PbB_0	baseline blood lead
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PEF	particulate emission factor
PPRTV	Provisional Peer Reviewed Toxicity Value
PRM	Potomac-Raritan-Magothy
QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RBA	relative bioavailability
RfC	reference concentration
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
RPF	relative potency factor
RSD	relative standard deviation
RSL	Regional Screening Level
SF	slope factor
SVOC	semi-volatile organic compound
TAL	target analyte list
TCL	target compound list
the site	Raritan Bay Slag Superfund Site
TOC	total organic carbon
TRW	Technical Review Workgroup
TSS	total suspended solids
UCL	upper confidence limit
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
cm^2	square centimeter
dL	deciliter
g	gram
hr	hour
kg	kilogram
L	liter
m	meter

m^3	cubic meter
mg	milligram
ml	milliliter
mm	millimeter
ppm	parts per million
s	second
µg	microgram
µm	micrometer

Executive Summary

Under the United States Army Corps of Engineers (USACE), Kansas City District, Contract No. W912DQ-08-D-0018, Task Order No. 018, CDM Federal Programs Corporation (CDM) has been tasked to provide technical services to complete a Remedial Investigation/Feasibility Study (RI/FS) for the Raritan Bay Slag Superfund Site (the site) located in Old Bridge and Sayreville, Middlesex County, New Jersey.

This human health risk assessment (HHRA), as part of the RI/FS, is developed to characterize potential human health risks associated with the site in the absence of any remedial action. The HHRA is conducted in accordance with current United States. Environmental Protection Agency (EPA) guidance outlined in *Risk Assessment Guidance for Superfund* (RAGS), Parts A, D, E, and F and other EPA guidance pertinent to human health risk assessments. The HHRA consists of sections describing the site background and setting, data evaluation, exposure assessment, toxicity assessment, risk characterization, and summary and conclusions.

Site Background and Setting

The site is located on the shore of Raritan Bay, within the Laurence Harbor section of Old Bridge Township, New Jersey. The site is approximately 1.5 miles in length and consists of the waterfront area between Margaret's Creek and the area just beyond the western jetty at the Cheesequake Creek Inlet. The portion of the site in Laurence Harbor is part of what is now called the Old Bridge Waterfront Park. The park is made up of walking paths, a playground area, several public beaches, and three jetties. The park waterfront is protected by a seawall, which is partially constructed with pieces of slag. The western jetty at the Cheesequake Creek Inlet and the adjoining waterfront area west of the jetty are located in Sayreville, and also contain slag.

The site has been divided into 10 site areas based on areas identified in historical investigations, site physical characteristics, and the locations of known or potential sources. The 10 site areas are defined as follows:

- Area 1: Laurence Harbor Seawall
- Area 2: Laurence Harbor Beach
- Area 3: Laurence Harbor Playground
- Area 4: Old Bridge Waterfront Park
- Area 5: Laurence Harbor Beach
- Area 6: Laurence Harbor Beach
- Area 7: Cheesequake Creek Inlet
- Area 8: Cheesequake Creek Inlet Western Jetty
- Area 9: Margaret's Creek
- Area 11: Depositional Areas

The slag was placed at the site approximately 40 years ago during the construction of the Area 1 seawall and western jetty. Elevated levels of lead, antimony, arsenic, and copper were identified by the New Jersey Department of Environmental Protection

(NJDEP) in the soil along the seawall in 2007 and at the edge of the beach near the western end of the seawall.

EPA collected samples at the site in September 2008 as part of an Integrated Assessment. Analytical results generated by both EPA and NJDEP indicated that significantly elevated levels of lead and other heavy metals were present in site media in and around both the seawall in Laurence Harbor and the western jetty at the Cheesequake Creek Inlet.

At EPA's request, the New Jersey Department of Health and Senior Services, in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), evaluated the analytical data generated from the samples collected at the site. Their findings concluded that, due to the elevated lead levels, a Public Health Hazard exists at the seawall in Laurence Harbor, the beach between the western end of the seawall and the first jetty, and the western jetty at the Cheesequake Creek Inlet, including the waterfront area immediately west of the inlet.

Data Evaluation

The data evaluation section includes a description of sample collection and analysis, data usability and the suitability of data for risk assessment purposes, analytical data summary, and the approach used to identify chemicals of potential concern (COPCs).

Analytical data were collected by EPA/Emergency Response Team (ERT) from September 2008 to August 2010 and by CDM from June 2010 to January 2011. These investigations included sampling and analysis of soil, groundwater, surface water, sediment, and biota. These data are used to adequately characterize contamination at the site to support the RI and the HHRA.

COPCs are identified based on criteria outlined in RAGS, primarily through comparison to risk-based screening levels. Twenty-five chemicals are identified as COPCs in soil, groundwater, surface water, sediment, and fish/shellfish at the site. These COPCs include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), a polychlorinated biphenyl (PCB), and metals. COPCs are listed below.

- VOCs: chloroform and tetrachloroethene
- SVOCs: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, dibenzofuran, indeno(1,2,3-cd)pyrene, naphthalene, and pentachlorophenol
- PCB: Aroclor 1254
- Metals: aluminum, antimony, arsenic, cadmium, chromium VI, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium, and zinc

Exposure Assessment

The exposure assessment describes exposure scenarios in which people may come into contact with site-related COPCs, provides equations and parameters to quantify exposure, and summarizes methods for evaluating exposure to lead. Results of the exposure assessment are integrated with chemical-specific toxicity information to characterize potential risks.

Potential exposure pathways for the site are defined based on potential source areas, release mechanisms, and current and potential future uses of the site. Potential receptors evaluated in the risk assessment are listed below.

- Current Scenario:
  - Recreational users in Areas 1, 3 through 6, and 9
  - Anglers throughout the site except Areas 3 and 4
  - Pedestrians throughout the site except Areas 2, 8, and 11
  - Trespassers in Areas 2, 8, and 11
  - Outdoor workers in Areas 3 and 4
  - Construction/utility workers throughout the site

- Future Scenario:
  - Recreational users in Areas 1 through 6, and 9
  - Anglers throughout the site except Areas 3 and 4
  - Pedestrians thought the site except Areas 8 and 11
  - Trespassers in Areas 8 and 11
  - Outdoor workers in Areas 3 and 4
  - Construction/utility workers throughout the site
  - Residents throughout the site

Exposure pathways evaluated for soil include incidental ingestion, dermal contact, and outdoor dust inhalation of particulates by recreational users, pedestrians, trespassers, outdoor workers, and construction/utility workers. Exposure pathways evaluated for groundwater include ingestion, dermal contact, and inhalation (vapor released during showering and bathing) by future hypothetical residents, and incidental ingestion of and dermal contact with groundwater by construction/utility workers. Exposure pathways evaluated for surface water and sediment include incidental ingestion and dermal contact by recreational users. The exposure pathway evaluated for fish/shellfish include ingestion by anglers.

Exposure point concentrations (EPCs) for the COPCs are used in the exposure assessment calculations to estimate potential chemical intake. The EPC is either the upper confidence limit (UCL) on the mean or the maximum detected concentration for chemicals with the UCL exceeding the maximum concentration.

Quantification of exposure includes evaluation of exposure parameters that describe the exposed population (e.g., contact rate, exposure frequency and duration, and

body weight). Each exposure parameter in the equation has a range of values. Daily intakes are calculated based on the reasonable maximum exposure (RME) scenario (the highest exposure reasonably expected to occur at a site). The intent is to estimate a conservative exposure case that is still within the range of possible exposures. Central tendency exposure (CTE) assumptions are also developed, which reflect more typical exposures. Risks based on CTE are calculated when RME risks exceed EPA's threshold risk range (i.e., cancer risk range of 1×10^{-6} to 1×10^{-4} or hazard index of 1).

Chemical intake is calculated by using an appropriate equation that divides exposure variables by an averaging time. For noncarcinogenic compounds, the averaging time equals the exposure duration, whereas for carcinogenic compounds, the averaging time used is a lifetime, assumed to be 70 years.

Exposures to lead are not evaluated using the same methods as those described for other site-related COPCs. EPA considers lead to be a special case because of the difficulty in identifying the "threshold". In lieu of evaluating risk using typical intake calculations and toxicity criteria, EPA developed models specifically to evaluate lead exposures. For this HHRA, blood lead concentrations are estimated using the Integrated Exposure Uptake Biokinetic Model (IEUBK) (EPA 2010d) and the Adult Lead Model (ALM) (EPA 2009c). The EPCs are based on arithmetic mean lead concentrations in environmental media.

Toxicity Assessment

COPCs are quantitatively evaluated on the basis of their noncancer and/or cancer potential. The reference dose (RfD) and reference concentration (RfC) are the toxicity values used to evaluate noncancer health hazards in humans. Inhalation unit risk and slope factor are the toxicity values used to evaluate cancer health effects in humans. These toxicity values are obtained from various sources following the hierarchy order specified by EPA.

Risk Characterization

Risk characterization involves integrating the exposure and toxicity assessments into quantitative expressions of risks/health effects. To characterize potential noncancer health effects, comparisons are made between estimated intakes of substances and toxicity values. Potential cancer effects are evaluated by calculating probabilities that an individual will develop cancer over a lifetime exposure based on projected intakes and chemical specific dose-response information. In general, EPA recommends target risk values, i.e., cancer risk of 10^{-6} to 10^{-4} or noncancer health hazard index (HI) of unity (1), as threshold values for potential human health impacts (EPA 1989). These target values aid in determining whether additional response action is necessary at the site.

Risks for all receptors are estimated using RME assumptions. Risks are also estimated using CTE assumptions in cases where the RME assumptions resulted in risk estimates above EPA thresholds.

Cancer Risk and Noncancer Health Hazard

Total estimated cancer risks for current and future recreational users, pedestrians, adult anglers consuming self-caught ribbed mussel and blue crab, children consuming fish/shellfish, trespassers, outdoor workers, construction/utility workers, and future residents are within EPA's target range of 1×10^{-6} to 1×10^{-4} for the RME scenario. For noncancer health hazards, current and future recreational users, pedestrians, adult anglers consuming self-caught fish/shellfish, children consuming ribbed mussel and blue crab, trespassers, outdoor workers, and construction/utility workers have total HIs that are below or at the EPA threshold of one for the RME scenario.

The current and future adult anglers consuming self-caught fish and hard clam scenarios have cancer risks at 2×10^{-4} for the RME scenario, exceeding the upper end of EPA's target range of 1×10^{-6} to 1×10^{-4}. The risk is entirely attributable to arsenic. When a more typical exposure is considered under the CTE scenario, cancer risks for consumption of fish (4×10^{-5}) and hard clam (3×10^{-5}) for adult anglers are within the EPA's target range of 1×10^{-6} to 1×10^{-4}.

For noncancer health hazards, current and future children consuming fish and hard clam caught by adult anglers have HIs for skin at 2 under the RME scenario, exceeding the EPA threshold of 1. The noncancer health hazard is almost entirely attributable to arsenic. When a more typical exposure is considered under the CTE scenario, total noncancer HIs for consumption of fish (0.6) and hard clam (0.9) for children are within EPA target threshold of 1.

The total estimated cancer risk for hypothetical future residents consuming groundwater as drinking water is within EPA's target range of 1×10^{-6} to 1×10^{-4}. The future hypothetical residents have noncancer HIs for the respiratory system (5), thyroid gland (5), and gastrointestinal (GI) system (7) exceeding the EPA threshold of 1 under the RME scenario. The potential health hazards to the respiratory system and thyroid gland are attributed to cobalt. The potential for adverse health effect to the GI system is a result of future exposure to iron in groundwater. When a more typical exposure is considered under the CTE scenario, the HIs for the respiratory system (2), thyroid gland (2), and GI system (3) still exceed the EPA threshold.

Risks from Lead

The IEUBK and the ALM models were used to assess risks to current and future receptors from exposure to lead in surface soil, sediment, groundwater, and biota. Because models are not currently available to evaluate exposure to lead in surface water via incidental ingestion or dermal contact during recreation (e.g., swimming or wading), exposure to lead in surface water was evaluated qualitatively by comparison to drinking water criteria.

For all current and future recreational users in Areas 5, 6, and the beach area of Area 9, anglers, and future resident children, the probabilities for blood concentrations for children to exceed the threshold of 10 µg/dL were less than 5%. These results

indicate that exposure to lead for recreating in Areas 5, 6, and the beach area of Area 9, consumption of fish/shellfish caught from the site, and groundwater ingestion is not a concern for children. However, 42% of children recreating in Area 2 exposed to the fine fraction of lead in surface soil may have blood lead levels above 10 µg/dL. This result indicates that children recreating in Area 2 could be at risk to develop blood lead levels above the threshold of concern.

For all current and future pedestrians, recreational adults and adolescents, the probabilities for fetal blood concentrations to exceed the threshold of concern were less than 1%. These results indicate that exposure to lead in surface soil is not a concern for these receptors in the exposure areas evaluated. Results of the ALM indicate that exposure to lead in sediment in the upland areas of Area 9 for recreational receptors would not result in blood lead levels above a level of concern. The probability that fetal blood lead level would be above a level of concern were about 11% for construction/utility workers exposed to lead in surface and subsurface soil in upland areas; this result is above the threshold level of concern.

For all shellfish consumption scenarios, the probability of fetal blood lead concentrations exceeding 10 µg/dL was less than 1%. These results indicate that adverse health effects are not expected for anglers exposed to lead in shellfish based on the available data. Additionally, recreational receptors exposed to lead in surface water are not of concern.

Summary and Conclusions

Total estimated cancer risks and noncancer health hazards are within EPA's target thresholds (cancer risk of 10^{-4} to 10^{-6} and noncancer HI of 1) for all receptor scenarios except the following:

- Current/Future Scenario:
  - Construction/utility workers
  - Adult anglers consuming fish or hard clam
  - Children consuming fish or hard clam
- Future Scenario:
  - Child recreational users in Area 2
  - Residents using groundwater as drinking water

Forty-two percent of future child recreational users in Area 2 may have blood lead levels above 10 µg/dL. This result indicates that children recreating in Area 2 could be at risk to develop blood lead levels above the threshold of concern. Additionally, the probability that the fetal blood lead level would be above a level of concern is approximately 11% for construction/utility workers; this result is above the threshold level of concern.

For the RME scenario, the estimated cancer risks for current and future adult anglers consuming fish or hard clam are 2×10^{-4}, exceeding EPA's target range of 1×10^{-6} to 1×10^{-4}. Arsenic is the cancer risk driver. When a more typical exposure is considered

under the CTE scenario, the estimated cancer risks are within EPA's target range. Children consuming fish or hard clam have noncancer HIs for the skin at 2, exceeding the EPA threshold of 1 under the RME scenario. The potential health hazards are almost entirely attributed to arsenic. When a more typical exposure is considered under the CTE scenario, the total HIs for children consuming fish or hard clam are below the EPA noncancer threshold. Risks to anglers and children could be overestimated since arsenic is present in fish and shellfish predominately in much less toxic organic forms when toxicity criteria for the most toxic inorganic arsenic are used in the risk assessment.

For the RME scenario, the future hypothetical resident drinking water scenario has noncancer HIs for the respiratory system, thyroid gland, and GI system at 5, 5, and 7, respectively. These HIs exceed the EPA threshold of 1. The noncancer health hazards are associated with exposure to cobalt and iron in groundwater. When a more typical exposure is considered under the CTE scenario, the HIs for the respiratory system, thyroid gland, and GI system are 2, 2, and 3, respectively, still exceeding the EPA threshold. Iron is a major component of the slag; in addition to the slag at the site, several lines of evidence indicate the elevated iron concentrations in groundwater are also from existing geochemical conditions in the area (see Section 6.1.2.7). Cobalt is a naturally occurring metal and is not a major component of the slag. Cobalt may be released from soil under acidic conditions in groundwater in Areas 1, 4, and the upland area of Area 9.

In conclusion, 42% of future child recreational users in Area 2 may have blood lead levels above 10 µg/dL. Additionally, the probability that the fetal blood lead level would be above a level of concern is approximately 11% for construction/utility workers. These results are above the threshold level of concern.

Cancer risk and noncancer health hazards exceed EPA's target threshold due to the presence of arsenic in fish and hard clam tissue from the site. Lead and arsenic are the risk drivers and they are apparently associated with past disposal of slag and battery casing wastes. Additionally, elevated levels of lead (up to 47,000 mg/kg) and arsenic (up to 760 J mg/kg) are present in soils in Area 1, Area 2, and the upland area of Area 9.

Noncancer health hazard in groundwater exceeds EPA's target threshold due to future hypothetical use of groundwater as drinking water. Groundwater is not currently used for drinking water at the site. Future potable use of groundwater is unlikely because of high salinity and a municipal water supply is readily available and serves the site and vicinity.

Section 1
Introduction

Under the United States Army Corps of Engineers (USACE), Kansas City District, Contract No. W912DQ-08-D-0018, Task Order No. 018, CDM Federal Programs Corporation (CDM) has been tasked to provide technical services to complete a Remedial Investigation/Feasibility Study (RI/FS) for the Raritan Bay Slag Superfund Site (the site) located in Old Bridge and Sayreville, Middlesex County, New Jersey.

This human health risk assessment (HHRA), as part of the RI/FS, is developed to characterize potential human health risks associated with the site in the absence of any remedial action. This HHRA identifies the potential exposure pathways by which populations may be exposed. Exposure pathways are identified based on considerations of the sources and locations of contaminants related to the site, the environmental fate and transport of the contaminants, and the location and activities of the potentially exposed populations. The HHRA describes exposure points and routes of exposure for each exposure pathway, as well as underlying assumptions regarding receptor characteristics and behavior (e.g., body weight, ingestion rate, exposure frequency). The HHRA also identifies chemicals of potential concern (COPCs) for each environmental medium, exposure point concentrations (EPCs) and toxicity values of COPCs. Finally, the HHRA characterizes potential cancer risks and noncancer health hazards associated with each complete exposure pathway.

1.1 Overview

To prepare this HHRA, CDM reviewed the available information obtained from United States Environmental Protection Agency (EPA) pertaining to the site. In this report, present and future land-use exposure pathways and receptors are identified. Subsequent sections present the exposure parameters used for the calculation of daily intakes, cancer and noncancer toxicity values for COPCs, and risk estimates. The exposure pathways and receptors, exposure parameters, toxicity values, and risk estimates are presented in tabular form in accordance with the standard tables in *Risk Assessment Guidance for Superfund (RAGS) Part D* (EPA 2001a).

This HHRA is developed in accordance with the following EPA guidance documents:

- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A* (EPA 1989)
- *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (EPA 1991a)
- *Exposure Factors Handbook*, Volumes I, II, and III (EPA 1997)
- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part D* (EPA 2001a)
- *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (EPA 2003a)

- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA 2004a)
- *User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Windows®* (EPA 2007a)
- *Child-Specific Exposure Factors Handbook* (EPA 2008a)
- *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment* (EPA 2009a)
- *EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites* (EPA 2010a)
- *ProUCL Version 4.1.00 User Guide (Draft)* and *ProUCL Version 4.1.00 Technical Guide (Draft)* (EPA 2010b and 2010c)
- Integrated Risk Information System (IRIS) (on-line database of toxicity information)
- Provisional Peer Reviewed Toxicity Values (PPRTV) (on-line database of toxicity value derived for use in the Superfund program when such value is not available from IRIS)

1.2 Report Organization

This HHRA is composed of eight sections, with tables and figures presented at the end of the text. The organization of the report and the contents of each section are described below.

Section 1 Introduction – provides an overview of the objectives and organization of the HHRA.

Section 2 Site Background and Setting – briefly presents the site location and description, site history, site geology and hydrogeology, surface water bodies, demography, and land use.

Section 3 Data Evaluation – presents sample collection and analysis at various media, analytical data summary, data usability, and identification of COPCs.

Section 4 Exposure Assessment - presents a conceptual site model (CSM) and identifies potential exposure pathways and potential receptor populations under both current and future land-use scenarios. In addition, methods for evaluating exposure to lead are also presented in this section.

Section 5 Toxicity Assessment - discusses the relevant toxicity information for the identified COPCs.

Section 6 Risk Characterization - integrates the toxicity and exposure assessments into quantitative and qualitative expressions of risk, and discusses uncertainties associated with the risk estimates.

Section 7 Summary and Conclusions - summarizes the results of the risk assessment and presents conclusions based on the results.

Section 8 References – lists references cited in this report.

Section 2
Site Background and Setting

This section describes the site location and description, site history, geology and hydrogeology, surface water bodies, sample collection and analysis, demography, and land use. This information is used to develop site-specific information on exposure pathways associated with the site.

2.1 Site Location and Description

The site is located on the shore of Raritan Bay, within the Laurence Harbor section of Old Bridge Township, New Jersey (Figure 2-1). A small portion of the northern end of the site, the western jetty at the Cheesequake Creek Inlet, is located in the Borough of Sayreville. The site is bordered to the east and west by residential properties, immediately to the south by State Highway 35 with residential properties beyond the highway, and to the north by Raritan Bay.

The site is approximately 1.5 miles in length and consists of the waterfront area between Margaret's Creek and the area just beyond the western jetty at the Cheesequake Creek Inlet. The portion of the site in Laurence Harbor is part of what is now called the Old Bridge Waterfront Park. The park is made up of walking paths, a playground area, several public beaches, and three jetties, not including the two jetties at the Cheesequake Creek Inlet. The park waterfront is protected by a seawall, which is partially constructed with pieces of slag. The western jetty at the Cheesequake Creek Inlet and the adjoining waterfront area west of the jetty are located in Sayreville, and also contain slag.

The site has been divided into 10 site areas based on areas identified in historical investigations, site physical characteristics, and the locations of known or potential sources. Figure 2-2 shows the site investigation areas. The 10 site areas, which are referenced in subsequent sections, are defined as follows:

- Area 1: Laurence Harbor Seawall - The seawall along Old Bridge Waterfront Park west of Margaret's Creek to the beach area at the foot of Laurence Parkway
- Area 2: Laurence Harbor Beach - The beach area at the foot of Laurence Parkway between the western end of the seawall and the first jetty
- Area 3: Laurence Harbor Playground - The park playground adjacent to the western end of the seawall
- Area 4: Old Bridge Waterfront Park - The park area along the seawall (not including the playground) from the fence to the roadway
- Area 5: Laurence Harbor Beach - The beach area between the first and third jetty

- Area 6: Laurence Harbor Beach - The beach area between the third jetty and Cheesequake Creek Inlet eastern jetty

- Area 7: Cheesequake Creek Inlet - The inlet between the eastern and western jetties from the Route 35 bridge into Raritan Bay to the extent of sediment deposition

- Area 8: Cheesequake Creek Inlet Western Jetty - The jetty west of the inlet in Sayreville

- Area 9: Margaret's Creek - The wetlands associated with the Creek (between the beach and Route 35), including the adjacent beach (east of the Creek to the Middlesex County Pumping Station)

- Area 11: Depositional Areas – The potential depositional areas associated with Areas 7 and 8

2.2 Site History

The slag was placed at the site approximately 40 years ago during the construction of the Area 1 seawall and western jetty. Elevated levels of lead, antimony, arsenic, and copper were identified by the New Jersey Department of Environmental Protection (NJDEP) in the soil along the seawall in 2007 and at the edge of the beach near the western end of the seawall.

EPA collected samples at the site in September 2008 as part of an Integrated Assessment. The sampling included the collection of soil, sediment, water, biological, slag and waste samples along the seawall in Laurence Harbor, the western jetty at the Cheesequake Creek Inlet, the beaches near these two locations, and the developed portion of the park. Analytical results generated by both EPA and NJDEP indicated that significantly elevated levels of lead and other heavy metals were present in site media in and around both the seawall in Laurence Harbor and the western jetty at the Cheesequake Creek Inlet.

At EPA's request, the New Jersey Department of Health and Senior Services, in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), evaluated the analytical data from the samples collected at the site. Their findings concluded that, due to the elevated lead levels, a Public Health Hazard exists at the seawall in Laurence Harbor, the beach between the western end of the seawall and the first jetty, and the western jetty at the Cheesequake Creek Inlet, including the waterfront area immediately west of the inlet. As a result, EPA restricted access to these areas (by installing fences and posting signs) and provided public outreach to inform residents of the potential health hazards that may exist in these areas.

2.3 Site Geology and Hydrogeology

This section provides a brief summary of the lithologic and hydrogeologic characteristics of the site and immediate area. A more detailed description of site geology and hydrogeology can be found in the RI report.

2.3.1 Site Geology

The site is underlain primarily by Quaternary age beach deposits which are up to 15 feet thick. Off shore, the site is underlain by Quaternary age estuarine deposits consisting of organic clay and silt, peat, and sand and gravel. These same estuarine deposits underlie Cheesequake Creek, Margaret's Creek and their associated wetlands. In the vicinity of the site the estuarine deposits are at least 50 feet thick underlying Cheesequake Creek where regional mapping shows that the top of the Cretaceous age Magothy Formation is at an elevation of –50 feet mean sea level. Developed areas, where houses and business are located, are underlain by weathered coastal plain sediments consisting of sand, silt, and clay, or Upper Terrace Deposits which consist of sand, gravel, and minor silt and are up to 20 feet thick. The surficial deposits described above are underlain by the Cretaceous-age Magothy Formation.

The Magothy Formation is extensive in outcrop and in the subsurface throughout the Coastal Plain of New Jersey. On a regional basis, the formation is part of a major Coastal Plain aquifer system known as the Potomac-Raritan-Magothy (PRM). The PRM system consists of lower, middle, and upper aquifers that are separated by confining units. Only the middle and upper aquifers and their intervening confining unit are present in Middlesex County. In the vicinity of the site, the Magothy Formation is underlain by bedrock at a depth of about 500 feet below the ground surface (bgs).

2.3.2 Site Hydrogeology

The site is bordered to the south by the predominantly saline wetlands associated with Cheesequake Creek and Margaret's Creek. Regionally, groundwater flow in the Magothy Formation is from the west to the east and to discharge into the Raritan Bay. Shallow groundwater flow in the surficial Quaternary age deposits is predominantly toward the nearest surface water body which might be a creek, a wetland, or Raritan Bay. Close to the site, groundwater flow is toward Raritan Bay. Groundwater levels in the surficial deposits are influenced by tidal fluctuations in the Raritan Bay, Cheesequake Creek, and Margaret's Creek and is saline. The influence is greatest close to Raritan Bay and creeks and dissipates with distance.

2.4 Surface Water Bodies

Major surface water bodies in the vicinity of the site include Raritan Bay, Cheesequake Creek, and Margaret's Creek.

2.4.1 Raritan Bay

Raritan Bay is a large embayment, approximately 109 square miles in area, bordering the states of New York and New Jersey. Raritan Bay receives input from the Raritan River, Shrewsbury and Navesink Rivers (via Sandy Hook Bay), and numerous smaller streams along the shorelines of Raritan Bay. Raritan Bay also receives input from the Hudson River via lower New York Harbor and from the Passaic and Hackensack Rivers via Newark Bay and Arthur Kill. With the exception of navigation channels, water depths in Raritan Bay are relatively shallow, often less than 20 feet deep. The average tidal range in Raritan Bay is 5.5 feet. The mixing of marine and fresh waters within Raritan Bay results in large fluctuations in salinity, temperature, and dissolved oxygen. Sediments in Raritan Bay are predominantly sand, with areas of gravelly sand overlain by silt and very fine sand (U.S. Fish and Wildlife Service [USFWS] 1997).

2.4.2 Cheesequake Creek

Cheesequake Creek is a tidal creek that drains tidal wetlands located southwest of the creek outlet and discharges to Raritan Bay between two jetties referred to as the Cheesequake Creek western and eastern jetties. The Cheesequake Creek western jetty has been augmented with slag that is visible on the surface. Side scan sonar of the creek bed between the two jetties and visual observations by EPA divers indicated that sediment in the creek is primarily gravel.

2.4.3 Margaret's Creek

Margaret's Creek is a small tidal stream that drains a wetland near the eastern border of the site and discharges directly to Raritan Bay. The creek is located just east of a seawall that has visible slag. Metals contamination has also been observed in the soils of the wetland that are drained by the creek. Field observations by CDM indicate that the stream has a sandy bed near its outlet to Raritan Bay. Stream flow in Margaret's Creek fluctuates widely in response to precipitation events and storm surges.

2.5 Demography and Land Use

The site consists of the waterfront area between Margaret's Creek and the area just beyond the western jetty at the Cheesequake Creek Inlet. The portion of the site in Laurence Harbor is part of Old Bridge Waterfront Park. The park includes walking paths, a playground area, several public beaches, and three jetties, not including the two jetties at the Cheesequake Creek Inlet. The seawall, jetties, beach area east of the Cheesequake Creek Inlet, and the western jetty at the Cheesequake Creek Inlet are popular fishing areas. The beaches east of the Cheesequake Creek Inlet and west of the seawall are the most popular for swimming. There are three public parking areas for park access: one at the eastern end, one at the western end, and one at the foot of Laurence Parkway. Direct access to the Waterfront Park can also be obtained via private properties adjacent to Areas 6 and 9.

The Old Bridge and Sayreville neighborhoods of Laurence Harbor are located to the southwest/south of the site. These neighborhoods support a mixture of residential, commercial, and industrial uses, with residential properties concentrated southwest/south of Areas 2, 3, 4, 5, and 11, and northwest and southeast of Margaret's Creek. Old Bridge Township is comprised of 38.8 square miles with a population of 65,942 (U.S. Census Bureau 2009). The Borough of Sayreville is comprised of 16.3 square miles with a population of 42,236 (U.S. Census Bureau 2009). Old Bridge Township and the Borough of Sayreville lie within Middlesex County.

Middlesex County Utilities Authority operates two pumping stations at the site, one at the eastern end (Area 9) and one at the western end (Area 11). A major sewer line connecting the two pumping stations runs across the site along the Raritan Bay shoreline. An additional sewer line runs across the Margaret's Creek upland area between Route 35 and the beach area.

Section 3
Data Evaluation

Samples of environmental media, including soil, groundwater, surface water, sediment, and biota, were collected in order to characterize the nature and extent of contamination from the site. The data evaluation step consists of reviewing and evaluating available data. Data evaluation allows for the identification of COPCs. The following subsections describe sample collection and analysis (Section 3.1), data usability and the suitability of data for risk assessment purposes (Section 3.2), analytical data summary (Section 3.3), and the approach used to identify COPCs (Section 3.4).

3.1 Sample Collection and Analysis

The site has been the subject of numerous environmental activities dating back to 2004. Previous investigations were conducted by EPA/Emergency Response Team (ERT) from September 2008 to August 2010. These events included sampling and analysis of soil, surface water, sediment, and biota. These investigations included the following:

- Summary Letter Report, Phase I Investigation (Weston 2009a)
- Hazard Ranking System Documentation Record (EPA 2009b)
- Chemical Assessment Report: Characterization of Slag/Waste Material Fate and Transport of Contaminants Biomonitoring of Contaminants, Report 1 of 2 (EPA/ERT 2010)
- Summary Letter Report, Phase II Investigation (Weston 2009b)
- Trip Report: Raritan Bay Sediment Sampling (EPA/ERT 2009)
- Final Beach Sampling Technical Memorandum (CDM 2010a)
- EPA/Division of Environmental Science and Assessment (DESA) August 2010 Area 2 Sampling

These studies were not designed to fully characterize the nature and extent of contamination at the site or to provide a basis on which remedial action decisions could be made. As part of the development of the RI/FS work plan, CDM reviewed the available data and prepared a *Final (Revised) Data Gap Analysis Technical Memorandum* (CDM 2010b). The memorandum identified gaps in the existing data and provided recommendations for field investigation activities to fill the data gaps. The data gap technical memorandum was used to develop a field investigation program designed to collect adequate data to supplement the existing information and complete the RI, risk assessments, and FS.

RI field investigation activities for the site were conducted from June 2010 to April 2011. The RI investigation included sampling and analysis of soil, surface water, sediment, groundwater, and biota.

Consequently, data from previous studies are supplemented with sampling and analysis results generated as part of the current RI to adequately characterize

contamination at the site to support the RI and the HHRA. A list of samples used in the HHRA is provided in Appendix A. Sample locations are provided in Figures 2-3 through 2-14. A detailed review of the investigation approach and findings is provided in the RI report. A brief description of samples collected for the risk assessment is provided below.

3.1.1 Soil Sampling

For the purposes of this HHRA, soil samples are defined as samples collected above the spring low tide line at the site. In this report, soil samples collected between the spring low tide line and the mean high tide line are termed intertidal zone soils. Soil samples collected above the mean high tide line are termed upland soils. The areas above the mean high tide line are termed upland areas.

For soil samples, the summary of analytical results is subdivided by depth range to support risk evaluations. Surface soil is defined as soil present from the ground surface to a depth of two feet. Subsurface soil consists of soil samples collected from 2 to 10 feet below ground surface.

Soil samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), target analyte list (TAL) inorganics including mercury, pesticides, polychlorinated biphenyls (PCBs), hexavalent chromium (chromium VI), total organic carbon (TOC), grain size, and pH. Brief descriptions of soil samples collected by EPA from September 2008 to August 2010 and by CDM during the RI, excluding duplicate samples, are provided below.

3.1.1.1 Area 1 Laurence Harbor Seawall

Two hundred forty-four surface soil samples were collected. Thirty-nine samples were collected from the upland area and 205 were collected from the intertidal zone (Figure 2-3).

One hundred eleven subsurface soil samples were collected. Thirty-five samples were collected from the upland area and 76 were collected from the intertidal zone (Figure 2-3).

3.1.1.2 Area 2 Laurence Harbor Beach

Ninety-five surface soil samples were collected. Forty-one samples were collected from the upland area and 54 were collected from the intertidal zone (Figure 2-4).

Fifty subsurface soil samples were collected. Twenty-eight samples were collected from the upland area and 22 were collected from the intertidal zone (Figure 2-4).

3.1.1.3 Area 3 Laurence Harbor Playground

Fifty-four surface soil samples and nineteen subsurface soil samples were collected in Area 3 (Figure 2-5).

3.1.1.4 Area 4 Old Bridge Waterfront Park

Thirty-seven surface soil samples were collected and thirty subsurface soil samples were collected (Figure 2-5).

3.1.1.5 Area 5 Laurence Harbor Beach

Two hundred twenty surface soil samples were collected. One hundred five samples were collected from the upland area and 115 were collected from the intertidal zone (Figure 2-6).

Ninety-two subsurface soil samples were collected. Fifty samples were collected from the upland area and 42 were collected from the intertidal zone (Figure 2-6).

3.1.1.6 Area 6 Laurence Harbor Beach

One hundred seventy-five surface soil samples were collected. Thirty-seven samples were collected from the upland area and 138 were collected from the intertidal zone (Figure 2-7).

Sixty-four subsurface soil samples were collected. Fifteen samples were collected from the upland area and 49 were collected from the intertidal zone (Figure 2-7).

3.1.1.7 Area 7 Cheesequake Creek Inlet

Twenty surface soil samples were collected. Two were collected from the upland area and 18 were collected from the intertidal zone (Figure 2-8).

Thirteen subsurface soil samples were collected. Two samples were collected from the upland area and 11 samples were collected from the intertidal zone (Figure 2-8).

3.1.1.8 Area 8 Cheesequake Creek Inlet Western Jetty

Sixty-six surface soil samples were collected. Four samples were collected from the jetty, 15 samples were from the upland area and 47 samples were collected from the intertidal zone (Figure 2-9).

Forty-three subsurface soil samples were collected. Two samples were collected from the jetty, 11 were from the upland area and 30 were from the intertidal zone (Figure 2-9).

3.1.1.9 Area 9 Margaret's Creek

Two hundred five surface soil samples were collected. One hundred seventy-five were collected from the upland area and 30 were collected from the intertidal zone (Figure 2-10).

One hundred forty-three subsurface soil samples were collected. One hundred thirty-two were collected from the upland area and 11 were from the intertidal zone (Figure 2-10).

3.1.1.10 Area 11 Depositional Areas

One hundred twenty-eight surface soil samples were collected. Twenty were collected from the upland area and 108 were collected from the intertidal zone (Figure 2-12).

Ninety-one subsurface soil samples were collected. Fifteen were collected from the upland area and 76 were from the intertidal zone (Figure 2-12).

3.1.1.11 Technical Review Workgroup Lead Composite Sampling

To support the evaluation of lead contamination, additional sampling for lead was performed in accordance with the *Superfund Lead-Contaminated Residential Sites Handbook* prepared by the EPA Lead Sites Workgroup (EPA 2003b). Soil samples were collected from the near-surface (0 to 2 inches bgs) because this depth best represents soil and dust that children may be exposed to and is used to predict child blood lead levels using the lead model.

Soil samples consisted of a composite of five subsamples located randomly within a sampling section. Each sampling section was approximately 0.25 acres (approximately 10,000 square feet) in area. The EPA Technical Review Workgroup (TRW) (EPA 2000) recommends that composite samples be sieved to less than 250 micrometer (µm), a particle size fraction that sticks to hands and is the primary source of ingested soil and dust. The portion of the total sample that passes through a 250 µm is termed the fine fraction (EPA 2000).

Thirty-two TRW surface soil composite samples were collected from Area 2; 3 samples from Area 3; 81 samples from Area 5; and 107 samples from Area 6. The samples were analyzed for lead in the fine fraction soil. TRW sample locations are provided in Figure 2-13.

3.1.2 Groundwater Sampling

Twenty unfiltered groundwater samples were collected from monitoring wells at the site from depth of 5 to 44 feet bgs. Samples were analyzed for TCL VOCs, SVOCs, total TAL inorganics including mercury, pesticides, PCBs, and chromium VI. In addition, groundwater samples were analyzed for natural attenuation parameters, including alkalinity, chloride, nitrate, sulfate, sulfide, total Kjehldahl nitrogen, ammonia, and total suspended solids (TSS). Water quality parameters including dissolved oxygen (DO), pH, temperature, conductivity, turbidity, and oxidation-reduction potential were measured in the field and recorded on field data sheets.

3.1.3 Surface Water Sampling

One hundred thirty-nine unfiltered surface water samples were collected from Raritan Bay, Cheesequake Creek Inlet, and Margaret's Creek. Eighteen unfiltered surface water samples were collected from wetland areas of Area 9. Samples were analyzed for TCL VOCs, SVOCs, total TAL inorganics including mercury, pesticides,

PCBs, and chromium VI. In addition, surface water samples were analyzed for TSS, chloride, hardness, and alkalinity.

3.1.4 Sediment Sampling

For the purposes of this HHRA, sediment samples are defined as samples collected below the spring low tide line. Surface sediment samples are those collected from the uppermost six inches of the sediment horizon. Sediment samples that include the uppermost six inches of sediment are included in the risk assessment. Samples that include the top six inches but also include deeper sediment in the same sample are excluded because analyses were not performed separately on the two horizons (≤ 6 inches and > 6 inches).

Surface sediment samples collected from each area are listed as follows:

- Area 1 – 73 samples
- Area 2 – 1 sample
- Area 5 – 13 samples
- Area 6 – 9 samples
- Area 7 – 34 samples
- Area 8 – 28 samples
- Area 9 – 7 samples from the beach area and Margaret's Creek, and 51 samples from the wetlands
- Area 11 – 22 samples

Sediment samples were analyzed for TCL VOCs, SVOCs, TAL inorganics including mercury, pesticides, and PCBs. For Area 2 sediment, only one sample was collected from the area. This was a result of the definition of sediment for the site as defined by the spring low tide line.

3.1.5 Biota Sampling

In September 2008, EPA/ERT (2010) conducted a chemical assessment investigation. During the investigation, biota samples were collected as listed below.

- Hard clam (*Mercenaria mercenaria*) – 3 composite tissue samples
- Soft shell clam (*Mya arenaria*) – 5 composite tissue samples
- Ribbed mussel (*Gukensia demissa*) – 6 composite tissue samples
- Forage fish (*Fundulus* spp) – 5 composite whole fish samples
- Macro algae *(Ulva* sp.) – 5 composite samples

Biota samples were analyzed for 10 metals including antimony, arsenic, copper, chromium, lead, manganese, nickel, silver, tin, and zinc, and percent of solids.

Additional biota samples were collected during the RI from September 2010 to January 2011 as summarized below.

- Fish (species commonly consumed by humans) – 5 individual skin-on fillet samples and one composite skin-on fillet sample
- Blue crab (*Callinectes sapidus*) – 5 composite muscle tissue samples and 5 composite hepatopancreas samples
- Hard clam – 2 composite tissue samples
- Ribbed mussel – 4 composite tissue samples

These additional biota samples were analyzed for 21 TAL metals (excluding cyanide) as specified in the ISM01.2 program (EPA 2011a), mercury, and percent of lipids.

The representativeness of biota data for estimating potential human exposure is evaluated by reviewing: (1) which species are consumed by humans, and (2) the size of samples collected and analyzed (i.e., is the size of organisms collected normally consumed by humans?). In this HHRA, fish, blue crab, and hard clam specimens as individual or composite samples are considered to be representative of biota typically consumed by people utilizing the site.

The ribbed mussel was the only mussel present at the time of biota sampling at the site. Ribbed mussel is an intertidal, salt marsh dwelling bivalve that is most frequently associated with tidal creek banks. They are rarely consumed by people because of an unpleasant taste. On the Atlantic coast, blue mussels (*Mytilus edulis*) are edible and harvested recreationally and commercially. Blue mussels were not found during the biota sampling, nor are they expected to occur at the site. However, Nelson *et al*. (1995) compared PCB and metal bioaccumulation in both blue and ribbed mussels in New Bedford Harbor, Massachusetts. Results of the study indicated that lead, cadmium, and iron uptake in both species were statistically similar. Therefore, ribbed mussels are used as a surrogate and ribbed mussel data is used in this HHRA.

Soft shell clams, although consumed by humans, are excluded from the HHRA because individuals collected were extremely small, ranging in width from 10 millimeters (mm) to 40 mm. Forage fish and macro algae are also excluded from evaluation in the HHRA because they are not consumed by people. Thus, in this HHRA, only fish, blue crab, hard clam, and ribbed mussel data are evaluated. The biota data used in the risk assessment are described below.

Fish

Fish tissue samples are available for the following six species: winter flounder (*Pseudopleuronectes americanus*), summer flounder (*Paralichthys dentatus*), striped bass (*Morone saxatilis*), tautog (*Tautoga onitis*), blue fish (*Pomatomus saltatrix*), and windowpane flounder (*Scophthalmus aquosus*). All of the species are potentially consumed by anglers in Raritan Bay; however, none are resident species to Raritan Bay. All fish samples are individual samples, except summer flounder, which is a composite of five individual fish. All fish samples are skin-on fillets.

Summer flounder and windowpane founder migrate from bays during the winter into deeper waters for spawning. Conversely, winter flounder migrate into deeper water during summer months. Striped bass is an anadromous species, meaning it spawns in freshwater rivers but lives its adult life in the ocean. Adult striped bass and blue fish follow a seasonal migration pattern. These species migrate south and offshore during the winter, and migrate back north and inshore in the spring. Adult tautog migrations consist of inshore spawning migration in the spring, and offshore migration in the fall to deeper waters.

Flounders are bottom feeders or benthic fish, contrasted by pelagic species such as blue fish, striped bass and tautog, which live near the surface or in the open water column. All species collected are highly mobile, meaning that during the limited time they reside in Raritan Bay, they are not likely to be closely associated with the site as they are expected to move freely about Raritan Bay foraging and seeking refuge.

Shellfish

Shellfish evaluated in this HHRA include blue crab, hard clam, and ribbed mussel. Commonly, the term shellfish refers to an aquatic invertebrate characterized by a protective shell or exoskeleton such as mollusks or crustaceans. Blue mussel, hard clam, and blue crab are recreationally and commercially important shellfish species in New Jersey; the latter two are the most abundant edible shellfish in Raritan Bay.

Collectively speaking, molluscan shellfish such as clams and mussels are good indicators of contamination in marine environments because they are sessile or sedentary, are filter feeders, are in constant or frequent contact with bottom sediment, are relatively hardy and are pollution tolerant. These characteristics, in addition to the presence of ribbed mussel and hard clam at the site, make them particularly valuable for evaluating the potential risk to human receptors via consumption of these organisms.

3.1.6 Lead and Arsenic Bioavailability and Speciation Study

Lead and arsenic have been identified as site-related metals at the site. One example of exposure to metals in soil and sediment occurs from ingesting contaminated soil that clings to people's hands. Not all metals swallowed will be absorbed into the body. Some metals, such as lead and arsenic, will pass through the digestive system without being absorbed. Some lead or arsenic is bound so tightly to soil particles that it is less likely to be absorbed by the lining of the intestinal tract than lead or arsenic bound loosely to soil particles. This process of how much lead or arsenic crosses the stomach and enters into the bloodstream and the body is known as bioavailability.

In vitro bioavailability and speciation studies were performed for lead and arsenic for soil samples collected from the site. The purposes of this study were to evaluate the physical and chemical characteristics of lead and arsenic detected at the site and to determine the degree to which lead and arsenic at the site are available for uptake into the human body when exposed to lead- or arsenic-contaminated soils. The *in*

vitro bioavailability test involves a laboratory procedure that is designed to mimic some of the conditions of the human digestive tract. The fraction of metal which solubilizes in an *in vitro* system is referred to as *in vitro* bioaccessibility (IVBA), which may then be used as an indicator of *in vivo* relative bioavailability (RBA) (EPA 2007b). RBA can then be converted to an estimate of the amount actually absorbed in the gastrointestinal tract for use in risk analysis (absolute bioavailability).

EPA has developed an *in vitro* bioavailability correlation factor for lead based on swine studies to evaluate the RBA (EPA 2007c). However, the correlation for arsenic is not strong enough to warrant using the *in vitro* method as a standalone means to determine a site-specific arsenic bioavailability. Thus, for arsenic bioavailability testing, EPA supports a weight-of-evidence approach which combines *in vitro* results and geochemical speciation data (EPA Region 8 2005).

Bioavailability analyses for lead and arsenic were performed on 40 representative surface soil samples collected from Areas 2, 3, 5, 6, and 9 (Figures 2-14 and 2-15). To determine the lead and arsenic mineralogy and forms/species, 13 selected samples were analyzed by quantitative electron microprobe analysis (EMPA). The samples were characterized using EMPA analysis to determine the chemical speciation, particle size distribution, association of the metal-bearing forms, frequency of occurrence, and relative mass. A detailed description of the bioavailability and speciation study background and methodology is provided in Appendix D.

3.2 Data Usability

This section presents a summary of the data usability assessment and a determination of how data are to be used in the HHRA. All data collected by CDM for the RI were subjected to a data quality assessment for data usability. A detailed discussion of data quality for the data collected for the RI and used in the risk assessment is presented in the *Data Quality Assessment Summary Report* (CDM 2011). These procedures include evaluation of precision, accuracy, representativeness and comparability, completeness, and qualified data. A summary of the data quality assessment pertinent to the HHRA is discussed below.

3.2.1 Data Usability Assessment

All data acquired during the RI were validated by EPA and CDM following procedures in EPA National Functional Guidelines for Inorganic Data Review (EPA 2004b) and EPA National Functional Guidelines for Organic Data Review (EPA 2008b). The complete data validation is provided in the *Data Quality Assessment Summary Report* (CDM 2011).

As part of the RI sampling program, field duplicates, matrix spike/matrix spike duplicates, and trip and rinsate blanks were submitted for analyses. These samples provide information on analytical variability and error, the overall performance of the field sampling effort, and the uncertainty surrounding the analytical results. Field

duplicate/split samples provide an indication of analytical variability and error. Rinsate blanks are indicators of equipment cleanliness and the effectiveness of equipment decontamination procedures. Trip blanks are used to assess whether cross contamination of samples has occurred during container shipment and storage. Analytical results obtained from field duplicates are used for quality assurance/quality control purposes and are not included in the datasets for risk evaluation.

Generally, data from the RI field investigation were determined to be suitable for risk assessment purposes as defined in data quality objectives in the Quality Assurance Project Plan (QAPP) (CDM 2010c). Some data were not usable and were flagged as rejected, as indicated by an "R" qualifier. These data were not used for any reporting purpose or during the risk assessment evaluation.

Total chromium was analyzed in all samples. Chromium VI analysis was performed for 24% surface soil, 58%surface/subsurface soil, all groundwater, 27% surface water, and 30 % sediment samples. It is assumed that chromium is present in only two of the several oxidation states of chromium, trivalent (chromium III) and hexavalent, based on their predominance and stability in the ambient environment and their toxicity. The concentration of chromium III is calculated by subtracting the chromium VI concentration from the total chromium concentration. Undetected chromium VI in a given sample is assigned a value of one-half of the reporting limit. For individual samples in which total chromium is not detected, chromium III is assumed to be not-detected and was assigned the value of the reporting limit of total chromium. For individual samples in which the chromium VI concentration is greater than total chromium, it is assumed that all chromium is present as chromium VI. Because there is neither a screening level nor a toxicity criterion for total chromium, total chromium is not quantitatively evaluated in the HHRA.

Soil, Sediment, and Surface Water

Ninety-seven percent of the RI data are suitable for their intended use. The remaining three percent should not be used for project decisions. The 90 percent completeness goal for usable data has been met. Reasons for rejected data are summarized below.

Less than one percent of the VOC data were rejected due to low internal standard recoveries. Additionally results for 1,4-dioxane were rejected due to instrument response factors below acceptable limits. Results from several SVOC compounds were rejected due to either surrogates recoveries, relative standard deviation (%RSD), percent difference (%D), or internal standard recoveries outside acceptable limits. Additionally pentachlorophenol was rejected due to poor response factors. The pesticide data were also rejected due to poor surrogate recoveries, second column compound identification, %RSD or %D. 4,4'-DDD was primarily the compound impacted by these conditions. Metals data were rejected due to laboratory duplicate, matrix spike, field duplicate, or inductively coupled plasma (ICP) serial dilution

quality control limits not being met during sample analysis. The analytes most severely impacted by these conditions were antimony, lead, selenium, and thallium.

Groundwater
Ninety-nine percent of the groundwater data collected as part of the RI are suitable for their intended use. The remaining less than one percent should not be used for project decisions. The 90 percent completeness goal for usable data has been met. All rejected data were limited to pesticides, and primarily due to lack of compound identification.

Biota
Approximately three percent of the data were rejected and consisted of all metals due to not meeting laboratory duplicate and ICP serial dilution criteria. Ninety-seven percent of the RI data are suitable for their intended use.

3.2.2 Reporting Limits

One aspect of data quality critical to risk assessment is adequacy of reporting limits for chemical analyses. A comparison of reporting limits to the screening levels for chemicals not detected in the samples used in the risk assessment is conducted. The sample matrices evaluated included soil, groundwater, surface water, sediment, and fish/shellfish. These comparisons are presented in Tables H-1a through H-6e in Appendix H.

As shown in these tables, the reporting limits are consistent with the project plan except those noted in the *Data Quality Assessment Summary Report* (CDM 2011). Notably, reporting limits for many chemicals in groundwater, surface water, and fish/shellfish are above screening levels. Appropriate analytical methods, target screening criteria, and method detection limits for chemicals were chosen to meet project objectives as described in the QAPP (CDM 2010c). Data quality objectives and preferred project quantitation limit goals were provided to the laboratory prior to analysis of samples from the site to ensure that reporting limits do not exceed the respective screening criteria to the extent possible and were adequate for risk assessment purposes. However, reporting limits for some analytical results were higher than those values because of equipment limitations and/or interferences from sample moistures or high concentrations of other co-associated chemicals that necessitated sample dilution. Uncertainties associated with elevated reporting limits are discussed in Section 6.4.1.1.

3.3 Analytical Data Summary

The evaluation and summary of analytical results are based on those chemicals that were reported at concentrations higher than the reporting limit in one or more samples.

Statistical summaries, comprising the minimum and maximum detected concentrations and detection frequency for chemicals detected are presented by

medium in Appendix B Tables B-2.1a through B-2.6e. Statistical summaries for all chemicals analyzed are presented in Appendix I. Appendix A includes tables listing the samples used in the risk assessment. Analytical data results are summarized below.

3.3.1 Soil

VOCs, SVOCs, pesticides, PCBs, and metals were detected in both surface and subsurface soil at the site. Based on current and future land use, potential receptor behavior, and exposure pathways identified in Section 4, soil data are categorized into groups shown below. Tables B-2.1a through B-2.2 in Appendix B present statistical summaries of the analytical data for these groups.

- Area 1 surface soil (Table B-2.1a)
- Area 2 surface soil (Table B-2.1b)
- Areas 3 and 4 surface soil (Table B-2.1c)
- Areas 5, 6, and the beach area of Area 9 surface soil (Table B-2.1d)
- Upland area of Area 9 surface soil (Table B-2.1e)
- Surface soil of all areas, except Areas 2, 8, and 11 (Table B-2.1f)
- Surface soil of all areas, except Areas 8 and 11 (Table B-2.1g)
- Areas 8 and 11 surface soil (Table B-2.1e)
- All upland area surface/subsurface soil (Table B-2.2)

Analytical data results are summarized in Section 3.3.1.1 for surface soil (Table I-1i in Appendix I) and in Section 3.3.1.2 for upland area surface/subsurface soil (Table B-2.2 in Appendix B). Results of TRW lead composite samples are summarized in Section 3.3.1.3.

3.3.1.1 Surface Soil

A statistical summary of all chemicals analyzed in surface soil is provided in Table I-1i in Appendix I.

VOCs: Thirteen VOCs were detected in surface soils; the majority of which were detected in less than 1% of the surface soil samples. Acetone, a common laboratory contaminant, was the most frequently detected VOC in surface soil (38 of 260 samples or about 15%). 1,4-Dioxane was detected once (sample SS-77 in Area 3) and had the highest concentration (420 µg/kg).

SVOCs: Thirty-three SVOCs were detected in surface soil. Carcinogenic polycyclic aromatic hydrocarbons (cPAHs), including benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, were detected in surface soil. Benzo(b)fluoranthene was the most frequently detected SVOC (178 of 263 samples), followed by benzo(a)anthracene (171 of 263 samples) and benzo(a)pyrene (155 of 263 samples). Butylbenzylphthalate had the highest detected concentration (61,000 µg/kg in Area 9). The highest cPAH concentrations were found in the upland area of Area 9 (3,800 J µg/kg of chrysene

and 2,200 J µg/kg of benzo[a]pyrene). The "J" qualifier indicates an estimated concentration.

Pesticides: Eighteen pesticides were infrequently detected in surface soil. DDT was the most frequently detected pesticide (39 of 262 samples) and the one with the highest concentration (1,300 JN µg/kg). The "JN" qualifier indicates a tentatively identified value. Other frequently detected pesticides include gamma-chlordane (37 of 262 samples) and alpha-chlordane (26 of 262 samples).

PCBs: Aroclor 1254 and Aroclor 1260 were detected in surface soil. Aroclor 1254 was detected in 48 of 262 samples at a maximum concentration of 62,000 µg/kg (Area 9). Aroclor 1260 was detected in 3 of 262 samples at a maximum estimated concentration of 36 µg/kg.

Inorganics: Twenty-four metals were detected in surface soil. Most metals are naturally occurring; therefore, they are detected in the majority of samples, with the exception of silver, thallium, and tin. Among the site-related metals, lead was detected in 1,184 of 1,233 samples at concentrations ranging from 1.1 milligrams per kilogram (mg/kg) to 198,000 mg/kg. Arsenic was detected in 1,191 of 1,233 samples at concentrations ranging from 0.16 J mg/kg to 2,470 J mg/kg. Antimony was detected in 487 of 1,231 samples at concentrations ranging from 0.11 J mg/kg to 3,270 mg/kg. Chromium was detected in 1,224 of 1,230 samples at concentrations ranging from 0.96 J mg/kg to 3,500 mg/kg. Copper was detected in 1,196 of 1,234 samples at concentrations ranging from 0.44 J mg/kg to 4,630 mg/kg. Iron was also detected in all surface soil samples at concentrations ranging from 912 J mg/kg to 183,000 J mg/kg.

Slag samples from the west jetty in Area 8 contained the highest lead, arsenic, antimony, chromium, and copper concentrations. Besides slag samples, soil samples from Area 1, Area 2, and the upland area of Area 9 contained highly elevated lead, arsenic, and antimony concentrations. The highest lead concentrations were 47,700 J mg/kg in Area 1 (Table B-2.1a in Appendix B), 3,000 mg/kg in Area 2 (Table B-2.1b in Appendix B), and 10,200 J mg/kg in the upland area of Area 9 (Table B-2.1e in Appendix B). The highest arsenic concentrations were 760 J mg/kg in Area 1, 150 mg/kg in Area 2, and 594 mg/kg in the upland area of Area 9. The highest antimony concentrations were 2,390 mg/kg in Area 1, 190 mg/kg in Area 2, and 2,200 mg/kg in the upland area of Area 9.

3.3.1.2 Upland Area Surface/Subsurface Soil

A statistical summary of the analytical data for all upland area surface/subsurface soil is provided in Table B-2.2 in Appendix B.

VOCs: Ten VOCs were detected in surface/subsurface soil. Acetone was the most frequently detected (59 of 420 samples), followed by methylene chloride (12 of 420 samples), carbon disulfide (8 of 420 samples), and styrene (7 of 420 samples).

SVOCs: Thirty-five SVOCs were detected in surface/subsurface soil. All seven cPAHs were detected in soil at a maximum concentration of 3,800 J µg/kg (chrysene). Benzo(b)fluoranthene was the most frequently detected SVOC (265 of 423 samples), followed by benzo(a)anthracene (241 of 423 samples) and benzo(a)pyrene (222 of 423 samples). Butylbenzylphthalate had the highest detected concentration (61,000 µg/kg).

Pesticides: Nineteen pesticides were detected in surface/subsurface soil. Gamma-chlordane was the most frequently detected pesticide (51 of 422 samples), followed by DDT (45 of 422 samples) and alpha-chlordane (41 of 262 samples). The highest pesticide concentration was found in Area 9 (DDT at 1,300 JN µg/kg).

PCBs: Aroclor 1254 and Aroclor 1260 were detected in soil. Aroclor 1254 was detected in 58 of 422 samples with a maximum concentration of 62,000 µg/kg. Aroclor 1260 was detected in 4 of 422 samples with a maximum concentration of 46 µg/kg.

Inorganics: Twenty-four metals were detected in surface and subsurface soil. Thallium is the least detected metal (57 of 781 samples). Among the site-related metals, lead was detected in 837 of 860 samples at concentrations ranging from 1.7 J mg/kg to 40,000 mg/kg. Arsenic was detected in 829 of 858 samples at concentrations ranging from 0.13 J mg/*kg* to 2,100 J mg/kg. Antimony was detected in 385 of 858 samples at concentrations ranging from 0.061 mg/kg to 3,270 mg/kg. Chromium was detected in 855 of 858 samples at concentrations ranging from 0.76 J mg/kg to 230 mg/kg. Copper was detected in 833 of 858 samples at concentrations ranging from 0.46 J mg/kg to 4,950 J mg/kg. Iron was also detected in all soil samples at concentrations ranging from 912 J mg/kg to 154,000 mg/kg.

3.3.1.3 TRW Lead Composite Samples

TRW composite soil samples were collected from Areas 2, 3, 5, and 6. Lead was analyzed in TRW fine fraction soil samples (i.e., <250 µm). Tables B-2.1b, B-2.1c, and B-2.1d in Appendix B present statistical summaries of the analytical data for the TRW lead samples.

Area 2: Lead was detected in all samples at concentrations ranging from 25 to 8,800 mg/kg.

Area 3: Lead was detected in all samples at concentrations ranging from 21 to 27 mg/kg.

Areas 5 and 6: Lead was detected in all samples at concentrations ranging from 3.3 to 400 mg/kg.

3.3.2 Groundwater

Based on current and future land use, potential receptor behavior, and exposure

pathways identified in Section 4, groundwater data are categorized into the following groups:

- Areas 6, 8, and 9 where the groundwater table is less than 10 feet bgs (Table B-2.3a)
- All areas (Table B-2.3b)

Tables B-2.3a and B-2.3b in Appendix B present statistical summaries of the analytical data for these groups. Chemicals detected in groundwater (Table B-2.3b in Appendix B) are summarized below.

VOCs: Methyl tert-butyl ether and tetrachloroethene (PCE) were detected in groundwater in 5 of 20 samples.

SVOCs: Fourteen SVOCs were infrequently detected in groundwater. One cPAH, benzo(a)anthracene was detected in 1 of 20 samples at a concentration of 0.17 micrograms per liter (µg/L). bis(2-Ethylhexyl)phthalate was the most frequently detected SVOC (3 of 20 samples).

Pesticides: Three pesticides were infrequently detected in groundwater**.** Gamma-chlordane was detected in 2 of 20 samples while alpha-chlordane and heptachlor epoxide were detected in 1 of 20 samples.

PCBs: PCBs were not detected in groundwater.

Inorganics: Twenty-two metals were detected in groundwater samples. Among the site-related metals, lead was detected in 19 of 20 samples at concentrations ranging from 0.4 J µg/L to 107 µg/L. Arsenic was detected in all samples at concentrations ranging from 0.45 µg/L to 6.8 J µg/L. Antimony was detected in 13 of 20 samples at concentrations ranging from 0.036 J µg/L to 5.4 µg/L. Chromium was detected in 19 of 20 samples at concentrations ranging from 0.76 J µg/L to 27.3 µg/L. Copper was detected in all samples at concentrations ranging from 0.63 J µg/L to 271 µg/L. Additionally, elevated levels of iron (up to 372,000 µg/L) and cobalt (up to 40.1 J µg/L) were found in groundwater in the upland area of Area 9.

3.3.3 Surface Water

Surface water samples are categorized into two groups as shown below.

- Raritan Bay – including Raritan Bay, Cheesequake Creek Inlet, and Margaret's Creek (Table B-2.4a)
- Wetland Areas in Area 9 (Table B-2.4b)

Tables B-2.4a and B-2.4b in Appendix B present statistical summaries of the analytical data for surface water. VOCs, SVOCs, and metals were detected in surface water. Analytical data results are summarized below.

3.3.3.1 Raritan Bay

VOCs: Five VOCs were detected in surface water. Toluene and m,p-xylene were the most frequently detected (4 of 15 samples), followed by methylene chloride and o-xylene (2 of 15 samples), and ethylbenzene (1 of 15 samples).

SVOCs: Three cPAHs, benzo(a)anthracene, benzo(b)fluoranthene, and chrysene, were detected once in surface water at an estimated maximum concentration of 0.067 µg/L (chrysene).

Inorganics: Twenty-two metals were detected in unfiltered surface water samples. Among the site-related metals, lead was detected in 40 of 139 samples at concentrations ranging from 5.8 J µg/L to 1,580 µg/L. Arsenic was detected in 31 of 139 samples at concentrations ranging from 1.9 J µg/L to 70.9 µg/L. Antimony was detected in 19 of 139 samples at concentrations ranging from 1.6 J µg/L to 53.2 J µg/L. Chromium was detected in 25 of 139 samples at concentrations ranging from 2.1 J µg/L to 28.9 J µg/L. Copper was detected in 38 of 139 samples at concentrations ranging from 4 J µg/L to 154 J µg/L. Iron was also detected in 49 of 117 samples at concentrations ranging from 345 J µg/L to 74,400 µg/L.

3.3.3.2 Wetland Areas of Area 9

VOCs: Chloroform was detected in 1 of 18 samples at an estimated concentration of 0.46 µg/L.

SVOCs: Four SVOCs, benzo(a)anthracene, bis(2-ethylhexyl)phthalate, 3,3-dichlorobenzidine, and pentachlorophenol, were each detected once of 17 samples.

Inorganics: Nineteen metals were detected in surface water. Among the site-related metals, lead was detected in 2 of 15 samples at concentrations ranging from 2.2 µg/L to 23.2 µg/L. Arsenic was detected in 2 of 15 samples at concentrations ranging from 0.44 µg/L to 2.1 µg/L. Chromium and copper were detected once at an estimated concentration of 2 µg/L and 1.1 µg/L, respectively. Iron was also detected in 10 of 15 samples at concentrations ranging from 501 µg/L to 21,100 µg/L.

3.3.4 Sediment

Based on current and future land use, potential receptor behavior, and exposure pathways identified in Section 4, sediment data are categorized into the following four groups:

- Area 1 (Table B-2.5a)
- Area 2 (Table B-2.5b)
- Areas 5, 6, and the beach area of Area 9 (Table B-2.5c)
- Wetland area of Area 9 (Table B-2.5d)

Tables B-2.5a through B-2.5d in Appendix B present statistical summaries of the

analytical data for these groups. Analytical data results are summarized below for Raritan Bay (including Area 1, Area 2, Areas 5, 6, and the beach area of Area 9) and wetland areas of Area 9.

3.3.4.1 Raritan Bay

A statistical summary of the analytical data for Area 1 sediment is provided in Table I-5e in Appendix I.

VOCs: Three VOCs were detected in sediment. Carbon disulfide was detected in 4 of 14 samples. Acetone was detected in 3 of 14 samples. 2-Butanone was detected once.

SVOCs: Twenty-one SVOCs were detected in sediment. Six cPAHs, including benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene, were detected in sediment. Benzo(a)anthracene was the most frequently detected SVOC (10 of 14 samples), followed by benzo(a)pyrene, benzaldehyde, bis(2-ethylhexyl)phthalate, and chrysene (7 of 14 samples).

Pesticides: Seven pesticides were detected in sediment. DDE is the most detected pesticide (3 of 14 samples), followed by endrin ketone (2 of 14 samples).

PCBs: Aroclor 1254 was detected twice out of 14 samples.

Inorganics: Twenty-three metals were detected in sediment. Silver and thallium were the least detected metals (13 of 101 and 5 of 101 samples, respectively). Among the site-related metals, lead was detected in 83 of 101 samples at concentrations ranging from 7.4 mg/kg to 52.9 mg/kg. Arsenic was detected in 85 of 101 samples at concentrations ranging from 0.66 J mg/kg to 40.2 J mg/kg. Antimony was detected in 18 of 101 samples at concentrations ranging from 0.63 J mg/kg to 3.1 mg/kg. Chromium was detected in 86 of 101 samples at concentrations ranging from 2.5 mg/kg to 36.5 mg/kg. Copper was detected in 86 of 101 samples at concentrations ranging from 1.1 J mg/kg to 35 J mg/kg. Iron was also detected in 85 of 96 samples at concentrations ranging from 2,000 mg/kg to 36,800 mg/kg.

3.3.4.2 Wetland Area of Area 9

A statistical summary of the analytical data for sediment samples collected from wetland areas of Area 9 is provided in Table B-2.5d in Appendix B.

VOCs: Four VOCs were detected in sediment. Acetone and carbon disulfide were the most frequently detected VOCs (9 of 38 samples).

SVOCs: Twenty-one SVOCs were detected in sediment. All cPAHs were detected in sediment. Benzo(a)pyrene, benzo(a)anthracene, and chrysene were the most frequently detected SVOCs (35 of 38 samples).

Pesticides: Four pesticides were detected in sediment. Alpha-chlordane was detected twice, and dieldrin, gamma-chlordane, and methoxychlor were detected once out of 38 sediment samples.

PCBs: Aroclor 1254 was detected in 2 of 38 samples at a maximum concentration of 19 µg/kg.

Inorganics: Twenty-three metals were detected in sediment. Among the site-related metals, lead was detected in all samples at concentrations ranging from 2.9 mg/kg to 564 mg/kg. Arsenic was detected in all samples at concentrations ranging from 3.7 mg/kg to 88.9 mg/kg. Antimony was detected in 3 of 40 samples at concentrations ranging from 0.72 J mg/kg to 10.9 mg/kg. Chromium was detected in all samples at concentrations ranging from 8.3 mg/kg to 59.7 mg/kg. Copper was detected in all samples at concentrations ranging from 3 J mg/kg to 1,790 mg/kg. Iron was also detected in all samples at concentrations ranging from 9,940 J mg/kg to 89,700 mg/kg.

3.3.5 Biota

Biota samples were analyzed for TAL metals including mercury and percent of lipids. Tables B-2.6a to B-2.6.e in Appendix B present statistical summaries of the analytical data for fish/shellfish. Analytical results for biota are expressed on a wet weight basis. Fish and shellfish are assumed to be prepared for consumption via broiling, baking or frying over such methods as drying or smoking to represent the consumption habits of majority of the potentially exposed populations.

Fish

A statistical summary of the analytical data for fish tissue is provided in Table B-2.6a. Nine metals were detected in fish tissue samples. Arsenic and mercury were detected in all samples. Chromium was detected in all but one sample. Zinc was detected in 3 of 6 samples; lead was detected in 2 of 6 samples; aluminum and manganese were detected in 1 of 6 samples. The winter flounder sample (FT-1) contained the highest concentrations of arsenic (0.68 mg/kg) and lead (0.046 J mg/kg).

Hard Clam

A statistical summary of the analytical data for hard clam tissue is provided in Table B-2.6b. As mentioned in Section 3.1.5, three samples were collected by EPA/ERT (2010) and two samples were collected by CDM during the RI. Aluminum, calcium, iron, magnesium, potassium, and sodium were only analyzed in the clam tissue samples collected during the RI.

Nineteen metals were detected in clam tissue samples. Iron was detected in the two samples collected during the RI. Copper, lead, manganese, and zinc were detected in all 5 samples collected by EPA/ERT and during the RI. Arsenic was detected in 4 of 5

samples. Barium, cadmium, chromium, cobalt, nickel, selenium, and silver were detected in 3 of 5 samples. A hard clam sample collected in Area 1 (sample MER-3) contained the highest arsenic (1.6 mg/kg wet weight) tissue concentration while a sample collected in Area 2 (samples ML-2A) contained the highest lead tissue concentration (3.8 mg/kg wet weight).

Ribbed Mussel

A statistical summary of the analytical data for ribbed mussel tissue is provided in Table B-2.6c. As mentioned in Section 3.1.5, six samples were collected by EPA/ERT (2010) and four samples were collected by CDM during the RI. Aluminum, calcium, iron, magnesium, potassium, and sodium were only analyzed in the ribbed mussel tissue samples collected during the RI.

Twenty metals were detected in ribbed mussel tissue samples. Iron was detected in all four samples collected during the RI. Copper, lead, manganese, and zinc were detected in all 10 samples. Arsenic, barium, cadmium, chromium, cobalt, nickel, selenium, and silver were detected in 6 of 10 samples. Antimony was detected in 3 of 10 samples. A ribbed mussel sample collected in Area 1 (sample RM-6) contained the highest arsenic (0.89 mg/kg wet weight) and lead (0.81 mg/kg wet weight) tissue concentrations.

Blue Crab

A statistical summary of the analytical data is provided in Table B-2.6d for blue crab muscle tissue and Table B-2.6e for combined muscle tissue and hepatopancreas. Ten composite blue crab samples were collected from Areas 1, 6, and 8. Five samples consisted of muscle tissue and five samples consisted of hepatopancreas.

Sixteen metals were detected in crab muscle tissue samples. Aluminum, arsenic, copper, iron, manganese, silver, and zinc were detected in all samples. Lead and mercury were detected in all but one sample. Chromium was detected in 3 of 5 samples. Beryllium and nickel were only detected in 1 of 5 samples.

Data from hepatopancreas composite samples are mathematically combined with data from composite muscle tissue samples to form composite samples of combined muscle tissue plus hepatopancreas. Weighted average combined muscle tissue plus hepatopancreas crab concentrations are calculated using the following formula:

$$C = C_{hp} \times \frac{WT_{hp}}{WT} + C_t \times \frac{WT_t}{WT} \qquad (3-1)$$

where:

C = chemical concentration in combined muscle tissue plus hepatopancreas, mg/kg

C_{hp} = chemical concentration in hepatopancreas, mg/kg
WT_{hp} = weight of hepatopancreas, gram
WT = weight of muscle tissue plus hepatopancreas, gram
C_t = chemical concentration in muscle tissue, mg/kg
WT_t = weight of muscle tissue, gram

Results for combined muscle tissue and hepatopancreas are presented in Table B-2.6e in Appendix B and summarized below.

In addition to the 16 metals detected in crab muscle tissues, cadmium, cobalt, and vanadium were detected in the combined muscle tissue and hepatopancreas samples. Aluminum, arsenic, copper, iron, manganese, silver, and zinc were detected in all samples. Cadmium, chromium, lead, and mercury were detected in all but one sample. Cobalt was detected in 3 of 5 samples. Nickel detected in 2 of 5 samples. Beryllium and vanadium were detected once.

3.3.6 Bioavailability and Speciation Study Results

Results for the *in vitro* bioavailability study are summarized in Table 3-1. The *Bioavailability and Speciation Study Report* is provided in Appendix D. Key study findings and results are summarized below.

Bioavailability of lead and arsenic varies widely among different samples, both within and across each area. The RBA results for lead in site soils range from 12% to 84% and average about 56%. The EMPA study reveals that lead is mainly associated with iron oxyhydroxide, which is expected to be moderately bioavailable.

The site-specific average RBA for lead is 56%, similar to the EPA default value of 60% (EPA 2009c and 2010d). However, soils containing greater than 1,000 mg/kg of lead had a RBA of 84%, much higher than the EPA default value of 60%. The microprobe analyses revealed that most lead in these samples is present in relative soluble forms associated with cerussite and anglesite. The particles are either cemented (18% to 56%) or liberated (18% to 46%), with over 60% of the particles being less than 10 µm in diameter. The combination of these characteristics results in a higher lead bioavailability than the EPA default value of 60%. This suggests that lead associated with battery casings or other wastes may be much more readily absorbed into the human body than is typically assumed for lead in soil. For practicality and conservatism, a RBA of 84% is recommended for the TRW lead data (i.e., <250 µm in TRW composite samples). For lead in total soil samples, the EPA default RBA value of 60% is recommended. Since fully soluble lead is only about 50% absorbed, and since absolute bioavailability is used in lead models, relative bioavailability is corrected to absolute.

In vitro bioaccessibility for arsenic is highly variable, ranging from 0.3% to 63%, with an average of 14%. The majority of the arsenic mass was consistently found in iron oxyhydroxide. Based on site data, the iron oxyhydroxides have relatively low

solubility in acidic conditions and thus are much less bioavailable. For conservatism, the EPA default RBA value of 60% is used for arsenic (EPA 2011f). For this assessment, it is assumed that relative and absolute bioavailabilities of arsenic are about the same because soluble arsenic is essentially completely absorbed from the gut. Thus unmodified estimates are used.

The EMPA study indicates that slag is rarely present in the fine fraction soil particles. Only four slag particles were observed out of 2,135 particles examined, or 0.2%. Even though slag is the predominant source of lead and arsenic at the site, it does not appear to disintegrate into fine particles (<250 µm) to the extent to influence bioaccessability of lead and arsenic. High concentrations of lead and arsenic in the fine fraction soils are most likely associated with battery casings or other wastes, such as clay molds used in the smelting process.

3.4 Identification of Chemicals of Potential Concern

Many chemicals have been detected in soil, groundwater, surface water, sediment, and biota from samples collected at the site. Screening of analytical data is conducted to identify COPCs to be further evaluated in the risk assessment. Screening helps to focus the assessment on chemicals that could pose a human health risk.

The screening levels are based on Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (EPA 2010a)[1]. Residential RSLs for soil are used as screening levels for soil and sediment, while tap water RSLs are used as screening levels for surface water and groundwater. RSLs for fish tissue developed by EPA Region 3 are used as screening levels for fish tissue, crab, clam, and mussel. To account for exposure to multiple chemicals, RSLs for chemicals based on noncancer health effects are decreased by a factor of 10 to account for a target hazard quotient (HQ) of 0.1.

Risk-based RSLs are not available for many chemicals. Based on similarities in chemical structure and physiological activities, surrogate screening levels are used as listed below.

- Chlordane for alpha-chlordane and gamma-chlordane
- Endosulfan for endosulfan II and endosulfan sulfate
- m-Xylene for m,p-xylene
- Acenaphthene for acenaphthylene
- Pyrene for benzo(g,h,i)perylene
- Anthracene for phenanthrene
- Hexachlorocyclohexane for delta- hexachlorocyclohexane
- Endosulfan for endosulfan I, endosulfan II and endosulfan sulfate

[1] Although a more recent version of RSL (EPA 2011e) was available at the time of preparing the HHRA, use of a previous version of RSL (November 2010) results in more conservative screening levels for surface water and sediment.

- Endrin for endrin aldehyde and endrin ketone

Screening levels and appropriate surrogates are not available for carbazole, di-n-octyl phthalate, and thallium. These chemicals are qualitatively evaluated in the Uncertainty Section (Section 6.4.3).

Risks from exposure to lead are not quantified following the exposure models for other COPCs. EPA considers lead to be a special case because of the difficulty in identifying the "threshold". Health risks from lead are evaluated based on blood lead concentration, which can be modeled using the Integrated Exposure Uptake Biokinetic (IEUBK) Model or the Adult Lead Model (ALM). The screening levels for lead for residential and industrial soil are 400 and 800 mg/kg, respectively, based on the OSWER Directive 9355.4-12 (EPA 1994). For groundwater, the screening level is 5 µg/L, based on the Ground Water Quality Standard Class IIA (New Jersey Administrative Code [N.J.A.C.] 7:9C). The screening level for lead in surface water is 5 µg/L, based on the fresh water criterion for lead for human health (N.J.A.C. 7:9B).

A screening level for lead in fish is developed specifically by EPA Region 2 for the site. The average dietary intake of lead in children is estimated between 2 and 7 micrograms per day (µg/day) (Pennington 1983; EPA 1994). EPA is concerned when lead from a single food source has the potential to exceed the total dietary intake. Using an EPA (2011b) recommended fish ingestion rate (IR) for recreational fishers of 54 g/day and adjusting for the young child by applying a regionally accepted factor of 1/3, results in a fish IR of 18 g/day. Using the most conservative dietary intake of 2 µg /day (the current IEUBK model default) and a fish IR of 18 g/day, a screening level for lead in fish is calculated as follows:

$$Screening\ Level\ in\ Fish = \frac{Intake}{IR} = \frac{2\mu g/day}{18 g/day} = 0.111\mu g/g \approx 100\mu g/kg \qquad (3-2)$$

This screening level (100 µg/kg) is used for all fish/shellfish data, assuming the same ingestion rate and dietary intake.

The maximum detected concentrations are compared to screening levels to identify COPCs. Chemicals are considered COPCs if the maximum detected concentration exceeds the respective screening level. Group A carcinogens (i.e., known human carcinogen) are retained as COPCs even when they are present at the site at concentrations below their respective screening levels. Calcium, magnesium, potassium, and sodium are essential nutrients and are not evaluated as COPCs in health risk assessments. Detection frequency and chemical toxicity are also considered in the identification of COPCs. If a chemical is detected in 5 percent or less of the samples in a data set having at least 20 samples, is not detected in other media, and is not site-related, then the chemical is only considered a COPC if it is a

Group A carcinogen. The decision process for identifying COPCs is provided in Tables B-2.1a through B-2.6e in Appendix B.

COPCs identified for further quantitative evaluation in the HHRA are summarized in Table 3-2 and listed below.

- VOCs: chloroform and tetrachloroethene
- SVOCs: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, dibenzofuran, indeno(1,2,3-cd)pyrene, naphthalene, and pentachlorophenol
- PCB: Aroclor 1254
- Metals: aluminum, antimony, arsenic, cadmium, chromium VI, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium, and zinc

Section 4
Exposure Assessment

As a component of the HHRA, the exposure assessment strives to predict human exposure to COPCs in affected media at the site and in the vicinity. The exposure assessment describes exposure scenarios in which people may come into contact with site-related COPCs, provides equations and parameters to quantify exposure, and summarizes methods for evaluating exposure to lead. Results of the exposure assessment are integrated with chemical-specific toxicity information to characterize potential risks.

4.1 Exposure Pathways

Potential exposure pathways for the site are defined based on current and potential future uses of the site. Each potential pathway is evaluated considering site-specific conditions to determine if the pathway could be present. The area demography and land use characteristics are taken into consideration when the pathways are developed. If a pathway between the source of contamination and a human receptor could potentially be complete, it is retained for further evaluation.

4.1.1 Conceptual Site Model

Contamination at the site is related to the placement of slag along Raritan Bay and the disposal of smelter wastes at the site. Over the years, the slag and smelter wastes have been undergoing weathering and lead, arsenic, antimony, chromium, and copper, among other metals including iron, have been released into the soil, surface water, and sediment. People recreating, working or living at or adjacent to the site may be exposed to contaminants in soil, surface water, sediment, and biota. A CSM, illustrating how chemicals may move from historical release points to locations where human exposure may occur, is developed to provide a roadmap to these possible exposures. The CSM is presented in Figure 4-1 for a current land use scenario and in Figure 4-2 for a future land use scenario. The CSMs are described in detail in the following sections.

Approximately 40 years ago, slag from a secondary lead smelter was used to construct a seawall along Raritan Bay and to augment a jetty on the western side of the Cheesequake Creek Inlet. In the secondary lead smelter process, lead-acid batteries and other lead-containing material were melted in a smelter kettle. The valuable metals were skimmed from the top, and the residue on the bottom, the slag, formed a hard material when cooled. The dense rock-like properties of the slag made it an attractive material to use for seawall and jetty construction. In addition, slag and smelter waste materials, including lead-acid battery casings, were disposed in the Margaret's Creek upland and wetland areas.

In the decades since the placement of the slag, the slag and waste materials have been undergoing weathering. The unstable phases in the slag and waste materials may be the first to breakdown during weathering. Air, water, and saltwater penetrated the slag and waste structure, facilitating further weathering and the release of lead,

arsenic, antimony, chromium, and copper, among other metals including iron, into the soil, groundwater, surface water, and sediment, and uptake by fish and shellfish.

4.1.2 Identification of Exposure Pathways

As defined in RAGS Part A (EPA 1989), an exposure pathway is composed of the following elements:

- A source and mechanism of chemical release to the environment
- An environmental transport medium (e.g., soil) for the released chemical and/or mechanism to transfer the chemical from one medium to another
- A point of potential contact by humans with the contaminated medium
- A route of exposure (i.e., ingestion, inhalation, or dermal contact)

In the risk assessment, pathways are identified for the No Action alternative to evaluate risk if no site remediation occurs. This assessment also assumes that no additional restrictions to site access or use exist.

As depicted in the CSMs (Figures 4-1 and 4-2), release and transport of contaminants from slag and wastes might affect soil, groundwater, surface water, sediment, and fish and shellfish at the site. There are three general routes through which individuals could potentially be exposed to chemical contamination in these media: ingestion, inhalation, and dermal contact.

The potential pathways for exposure associated with these media for people living, working, and recreating in the area under both current and potential future land-use conditions are also illustrated in the CSMs. An identified pathway does not imply that exposure is actually occurring, only that the potential exists. For the HHRA, estimated risks are calculated for complete pathways and not incomplete pathways.

4.1.2.1 Soil Exposure Pathways

Metals such as lead, arsenic, antimony, chromium, and copper have been detected in soil at the site at elevated concentrations. It is most likely these chemicals are released from slag and smelter wastes into soil. People visiting or working at or adjacent to the site could come into contact with contaminants in soil. Routes of exposure include incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil.

4.1.2.2 Groundwater Exposure Pathways

The Old Bridge and Sayreville neighborhoods of Laurence Harbor are currently supplied with potable water from the municipal water supply system. Groundwater at the site is classified as Class IIA, but is not used as a potable drinking water supply because of high salinity (e.g., 0.45% in MW-12S). Future development of the groundwater resource at the site is unlikely; however, in theory, potable water wells could be installed in the future. Future residents could hypothetically be exposed to

groundwater via domestic uses. Routes of exposure include ingestion of and dermal contact with water and inhalation of vapors during showing/bathing.

4.1.2.3 Surface Water and Sediment Exposure Pathways

Contaminants at the site have been transported to Raritan Bay and wetlands in Area 9 via weathering, including disintegration of slag and smelter wastes, runoff, mixing, and deposition. People visiting Raritan Bay and wetlands in Area 9 may be exposed to contaminants in surface water and sediment. Routes of exposure include incidental ingestion of and dermal contact with surface water and sediment.

4.1.2.4 Biota Pathways

Fish and shellfish at the site may have been impacted with site-related contaminants. People who catch and eat fish and shellfish from the site may be exposed to contaminants through consumption; this also applies to people who share in the consumption of the catch including young children. The route of exposure is ingestion of fish and shellfish.

4.2 Characterization of Potentially Exposed Populations

The portion of the site in Laurence Harbor is part of Old Bridge Waterfront Park. The park includes walking paths, a playground area, several public beaches, and three jetties, not including the two jetties at the Cheesequake Creek Inlet. The seawall, jetties, beach area east of the Cheesequake Creek Inlet, and the western jetty at the Cheesequake Creek Inlet are popular fishing areas. The beaches in Areas 5 and 6 are the most popular for swimming.

Public access to the Area 1 seawall is currently restricted by a fence and public health hazard warning signs are posted; however, recreational users can access the beach from the east (Area 9) and by boat from Raritan Bay. Public access to the Area 2 beach is also restricted, with the exception of a small portion of the beach adjacent to the sidewalk. However, trespassing in Area 2 may occur. Upland access to Areas 8 and 11 is restricted by a perimeter fence; however, access can be obtained to the west from Shoreland Circle. Public access to Margaret's Creek (Area 9) is restricted by a perimeter fence along Route 35, although access could be gained through the beach area and possibly through the bordering residential properties.

Middlesex County Utilities Authority operates two pumping stations at the site, one at the eastern end (Area 9) and one at the western end (Area 11). A major sewer line connecting the two pumping stations runs across the site along the shoreline of Raritan Bay. An additional sewer line runs across the Margaret's Creek upland area between Route 35 and the beach area.

Based on current and future land uses, potentially exposed populations include recreational users, pedestrians, anglers, trespassers, outdoor workers, construction/utility workers, and residents. Not all of these populations are expected

to be present in all of the areas. The following subsections detail the potential exposure pathways identified for each potentially exposed population based on land use and potential receptor behavior.

4.2.1 Current Receptors

Based on current land uses and identified potential exposure pathways, likely current receptors at the site are identified as follows:

- Recreational users in Areas 1, 3 through 6, and 9
- Anglers throughout the site except Areas 3 and 4
- Pedestrians throughout the site except Areas 2, 8, and 11
- Trespassers in Areas 2, 8, and 11
- Outdoor workers in Areas 3 and 4
- Construction/utility workers throughout the site

4.2.1.1 Recreational Users

Recreational users are defined as those individuals who visit the waterfront park, playground, and Margaret's Creek. They may come into contact with contaminants in surface soil, surface water, and sediment during beach play, water recreation, walking, or playing. Not all of these populations are expected to be present in all of the areas. The following subsections detail the potential receptors identified for each area.

Area 1

As stated earlier, access to the area is currently restricted by a fence. In addition, the shoreline along Area 1 is lined with slag and is steep and difficult to negotiate. No actual beach areas exist at high tide, but a beach is exposed during low tide, especially at the eastern end. While young children could visit Area 1, such visits would probably be rare because access to Area 1 is improbable for young children under six years old without adult supervision. Therefore, a child scenario is not evaluated.

The possibility exists that adolescents (6 to 18 years old) and adults could be present in Area 1. They are selected as potential receptors for a recreational user scenario. Exposure parameters for recreational users are described in Section 4.5.

Areas 3 and 4

Area 3 is a playground adjacent to the western end of the seawall. Area 4 is a park area along the seawall with a paved walking path/bikeway. The Old Bridge Township Recreation Center is located at the foot of Laurence Parkway, southeast of Area 3. The Recreation Center building has been primarily used for numerous children's programs and as a meeting place for adult groups from the township. The Recreation Center has held summer camp at the Recreation Center building for children ages 6 to 13 years old. The summer camp is generally held from 9 am to 1 pm for five days per week for a total of four weeks in July.

People visiting the playground and children attending the summer camp at the Recreation Center may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from surface soil. While children of all ages are likely to be present at the playground, young children (0 to 6 years old) generally have higher relative soil intake rates when compared to older children. The young child exposure scenario provides a conservative basis for evaluating potential exposures to older children. Adults may accompany young children to the playground. Adolescents (6 to 18 years old) attending the summer camp in the Recreation Center building may play in Areas 3 and 4 for prolonged hours in July. Thus, young children, adults, and adolescents are selected as potential receptors. Exposure parameters are described in Section 4.5.

Areas 5, 6, and the Beach Area of Area 9

Areas 5, 6, and the beach area of Area 9 are comprised of beaches between Cheesequake Creek and Margaret's Creek. The public beaches in these three areas are popular for swimming, beach playing, walking, and other recreational activities. People may come into contact with contaminants in surface soil, surface water, and sediment while visiting the beaches. Routes of potential exposure include incidental ingestion of and dermal contact with soil, surface water, and sediment, and inhalation of particulates released from surface soil.

Incidental ingestion of soils may occur via hand to mouth activities. This pathway may be significant, especially for young children (0 to 6 years old) who tend to ingest larger quantities of soil during beach play. Because young children generally have a higher incidental soil intake rate and a lower body weight when compared to older children, children under six years old are selected as potential receptors for a recreational user scenario in these beach areas. The young child exposure scenario provides a conservative basis for evaluating potential exposures to older children. Adults are also selected as potential receptors. They may accompany young children to the beaches. They also serve to represent health-protective estimates of the risk to other adults who live in homes bordering the site, volunteers and public-sector workers responsible for habitat restoration within intertidal areas, and individuals who may access intertidal areas by passing through private property boundaries. Exposure parameters for recreational users are described in Section 4.5.

Upland Area of Area 9

Margaret's Creek is comprised of wetlands and upland areas between Raritan Bay and Route 35. Access to the upland and wetland is restricted by a perimeter fence along Route 35. Although Margaret's Creek is a remote location not normally frequented by people, recreational visitors could gain access to the upland areas through the beach area and possibly through the bordering residential properties. Access to the wetlands through private residential properties or upland areas is limited by overgrown dense stands of common reed (*Phragmites australis*), which forms dense impenetrable stands throughout the wetlands. Direct exposure to

surface water and sediment in the wetlands is unlikely; however, in theory, recreational users could gain access to the wetlands.

Recreational users visiting the area may be exposed to contaminants in surface soil, surface water, and sediment. Routes of potential exposure include incidental ingestion of and dermal contact with surface soil, surface water, and sediment, and inhalation of particulates released from surface soil.

Adults and adolescents (6 to 18 years old) are selected as potential receptors. Potential exposure for recreational users to soil is examined using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.1.2 Pedestrians

The pedestrian population is defined as those individuals who walk at or adjacent to the site on a frequent basis. It is likely that walking occurs both on the walking path and on the beach areas (e.g., Areas 5, 6, and the beach area of Area 9). Walking may also commonly occur in the upland area of Area 9. While walking, pedestrians may be exposed to contaminants in surface soil in these areas. Routes of potential exposure include incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust.

Adults and adolescents (6 to 18 years old) are selected as potential receptors. Potential exposure to COPCs in soil for pedestrians is examined using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.1.3 Anglers

The angler population is defined as those individuals who catch and/or consume fish and shellfish caught from the site. Fish and shellfish could be impacted with site-related chemicals. The NJDEP Fish Consumption Advisory (2009) suggests that people limit consumption of American lobster, weakfish, striped bass, winter flounder, porgy, American eel, summer flounder, white perch, and blue crab from the Raritan Bay Complex to at or below recommended quantities. In spite of the existing consumption advisory, it is likely that some people may consume fish and shellfish from the site. Young children generally have higher fish/shellfish intake rates per body weight when compared to older children. Thus, the angler scenario assesses exposure to adult anglers and young children (0 to 6 years old) who may consume fish and shellfish caught at the site by anglers. These receptors are considered family members of anglers and as a separate subpopulation. Anglers are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.1.4 Trespassers

The beach at Area 2 was completely closed to restrict public access and public health hazard warning signs were posted. In August 2010, EPA conducted soil sampling in Area 2 to determine where and if the fence could be moved. Results of the soil sampling indicated that elevated lead levels exist on the beach. However, soils in a portion of the beach adjacent to the sidewalk contained lead concentrations below the EPA screening level of 400 mg/kg for residential soil.

New Jersey Department of Health and Senior Services (2010) recommended that this portion of the beach could be open. In April 2011, the fence was moved closer to Raritan Bay to extend access beyond the sidewalk to a small portion of the beach. The majority of the Area 2 beach remains closed with public health hazard signs warning no swimming, no sunbathing, and no fishing. Since the portion of the beach accessible to the public is not impacted with lead contamination and the portion with contamination is closed, potential exposure pathways in Area 2 are currently incomplete for recreational purposes. However, the possibility exists that trespassers could trespass the restricted area.

Areas 8 and 11 are currently vacant. Unauthorized access to these areas is restricted. However, trespassers could gain access to part or all areas of Areas 8 and 11. When trespassing, these individuals may be exposed to contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust. The primary exposure pathways for the trespasser scenario are direct contact with intertidal soils. While direct contact with surface water and sediment may occur, intake rates (e.g., exposure frequency, ingestion rate) of this contact during trespassing is likely to be low when compared to those with intertidal soil. The greater direct contact risk to human health is expected from contact with soils, not surface water and sediment. Soils are more readily accessible and are in closer contact with slag materials. Furthermore, a future recreational user scenario has been characterized for Area 2. Recreational users are assumed to be more frequently exposed and have higher intake rates when compared to trespassers. The recreational user exposure scenario provides a conservative basis for evaluating potential exposures to trespassers. Therefore, direct contact with surface water and sediment contact is not quantitatively evaluated for the trespasser scenario.

Adults and adolescent trespassers between 6 and 18 years in age are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.1.5 Outdoor Workers

Area 3 is a playground and Area 4 is a park area with a paved walking path/bikeway, all part of the Old Bridge Waterfront Park. Current outdoor workers could come into contact with surface soil while engaging in outdoor activities such as landscaping and maintenance operations in Areas 3 and 4. Routes of exposure

include incidental ingestion of and dermal contact with soil, and inhalation of particulates released from surface soil. Outdoor workers are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.1.6 Construction/Utility Workers

Middlesex County Utilities Authority operates two pumping stations at the site, one at the eastern end (Area 9) and one at the western end (Area 11). A major sewer line connecting the two pumping stations runs across the site along the shoreline of Raritan Bay. An additional sewer line runs across the Margaret's Creek upland area between Route 35 and the beach area.

Construction/utility workers engaging in repair and construction activities along sewer lines could have short-term, high intensity exposure to contaminants in soil. Construction/utility workers may encounter shallow groundwater at upland areas of Areas 6, 8, and 9 where the depth to groundwater is 10 feet or less.

Routes of exposure include incidental ingestion of and dermal contact with soil and groundwater, and inhalation of particulates released from surface and subsurface soil. Construction/utility workers are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.

4.2.2 Future Receptors

It is assumed that future land use at the site will remain the same with the exception of Areas 1 and 2. Areas 1 and 2 may be open to the public in the future. In addition, it is also assumed that the groundwater at the site may be used as drinking water in the future. Thus, future receptors for the site include recreational users, pedestrians, anglers, trespassers, outdoor workers, construction/utility workers, and residents.

Based on anticipated future land uses and identified potential exposure pathways, likely future receptors at the site are identified as follows:

- Recreational users in Areas 1 through 6, and 9
- Pedestrians throughout the site except Areas 8 and 11
- Anglers throughout the site except Areas 3 and 4
- Trespassers in Areas 8 and 11
- Outdoor workers in Areas 3 and 4
- Construction/utility workers throughout the site
- Residents throughout the site (domestic use of groundwater only)

4.2.2.1 Recreational Users

Area 1

Area 1 may be open to the public in the future. As mentioned earlier, the shoreline along Area 1 is lined with slag and is steep and difficult to negotiate. No actual beach areas exist at high tide, but a beach is exposed during low tide, especially at the

eastern end. Access to Area 1 is improbable for young children under six years old without adult supervision. Therefore, direct contact to contaminants in this area by young children is not likely.

Adolescents (6 to 18 years old) and adults are more likely to be present in Area 1. They are selected as potential receptors for a recreational user scenario in Area 1. Exposure parameters for recreational users are described in Section 4.5.

Areas 3 and 4
People visiting the playground and children attending the summer camp at the Recreation Center may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from surface soil.

While children and adults are likely to be present at the playground, young children (0 to 6 years old) generally have higher relative soil intake rates when compared to older children. The young child exposure scenario provides a conservative basis for evaluating potential exposures to older children. Adults may accompany young children to the playground. Adolescents (6 to 18 years old) may attend summer camp in the Recreation Center building and play in Areas 3 and 4 in July. Young children, adolescents, and adults are selected as potential receptors. Exposure parameters for child, adolescent, and adult recreation users are described in Section 4.5.

Areas 2, 5, 6, and the Beach Area of Area 9
Area 2 may be open to the public in the future. People may come into contact with contaminants in surface soil, surface water, and sediment while visiting the public beaches in Areas 2, 5, 6, and the beach area of Area 9. Routes of potential exposure include incidental ingestion of and dermal contact with soil, surface water, and sediment, and inhalation of particulates released from surface soil.

Similar to the current scenario, young children (0 to 6 years old) generally have a higher incidental soil intake rate and a lower body weight when compared to older children. Children under six years old are selected as potential receptors for a recreational user scenario in these beach areas. The young child exposure scenario provides a conservative basis for evaluating potential exposures to older children. Adults are also selected as potential receptors. They may accompany young children to the beaches. They also serve to represent health-protective estimates of the risk to other adults who live in homes bordering the site, volunteers and public-sector employees responsible for habitat restoration within intertidal areas, and individuals who may access intertidal areas by passing through private property boundaries. Exposure parameters for recreational users are described in Section 4.5.

Upland Area of Area 9
Similar to current recreational users, future recreational users may be exposed to contaminants in surface soil, surface water, and sediment while visiting the upland

area of Area 9. Routes of potential exposure include incidental ingestion of and dermal contact with soil, surface water, and sediment, and inhalation of particulates released from surface soil.

Adults and adolescents (6 to 18 years old) are selected as potential receptors. Potential exposure for recreational users to soil is examined using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.2.2 Pedestrians

Pedestrians may walk at or adjacent to the site on a frequent basis. Walking is likely to occur both on the walking path and on the beach area within the intertidal zone. Walking may also commonly occur in the upland area of Area 9. While walking, pedestrians may have some contact with surface soil in these areas. Routes of potential exposure include incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust.

Adults and adolescents (6 to 18 years old) are selected as potential receptors. Potential exposure for pedestrians to soil is examined using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.2.3 Anglers

People may be exposed to site-specific COPCs through consumption of fish and shellfish caught from the site. As stated earlier, young children generally have higher fish/shellfish intake rates per body weight when compared to older children. Thus, the angler scenario assesses exposure to adult anglers and young children (0 to 6 years old) who may consume fish and shellfish caught at the site by anglers. Anglers are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.2.4 Trespassers

It is assumed that Areas 8 and 11 will remain vacant in the future and unauthorized access to these areas will be restricted. However, trespassers could gain access to part or all areas of Areas 8 and 11. When trespassing, these individuals may be exposed to COPCs in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of fugitive dust. Adults and adolescent trespassers between 12 and 18 years in age are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.2.5 Outdoor Workers

Future outdoor workers could come into contact with surface soil while engaging in outdoor activities such as landscaping and maintenance operations in Areas 3 and 4. Routes of exposure include incidental ingestion of and dermal contact with soil, and inhalation of particulates released from surface soil. Outdoor workers are evaluated

using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.2.6 Construction/Utility Workers

Future construction/utility workers engaging in repair and construction activities along sewer lines could have short-term, high intensity exposure to contaminants in soil. Construction/utility workers may encounter shallow groundwater at Areas 6 and 8, and upland area of Area 9 where depth to groundwater is 10 feet or less.

It is assumed that land use at the site will remain the same and construction activities are limited to upland areas. Routes of exposure include incidental ingestion of and dermal contact with soil and groundwater, and inhalation of particulates released from surface and subsurface soil. Construction/utility workers are evaluated using default parameters recommended by EPA and site-specific considerations as described in Section 4.5.

4.2.2.7 Residents

The Old Bridge and Sayreville neighborhoods of Laurence Harbor are currently supplied with potable water from the municipal water supply system. Groundwater at the site is classified as Class IIA, but is not used as a potable drinking water supply because of high salinity. Future development of the groundwater resource at the site is unlikely; however, in theory, potable water wells could be installed in the future. Future residents could hypothetically be exposed to groundwater via drinking uses. Routes of exposure include ingestion of and dermal contact with groundwater, and inhalation of vapors in groundwater while bathing or showering. Future residents are evaluated using default parameters recommended by EPA as described in Section 4.5.

4.3 Summary of Exposure Pathways and Receptors

The following exposure pathways are considered to be potentially complete and are evaluated as part of the assessment of exposure to contaminants at the site. A summary of these exposure pathways is illustrated in Figures 4-1 and 4-2 and presented in Table 4-1.

CURRENT LAND-USE SCENARIO

Area 1

- Recreational Users (adults and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Surface Water
    - Incidental ingestion
    - Dermal contact

- Sediment
  - Incidental ingestion
  - Dermal contact

Areas 3 and 4

- Recreational Users (adults, children [0 to 6 years old], and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

- Outdoor Workers
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

Areas 5, 6, and Beach Area of Area 9

- Recreational Users (adults and children [0 to 6 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Surface Water
    - Incidental ingestion
    - Dermal contact
  - Sediment
    - Incidental ingestion
    - Dermal contact

Upland Area of Area 9

- Recreational Users (adult and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Surface Water
    - Incidental ingestion
    - Dermal contact
  - Sediment
    - Incidental ingestion
    - Dermal contact

All Areas (Except Areas 2, 8, and 11)

- Pedestrians
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

All Areas (except Areas 3 and 4)

- Anglers (adult and children [0 to 6 years old])
  - Fish and Shellfish
    - Ingestion

Areas 2, 8, and 11

- Trespassers (adult and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

All Areas (Upland Only)

- Construction/Utility Workers
  - Surface and Subsurface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Groundwater (Upland areas in Areas 6, 8, and 9)
    - Incidental ingestion
    - Dermal contact

FUTURE LAND-USE SCENARIO

Area 1

- Recreational Users (adults and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Surface Water
    - Incidental ingestion
    - Dermal contact
  - Sediment
    - Incidental ingestion
    - Dermal contact

Areas 3 and 4

- Recreational Users (adults, children [0 to 6 years old], and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

- Outdoor Workers
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

Areas 2, 5, 6, and Beach Area of Area 9

- Recreational Users (adults and children [0 to 6 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Surface Water
    - Incidental ingestion
    - Dermal contact
  - Sediment
    - Incidental ingestion
    - Dermal contact

Upland Area of Area 9

- Recreational Users (adult and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Surface Water
    - Incidental ingestion
    - Dermal contact
  - Sediment
    - Incidental ingestion
    - Dermal contact

All Areas (Except Areas 8 and 11)

- Pedestrians
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

All Areas (except Areas 3 and 4)

- Anglers (adult and children [0 to 6 years old])
  - Fish and Shellfish
    - Ingestion

Areas 8 and 11

- Trespassers (adult and adolescents [6 to 18 years old])
  - Surface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates

All Areas (Upland Only)

- Construction/Utility Workers
  - Surface and Subsurface Soil
    - Incidental ingestion
    - Dermal contact
    - Inhalation of particulates
  - Groundwater (Upland areas in Areas 6, 8, and 9)
    - Incidental ingestion
    - Dermal contact

All Areas

- Residents
  - Groundwater
    - Ingestion
    - Dermal contact
    - Inhalation (shower and bath)

4.4 Calculation of Exposure Point Concentrations

This section presents the methodology that was employed to calculate the EPCs for the COPCs for each medium including ambient air from soil particulates.

4.4.1 Exposure Point Concentrations of Samples Collected

For each data set (representing a single chemical in soil, surface water, sediment, and biota) with 10 or more samples, a 95 percent (or higher) upper confidence limit (UCL) on the arithmetic mean concentration was calculated and compared to the maximum detected concentration for that chemical. The lower value of the UCL and the

maximum detected value is selected as the EPC, as recommended by EPA (1992). UCLs are not calculated for data sets with fewer than four detected concentrations. In such cases, maximum concentrations are used as the EPCs.

Several statistical methods can be used to estimate the UCL of a data set, depending upon the data distribution. Therefore, two key steps are required to estimate the UCL of a data set.

- Determine the distribution of the data (i.e., normal, lognormal, gamma, or neither)
- Compute the UCL using the appropriate procedure for the data distribution

In this assessment, both steps were performed with the ProUCL statistical software (EPA 2010b). Based on EPA guidance (1989) and EPA Region 2 direction, these steps are performed with the environmental data assuming that nondetected data have a concentration equal to one-half the reporting limit (i.e., one-half the value reported with a "U" qualifier).

The ProUCL program tests the normal, lognormal, gamma, and non-parametric distributions of each data set and the UCLs are calculated with the statistical procedures recommended by EPA, based on the findings of Singh, Singh, and Engelhardt (1997, 1999) (EPA 2010b). ProUCL computes the UCL using 5 parametric and 10 non-parametric methods, depending on the distribution.

- For normal distributions, the Student's t-statistic is used to calculate the UCL.
- For lognormal distributions, one of four different computation methods is used to calculate the UCL depending on the skewness of the data (as indicated by the standard deviation of the log-transformed data) and the sample size.
- For gamma distributions, one of two computation methods is used to calculate the UCL based on a "k value," which is the shape parameter of a gamma distribution. For values of $k \geq 0.1$, the exposure point concentration term is computed using an adjusted gamma UCL of the mean (when $0.1 \leq k \leq 0.5$) or an approximate gamma UCL of the mean (when $k > 0.5$). For values of $k < 0.1$, a UCL is obtained using either the bootstrap-t method or Hall's bootstrap method when the sample size is small (less than 15), or the approximate gamma for larger datasets.
- For data sets that do not fit a normal, a lognormal, or gamma distribution, the ProUCL program calculates and recommends a UCL from 1 of the 10 non-parametric methods (EPA 2010b).

Tables B-3.1a through B-3.6e in Appendix B present the EPCs for each COPC in each medium. As noted previously, the EPC is the lower value of the UCL and the maximum detected value. ProUCL outputs for COPCs are presented in Appendix C.

The HHRA evaluated surface water in Raritan Bay as a whole based on the consideration that Raritan Bay is a highly dynamic system. Surface water is constantly mixed and moved around by tidal currents and wave-driven currents. Because hydrodynamic forces constantly distribute and redistribute dissolved metals in the bay, evaluating surface water samples as a whole is representative of the condition in the bay. However, at Area 2 lead concentrations in surface water samples collected in 2008 were high, ranging from 867 µg/L to 1,450 J µg/L. These concentrations are at least 60 times the federal maximum contaminant level (MCL) of 15 µg/L in drinking water. This may indicate a concern for individuals who incidentally ingest surface water in Area 2. More discussion of uncertainties associated with surface water is provided in Section 6.4.2.1.

4.4.2 Inhalation Exposure Algorithms

In accordance with EPA *Risk Assessment Guidance for Superfund, Part F, Supplemental Guidance for Inhalation Exposure* (EPA 2009a), inhalation exposure could be categorized as acute, subchronic, and chronic exposures, based on exposure duration and exposure pattern.

Chronic exposure is generally used for continuous or near-continuous inhalation exposures that occur for seven years or more. Subchronic exposure refers to repeated exposures for more than 30 days up to 7 years. Acute exposure includes exposures lasting 24 hours or less or intermittent exposures that occur at a series of short periods (e.g., 4 hours) separated by several days of no exposure.

4.4.2.1 Types of Inhalation Exposure

Based on the exposure duration and exposure pattern, inhalation exposure for selected receptor populations is classified as follows:

- Chronic exposure
  - *Recreational Users* – inhalation of particulates released from soil
  - *Pedestrians* - inhalation of particulates released from soil
  - *Outdoor workers* - inhalation of particulates released from soil
  - *Residents* – inhalation of vapor during shower/bath
- Subchronic exposure
  - *Construction/utility workers* - inhalation of particulates released from soil
- Acute exposure
  - *Trespassers* - inhalation of particulates released from soil

Exposure concentrations for inhalation exposure to carcinogens and chronic and subchronic exposure to non-carcinogens are calculated as shown in Equation 4-1 (EPA 2009a):

$$EC = \frac{CA \times EF \times ET \times ED}{AT} \qquad (4-1)$$

where:

EC	=	exposure concentration, micrograms per cubic meter (µg/m³)
CA	=	concentration in air, µg/m³
ET	=	exposure time, hours/day
EF	=	exposure frequency, days/year
ED	=	exposure duration, years
AT	=	averaging time, hours, equivalent to the exposure duration for non-carcinogens and 70 years for carcinogens

Exposure concentrations for acute exposure to noncarcinogens are given as Equation 4-2 (EPA 2009a):

$$EC = CA \qquad (4 - 2)$$

where:

EC	=	exposure concentration, µg/m³
CA	=	concentration in air, µg/m³

4.4.2.2 Ambient Air Exposure Point Concentrations

Inhalation of contaminants adsorbed to respirable particles is assessed using a particulate emission factor (PEF) (EPA 2002b). PEFs are calculated using site-specific data, when available, and EPA default values. The vegetative cover is assumed to be 5% for beach areas (Areas 1, 2, 5, 6, and 9), 80% for Areas 3 and 4, and the upland area of Area 9, and 50% for all other areas. Site-specific areal extent of contamination is used for a particular exposure area. The mean annual wind speed is 4.47 meter per second (m/s), based on the mean annual wind speed from 1930 to 1996 for Newark, New Jersey, the closet station to the site. The equivalent threshold value of wind speed is 11.32 m/s, based on the EPA default value (EPA 2002b). Air dispersion model constants are based on values for Philadelphia, Pennsylvania, the closest major city to the site with dispersion data (EPA 2002b). PEFs are summarized in Table B-4.6 of Appendix B.

The concentration of particulates from soil into ambient air is calculated as follows:

$$CA = \frac{CS}{PEF} \qquad (4-3)$$

where:

CA	=	concentration in air, µg/m^3
CS	=	concentration in soil, µg/kg
PEF	=	particulate emission factors from soil, cubic meters per kilogram (m^3/kg)

4.4.2.3 Indoor Air Exposure Point Concentrations Using the Shower Model

Modeling is required to estimate the indoor air concentrations of VOCs from groundwater while showering. In this scenario, receptors are assumed to inhale VOCs while showering and during time spent in the bathroom after showering. Dermal absorption of volatilized VOCs is assumed to be negligible due to low dermal permeabilities. Methodologies for estimating exposure to VOCs in domestic water supplies from the inhalation exposure route are based on a shower model developed by Schaum *et al*. (1994).

The shower model treats the bathroom as one compartment and yields an air concentration averaged over the time of the actual shower and the time spent in the bathroom after the shower. The model was derived by assuming that the chemical contaminant volatilizes at a constant rate, instantly mixes uniformly with the bathroom air, and that ventilation with clean air does not occur. This implies that the chemical concentration in the air increases linearly from zero to a maximum at the end of the shower, and then remains constant during the time an individual spends in the bathroom immediately after showering. The air concentration is estimated as follows:

$$C_a = \frac{\left(\frac{C_{aMax}}{2}\right)t_1 + \left(C_{aMax}\right)t_2}{t_1 + t_2} \qquad (4-4)$$

where:

C_a	=	concentration of a chemical contaminant in air, milligrams per cubic meter (mg/m^3)
C_{aMax}	=	maximum concentration of a chemical contaminant in air (mg/m^3)
t_1	=	Time of shower (hour)
t_2	=	Time after shower (hour)

C_{aMax} is estimated as follows:

$$C_{aMax} = \frac{C_w\, fF_w t_1}{V_a} \qquad (4-5)$$

where:

C_{aMax}	=	maximum concentration of a chemical contaminant in air (mg/m^3)
C_w	=	water concentration, milligrams per liter (mg/L)
F	=	fraction volatilized (unitless)
F_w	=	water flow rate, liters per hour (L/hour)
V_a	=	bathroom volume, cubic meters (m^3)

The water concentration, C_w, is a site-specific value that refers to the concentration of a chemical in water as it enters the shower. The UCL value or the maximum detected value is utilized as the water concentration (i.e., the EPC listed in Table B-3.2a in Appendix B).

The fraction volatilized, *f*, is a chemical-specific value that refers to the mass fraction of a chemical in water that volatilizes over the course of the shower. Volatilization rates depend on properties such as Henry's Law constants and molecular weights. Chemical-specific fraction volatilized values are calculated from these chemical properties using the equation provided by Schaum *et al*. (1994) (see Tables F-1 and F-2 in Appendix F).

The water flow rate, F_w, refers to the rate at which water flows into the shower. A value of 1,000 L/hour is assumed in the model for the reasonable maximum exposure (RME) scenario and 500 L/hour for the central tendency exposure (CTE) scenario (Schaum *et al*. 1994).

The bathroom volume, V_a, refers to the volume of the bathroom including the shower stall. A value of 6 cubic meters (m$^{3)}$ is assumed in the model for the RME scenario and 16 m^3 for the CTE scenario (Schaum *et al*. 1994). The shower time, t_1, refers to the actual time of the shower. Values of 15 and 27 minutes for adults and young children, respectively, for the RME and 6 and 8.4 minutes for adults and young children (0 to 6 years), respectively, for the CTE (EPA 2001b) are assumed in the model.

The time spent in the bathroom after showering, t_2, is assumed to be 20 and 33 minutes for adults and young children (0–6 years), respectively, for the RME and 9 and 11.5 minutes for adults and young children, respectively, for the CTE (EPA 2001b).

The model is conservative in nature due to the combination of the following assumptions.

- Volatilization is constant.
- There is no ventilation.

- The exchange rate between air in the shower chamber and bathroom air is so rapid that the combined volume can be treated as a single chamber with a single concentration of the volatilized chemical (i.e., same chemical concentration throughout shower and bathroom).

Exposure point air concentrations from the shower model are presented in Tables F-3 and F-4 in Appendix F.

4.5 Exposure Parameter Assumptions

Exposure parameters for each scenario are primarily taken from EPA documents (EPA 1989, 1991a, 1997, 2002b, 2004a, 2008a, and 2009a) and are consistent with EPA Region 2's approach. EPA's standard default assumptions (EPA 1991a) or site-specific values are used. Otherwise values from the most recent guidance available are used unless EPA Region 2 has a known preference for a specific value.

It is not possible to estimate accurately exposures for individuals in an exposed population because (1) behavior patterns for individuals in these populations change over time, (2) day-to-day behaviors vary among individuals within a population, and (3) individual variation exists in important parameters such as ingestion rate and body weight. In this risk assessment, the exposure assessments address reasonable maximum estimates for exposures that could conceivably occur in a population. RME is defined as exposure above about the 90th percentile of the population distribution. The intent of RME is to estimate a conservative exposure case (well above the average) that is still within the range of possible exposures. CTE parameters are also developed to provide estimates representing average exposures. Risks based on CTE are calculated only if RME risks exceed EPA's threshold risk range (i.e., cancer risk range of 1×10^{-6} to 1×10^{-4} or noncancer hazard index [HI] of 1).

RME and CTE parameters used in the risk assessment are provided in Tables B-4.1 through B-4.5 in Appendix B.

4.5.1 Recreational Users

All recreational users are assumed to spend 2 hours per day at an exposure area for 100 days per year for the RME scenario (EPA 2009a), except children attending summer camp at the Recreational Center building and visiting the playground (Areas 3 and 4). Recreational users attending the summer camp are assumed to be exposed for 4 hours per day for 20 days per year, based on site-specific data. Recreational users (young children 0 to 6 years old and adults) visiting the playground are assumed to be exposed for 2 hours per day for 3 days per week in the spring and fall, 5 days per week in the summer, for a total of 182 days per year. One-half of the RME exposure time and frequency are used for the CTE scenario.

The RME duration for recreational users assumed is 6 years for young children (0 to 6 years old), 12 years for adolescents (6 to 18 years old), and 12 or 24 years for adults,

depending on exposure area. The CTE duration for adult recreational user is 9 years, based on the 50th percentile value for years living in current home (EPA 1997). The CTE duration is assumed to be 6 years for young children and 12 years for adolescents.

A life expectancy of 70 years (EPA 1989) is used for all receptor groups as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncancer effects is equal to the exposure duration, or 12 or 24 years for adults for the RME scenario and 9 years for the CTE scenario. The averaging time for noncancer effects is 12 years for adolescents and 6 years for children under both scenarios. A body weight of 70 kg is used for adult (EPA 2002b), 53 kg for adolescent, and 15 kg for children (0 to 6 years old) (EPA 2008a) under both scenarios.

4.5.1.1 Soil

Recreational users are assumed to be exposed to soil via ingestion of and dermal contact with soil, and inhalation of fugitive dust.

Ingestion Rate

The incidental soil ingestion rate of recreational users is assumed to be 100 mg/day for adults (EPA 2002b) and adolescents (6 to 18 years old) (EPA 2008a), and 200 mg/day for children (0 to 6 years old) for the RME scenario (EPA 2002b). For the CTE scenario, the soil ingestions rate is assumed to be 50 mg/day for adults (EPA 1997) and adolescents (EPA 2008a), and 100 mg/day for children (EPA 2008a).

Surface Area

Although recreational users in the beach areas (Areas 2, 5, 6, and 9) are expected to wear a swimming suit, it is assumed that their total surface area is exposed to intertidal zone soil while sunbathing or playing in the sand. The exposed skin surface area for adult recreational users is 18,000 square centimeter (cm^2), the average of the 50th percentile for males and females greater than 18 years of age (EPA 2004a). The exposed skin surface area for child recreational users is 6,600 cm^2, based on the average of the 50th percentile for male and female children (EPA 2004a).

For Area 1, the recreational user is assumed to wear a short-sleeved shirt, shorts, and no shoes; therefore, the exposed skin surface is limited to the head, hands, forearms, lower legs, and feet. The exposed skin surface area for adult recreational users is 6,900 cm^2 for adults (EPA 2004a). The exposed skin surface area for adolescent recreational users is 6,100 cm^2, based on the weighted average surface area for children ages 6 to 21 years (EPA 2008a).

For Areas 3 and 4 and the upland area of Area 9, the recreational user is assumed to wear a short-sleeved shirt, shorts, and shoes; therefore, the exposed skin surface is limited to the head, hands, forearms, and lower legs. The exposed skin surface area is 5,700 cm^2 for adults (EPA 2004a). The exposed skin surface area is 5,000 cm^2 for

adolescents and 2,300 cm^2 for children, based on the weighted average surface area for the individual age group (EPA 2008a).

Soil Adherence Factor
The RME dermal adherence factor of 0.07 milligram per square centimeter (mg/cm^2) is assumed for adults, based on the 50th percentile weighted adherence factor measured for gardeners, the activity determined to represent a reasonable, high-end contact (EPA 2004a) representative of adults recreating in the area. The RME adolescent adherence factor is 0.09 mg/cm^2 for Area 1, and 0.07 mg/cm^2 for Area 3, 4, and the upland area of Area 9, based on the surface area weighted soil adherence factor for adolescent ages 6 to 21 years playing in soil activities (EPA 2008a). The RME child adherence factor is 0.1 mg/cm^2 for the beach areas (Areas 2, 5, 6, and beach area of Area 9) and 0.13 mg/cm^2 for Areas 3 and 4, based on the surface area weighted soil adherence factor for children ages 0 to <6 years playing in soil activities (EPA 2008a).

Under the CTE scenario, a dermal adherence factor of 0.01 mg/cm^2 is assumed for adults (EPA 2004a). The CTE adherence factors for adolescents are 0.05 mg/cm^2 for Area 1 and 0.04 mg/cm^2 for Areas 3, 4, and upland area of Area 9, based on the surface area weighted soil adherence factor for each age group in daycare (EPA 2008a). The CTE adherence factors for children are 0.06 mg/cm^2 for the beach areas (Areas 2, 5, 6, and beach area of Area 9) and 0.07 mg/cm^2 for Areas 3 and 4, based on the surface area weighted soil adherence factor for each age group in daycare (EPA 2008a). The chemical-specific dermal absorption fractions for COPCs are presented in Table B-4.6.

4.5.1.2 Surface Water and Sediment

Recreational users are assumed to be exposed to surface water and sediment via ingestion and dermal contact.

Ingestion Rate
The incidental ingestion rate recommended by EPA (2008) for surface water for children ages 18 to 21 years while swimming is 20 milliliters per hour (ml/hr). This rate is used for adult recreational users in the beach areas (Areas 1, 2, 5, 6, and beach area of Area 9) for a swimming scenario. The incidental water ingestion rate for children ages 6 to 15 years while swimming of 50 ml/hr is used for child and adolescent recreational users (EPA 2008a).

For the upland area of Area 9, incidental ingestion of surface water while wading in the wetland is unlikely to occur at the same rate as the incidental ingestion rate while swimming. The incidental ingestion rate is thus assumed to be 2 ml/hr for adults and 5 ml/hr for adolescents, or one-tenth the water ingestion rate for a swimming scenario for both RME and CTE scenarios.

Ingestion of sediment in the beach areas (Areas 1, 2, 5, 6, and beach area of Area 9) is limited to sediment that has been suspended in the water column while swimming and sediment which sticks to the feet, hands, or other body parts. In the absence of ingestion rates for sediment, exposure assumptions are based on one tenth of recommended ingestion rates for soil. The incidental ingestion rate for sediment is, therefore, assumed to be 10 mg/day for adults and adolescents, and 20 mg/day for the RME scenarios. One-half of the RME rates are used for the CTE scenario.

For the upland area of Area 9, incidental ingestion rates for sediment are based on recommended ingestion rates for soil. The incidental ingestion rate for sediment is, therefore, assumed to be 100 mg/day and 50 mg/day for RME and CTE scenarios, respectively, for adults and adolescents.

Surface Area

For dermal contact with surface water in a swimming scenario in the beach areas, the recreational user is assumed to have full body contact with surface water. The exposed skin surface area is 18,000 cm^2 for adults, 15,000 cm^2 for adolescents, and 6,600 cm^2 for children, based on the weighted average surface area for each age group (EPA 2004a and 2008). This skin surface area value is assumed for both the RME and CTE scenarios.

For dermal contact with surface water in a wading scenario in the upland area of Area 9, the recreational user is assumed to wear a short-sleeved shirt and shorts (no shoes); therefore, the exposed skin is limited to the head, hands, forearms, lower legs, and feet. The exposed skin surface area for the adult recreational users is 6,900 cm^2, the average of the 50th percentile for males and females greater than 18 years of age (EPA 2004a). The exposed skin surface area for adolescent recreational users is 6,100 cm^2, the weighted average for children 6 to 21 years of age (EPA 2008a).

For dermal contact with sediment, the recreational user is assumed to wear a short-sleeved shirt, shorts, and no shoes; therefore, the exposed skin surface is limited to the head, hands, forearms, lower legs, and feet. The exposed skin surface area is 6,900 cm^2 for adult recreational users (EPA 2004a) and 6,100 cm^2 for adolescent recreational users (EPA 2008a). The exposed skin surface area for child recreational users is 4,200 cm^2, the weighted average for children 0 to <6 years of age (EPA 2008a).

Sediment Adherence Factor

In the absence of a sediment adherence factor for adults, the recommended geometric mean soil adherence factor for reed gathers of 0.3 mg/cm^2 is used for adults and adolescents under the RME scenario (EPA 2004a). The CTE value of 0.07 mg/cm^2 is used for adults and adolescent, based on the geometric mean value for gardeners (EPA 2004a). For children, a sediment adherence factor of 0.2 mg/cm^2 is used for both RME and CTE scenarios, based on the geometric mean soil adherence factor for children playing in wet soil (EPA 2004a). The chemical-specific dermal absorption fractions for COPCs are presented in Table B-4.6.

4.5.2 Pedestrians

Pedestrians are assumed to visit the site more frequently but receive a lower exposure to surface soil because of the nature of the activity. They are assumed to walk at the site for 350 days per year (EPA 1991) and spend 2 hours per visit for the RME scenario. One-half of the RME exposure time and frequency are used for the CTE scenario.

The RME duration for the pedestrian is assumed 12 years for adolescents (6 to 18 years old) and 12 years for adults. The CTE duration for the adult pedestrian is 9 years, based on the 50th percentile value for years living in the current home (EPA 1997). The CTE duration is assumed to be 12 years for adolescents.

A life expectancy of 70 years (EPA 1989) is used for all receptor groups as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncancer effects is 12 years for adults and adolescents for the RME scenario. For the CTE scenario, the averaging time for noncancer effects is 9 years for adults and 12 years for adolescents. A body weight of 70 kg is used for adults (EPA 2002b) and 53 kg for adolescents (EPA 2008a) under both scenarios.

Ingestion Rate

The incidental soil ingestion rate for pedestrians is assumed to be 100 mg/day for adults (EPA 2002b) and adolescents (EPA 2008a) for the RME scenario. For the CTE scenario, the soil ingestions rate is assumed to be 50 mg/day for adults (EPA 1997) and adolescents (EPA 2008a).

Surface Area

The pedestrian is assumed to wear a short-sleeved shirt, shorts, and shoes; therefore, the exposed skin surface is limited to the head, hands, forearms, and lower legs. The exposed skin surface area is 5,700 cm^2 for adults (EPA 2004a) and 5,000 cm^2 for adolescents (EPA 2008a).

Soil Adherence Factor

The RME dermal adherence factor of 0.07 mg/cm^2 is assumed for adults, based on the 50th percentile weighted adherence factor measured for gardeners (EPA 2004a). The RME adherence factor for adolescents is 0.07 mg/cm^2 (EPA 2008a). Under the CTE scenario, a dermal adherence factor of 0.01 mg/cm^2 is assumed for adults (EPA 2004a) and 0.04 mg/cm^2 for adolescents (EPA 2008a). The chemical-specific dermal absorption fractions for COPCs are presented in Table B-4.6.

4.5.3 Anglers

Anglers are evaluated for exposure to COPCs through consumption of fish and shellfish caught from the site. Adults and children (0 to 6 years old) are selected as potential receptor populations for the angler scenario.

May and Burger (1996) studied fishing behavior and fish consumption pattern in Raritan Bay. They estimated that the mean ingestion rate for Raritan Bay fish consumers is 44 gram per day (g/day), based on a serving size of 10.3 ounces per meal, 4.6 meals per month for 12 months per year. Burger (2002) studied fishing and fish consumption pattern within the Newark Bay Complex. Results of the study indicated that the mean fish ingestion rate at Newark Bay Complex was 22 g/day, based on a consumption rate of self-caught fish of 8,120 gram per year. While Raritan Bay is not a part of the Newark Bay Complex, the waterways are connected. Averaging the fish ingestion rates from both studies results in a rate of 33 g/day. This value is used as the fish ingestion rate for adult anglers for the RME scenario (EPA 2011g). For the CTE scenario, the mean fish ingestion rate of 22 g/day from the Burger study (2002) is used. It is assumed that young children would consume fish at 1/3 of rate of an adult which is 11 g/day and 7.3 g/day under RME and CTE scenarios, respectively (EPA 2011g).

The Burger study also derived a mean crab ingestion rate of 16 g/day, based on a consumption rate of self-caught crab of 5,796 gram per year (Burger 2002). This ingestion rate is consistent with the Burger (1998) study in Barnegat Bay of 16.6 g/day. The ingestion rate of 16 g/day is used for adult anglers for the RME scenario for consumption of all shellfish (i.e., blue crab, hard clam, and ribbed mussel). The CTE shellfish ingestion rate for adult anglers is assumed to be 6.6 g/day, based on the recommended mean fish (finfish and shellfish) ingestion rate for freshwater/estuary fish (EPA 1997). It is also assumed that young children would consume shellfish at 1/3 of rate of an adult (EPA 2011g) which is 5.3 g/day and 2.2 g/day under RME and CTE scenarios, respectively.

The exposure frequency for fish and shellfish ingestion is assumed to be 365 days per year (EPA 1997). The exposure duration is assumed to be 6 years for young child (0 to 6 years old) under both RME and CTE scenarios and 24 years for adults under RME scenario and 9 years under CTE scenario (EPA 1997).

A life expectancy of 70 years (EPA 1989) is used for all receptor groups as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncancer effects is equal to the exposure duration, or 24 years for adults under the RME scenario, 9 years for adults under the CTE scenario and 6 years for children under both scenarios. A body weight of 70 kg is used for adults (EPA 1991a) and 15 kg for children (0 to 6 years old) (EPA 2008a) under both scenarios.

4.5.4 Trespassers

Trespassers are assumed to trespass in restricted areas one day per week in the spring and fall and two days per week in the summer, for a total of 52 days per year. They are assumed to spend 2 hours per visit for the RME scenario. One-half of the RME exposure time and frequency are used for the CTE scenario.

The RME duration for the trespasser is 12 years for adolescents (6 to 18 years old) and 12 years for adults. The CTE duration for adult trespasser is 9 years, based on the 50th percentile value for years living in the current home (EPA 1997). The CTE duration is assumed to be 12 years for adolescents.

A life expectancy of 70 years (EPA 1989) is used for all receptor groups as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncancer effects is 12 years for adults and adolescents for the RME scenario. For the CTE scenario, the averaging time for noncancer effects is 9 years for adults and 12 years for adolescents. A body weight of 70 kg is used for adults (EPA 2002b) and 53 kg for adolescents (EPA 2008a) under both scenarios.

Ingestion Rate
The incidental soil ingestion rate for the trespasser is assumed to be 100 mg/day for adults (EPA 2002) and adolescents (EPA 2008a) for the RME scenario (EPA 2002b). For the CTE scenario, the soil ingestions rate is assumed to be 50 mg/day for adults (EPA 1997) and adolescents (EPA 2008a).

Surface Area
The trespasser is assumed to wear a short-sleeved shirt, shorts, and shoes; therefore, the exposed skin surface is limited to the head, hands, forearms, and lower legs. The exposed skin surface area is 5,700 cm^2 for adults (EPA 2004a) and 5,000 cm^2 for adolescents (EPA 2008a).

Soil Adherence Factor
The RME dermal adherence factor of 0.07 mg/cm^2 is assumed for adults, based on the 50th percentile weighted adherence factor measured for gardeners (EPA 2004a). The RME adolescent adherence factor is 0.07 mg/cm^2 (EPA 2008a). Under the CTE scenario, a dermal adherence factor of 0.01 mg/cm^2 is assumed for adults (EPA 2004a) and 0.04 mg/cm^2 for adolescents is (EPA 2008a). The chemical-specific dermal absorption fractions for COPCs are presented in Table B-4.6.

4.5.5 Outdoor Workers

Outdoor workers are assumed to be exposed to contaminants in surface soil for 225 days per year for the RME scenario (EPA 2002b) and 219 days for the CTE scenario (EPA 2004a). The exposure duration for outdoor workers is 25 years for the RME scenario, based on the 95th percentile value for job tenure for men in the manufacturing sector (EPA 2002b). The CTE duration is 9 years (EPA 2004a). The exposure time for outdoor workers is 8 hours per day for the RME scenario and 4 hours per day for the CTE scenario. A life expectancy of 70 years (EPA 1989) is used as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncancer effects is equal to the exposure duration, or 25 years under the RME scenario, and 7 years for the CTE scenario (EPA 1989). A body weight of 70 kg is used for outdoor workers for both the RME and the CTE scenarios (EPA 2002b).

The incidental soil ingestion rate for outdoor workers is assumed to be 100 mg/day (EPA 2002b) for the RME scenario and 50 mg/day for the CTE scenario (EPA 1997). For dermal contact with soil, the outdoor worker is assumed to wear a short-sleeved shirt, long pants, and shoes; therefore, the exposed skin surface is limited to the head, hands, and forearms. The resulting exposed skin surface area is 3,300 cm^2, the average of the 50th percentile for males and females greater than 18 years of age (EPA 2004a). A dermal adherence factor of 0.2 mg/cm^2 is assumed for RME scenario and 0.02 mg/cm^2 is assumed for CTE scenario (EPA 2002b). The chemical-specific dermal absorption fractions for COPCs are presented in Table B-4.6.

4.5.6 Construction/Utility Workers

Exposure pathways evaluated for construction/utility workers at the site include incidental ingestion of and dermal contact with surface and subsurface soil and inhalation of particulates.

Construction/utility workers are assumed to be exposed to soils for 8 hours per day, for 12 months (250 workdays) per year for a total duration of 1 year for the RME scenario. Construction/utility workers are assumed to come into contact with groundwater for 4 hours per day for 250 days. A life expectancy of 70 years (EPA 1989) is used as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncancer effects is equal to the exposure duration, or 365 days for construction workers. A body weight of 70 kg is used for construction/utility workers (EPA 2002b).

For the soil ingestion exposure pathway, construction/utility workers are assumed to ingest 330 mg of soil per day (EPA 2002b). For dermal contact with soil, the construction worker is assumed to wear a short-sleeved shirt, long pants, and shoes; therefore, the exposed skin surface is limited to the head, hands, and forearms. The exposed skin surface area for workers is 3,300 cm^2, the average of the 50th percentile for males and females older than 18 years of age (EPA 2002b). A dermal adherence factor of 0.3 mg/cm^2 is assumed (EPA 2002b), corresponding to the 95th percentile value that has been measured for construction workers. The chemical-specific dermal absorption factors for COPCs are presented in Table B-4.6.

In the absence of incidental ingestion rates for groundwater, one tenth of the recommended mean water ingestion rate for children ages 18 to 21 years while swimming (EPA 2008) is assumed for construction/utility workers. For dermal contact with groundwater, exposed skin surface area for construction/utility workers is 5,700 cm^2, assuming the exposed skin surface is limited to the head, hands, forearms, and lower legs (EPA 2004a).

4.5.7 Residents

Future development of the groundwater resource at the site is unlikely; however, in theory, potable water wells could be installed in the future. Future residents could hypothetically be exposed to groundwater via domestic uses. Routes of exposure

include ingestion of and dermal contact with water and inhalation of vapors during the shower/bath.

All residents are assumed to be exposed for 24 hours per day, for 350 days per year for both the RME and CTE scenarios (EPA 1991a). The total RME duration for residents is assumed to be 30 years (EPA 1991a): 24 years as an adult and 6 years as a young child. The CTE duration for adult residents is 9 years, based on the 50th percentile value for years living in the current home (EPA 1997). The CTE duration is assumed to be 6 years for children.

A life expectancy of 70 years (EPA 1989) is used for all receptor groups as the averaging time for exposure to carcinogenic contaminants. The averaging time for noncarcinogenic effects is equal to the exposure duration, or 24 years for adults under the RME scenario, 9 years for adults under the CTE scenario, and 6 years for children under both scenarios. A body weight of 70 kg is used for adult residents (EPA 2002b) and 15 kg for children (0 to 6 years old) (EPA 2008a) under both scenarios.

For noncancer hazards, the most sensitive receptor is a child (0 to 6 years of age), because a young child generally has higher relative intake rates when compared to older children and adults. Therefore, although both adult and child noncancer hazards were prepared, noncancer results for a child are discussed (Table B-7.17 in Appendix B).

Carcinogenic exposure estimates throughout a lifetime are impacted by age-dependent intake factors. To take into account the difference in daily ingestion rates, body weights, and exposure durations for young children and adults, age-adjusted intake factors are used for carcinogenic exposure estimates (EPA 1991b). This is accomplished by using factors for a child for the first six years of exposure and adult factors for the remainder 24 years of the exposure period.

For groundwater ingestion exposure parameters, adult residents are assumed to consume 2 liters (L) of water per day for the RME scenario (EPA 1991a) and 1.4 L/day for the CTE scenario, based on a mean water ingestion rate for adults (EPA 1997). A water intake rate of 1 L/day is assumed for child residents based on a 95th percentile drinking water ingestion rate for children 0 to 6 years old (EPA 1991a and 2008). The CTE drinking water intake rate for children is assumed to be 0.34 L/day, based on a weighted mean drinking water ingestion rate for children between 0 to 6 years of age (EPA 2008a).

Inhalation and dermal exposure of residents to groundwater may occur through showering and other household activities. For the RME scenario, shower duration for adults is assumed to be 15 minutes, with an additional 20 minutes for drying off, brushing teeth, combing hair, etc., for a total of 0.58 hour (EPA 2001b). For the CTE scenario, shower duration for adults is assumed to be 6 minutes, with an additional 9 minutes spent in the bathroom afterwards, for a total of 0.25 hour (EPA 2001b). For

the RME scenario, children (0–6 years old) are assumed to spend 27 minutes in the bath, with an additional 33 minutes spent in the bathroom afterwards, for a total of 1 hour (EPA 2001b). For the CTE scenario, children are assumed to spend 8.5 minutes in the bath, with an additional 11.5 minutes spent in the bathroom afterwards, for a total of 0.33 hour (EPA 2001b).

For surface area exposed, the estimate of total body surface area is 18,000 cm^2 for adults, based on the average 50th percentiles for males and females (EPA 2004a). For child residents, the total surface area is 6,600 cm^2, based on weighted surface area for children between 0 to 6 years of age (EPA 2008a). Chemical-specific dermal permeability coefficients for COPCs are presented in Table B-4.6 (EPA 2004a).

4.6 Methods for Evaluating Exposure to Lead

Exposures to lead are not evaluated using the same methods as those described for other site-related COPCs. EPA has not published conventional quantitative toxicity values for lead because available data suggest a very low or possibly no threshold for adverse effects, even at exposure levels that might be considered background. However, the toxicokinetics of lead are well understood and indicate that lead is regulated based on the blood lead concentration. Blood lead concentration can be correlated with both exposure and adverse health effects. In lieu of evaluating risk using typical intake calculations and toxicity criteria, EPA developed models specifically to evaluate lead exposures. For this HHRA, blood lead concentrations are estimated using the IEUBK (EPA 2010d) and the ALM (EPA 2009c).

The HHRA uses the IEUBK model to evaluate young children exposed to lead at the site. The IEUBK model is generally used to evaluate exposures to lead for young children in a residential situation. Young children are the subpopulation of primary concern for lead exposure because they tend to: (1) have higher exposures to lead in soil, dust, and paint, (2) absorb more of the lead that is ingested, and (3) are more sensitive to the toxic effects of lead than are older children or adults. Thus, protection of young children will also be protective of adults in the same environment.

The adult lead model is used to evaluate exposure to lead for adults and adolescents. Models that have been developed to evaluate adolescent exposure have not been widely accepted as regulatory tools by EPA and All Ages Lead Model is still in a developmental stage; therefore, the ALM was used to evaluate lead risks for adolescent recreational receptors.

Exposure to lead in surface soil is evaluated for recreational users in Areas 1, 2, 5, 6, and 9. Construction/utility workers are evaluated for exposure to lead in surface and subsurface soil in all upland areas. Exposure to lead in surface soil is evaluated for pedestrians for all areas except Areas 2, 8, and 11 for current scenarios and in the future for all areas except 8 and 11. Lead was not selected as a COPC in Areas 3 and 4 because maximum detected concentrations in total soil (97.8 J mg/kg) and fine

fraction soil (27 mg/kg) are below the screening criterion of 400 mg/kg for residential soil.

Ingestion of lead in fish and shellfish is a concern and is evaluated for adult anglers and young children. Biota evaluated include: fish, hard calm, ribbed mussel, and blue crab. Exposure to lead in sediment in the wetlands of Area 9 is evaluated for recreational users. Exposure to lead in surface water is a potential concern primarily because lead was selected as a surface water COPC based on screening against the NJDEP surface water criterion. Exposure to lead in groundwater is evaluated for future residents using groundwater as a drinking water source.

The assumptions used in each model for the scenarios evaluated in this HHRA are discussed in the subsections below.

4.6.1 IEUBK Model for Young Children

The HHRA uses the IEUBK model (Version 1.1, Build 11 for Windows®) (EPA 2010d) to predict blood-lead concentrations for young children exposed to lead at the site. The IEUBK model is a software package which allows the user to estimate, for a hypothetical child or population of children, a plausible distribution of blood lead concentrations centered on the geometric mean blood lead concentration predicted by the model from available information about children's exposure to lead. Protection of young children is considered achieved if the odds of a typical or hypothetical child (or group of similarly exposed children) with blood lead levels of 10 microgram per deciliter (µg/dL) or greater is no more than 5 percent (EPA 1994).

The IEUBK model is typically used to evaluate exposure to lead for children in a residential type exposure scenario on a house (yard)-by-house (yard) basis. The IEUBK model uses the total lead uptake calculated from the estimated intakes of lead in all media (soil, dust, air, water, and diet) to predict mean blood lead concentration for children (84 months or younger). The model simulates lead uptake, distribution within the body, and elimination of lead from the body. The model uses standard age-weighted exposure parameters for the consumption of food, drinking water, soil, dust, and inhalation of air, matched with site-specific concentrations of lead in these media, to estimate exposure for a child. Default input parameters exist in the model for lead intake via air, drinking water, and diet. The IEUBK model also allows for alternate dietary data to be used if data are available; the alternate dietary option is used to evaluate the consumption of lead in fish and shellfish by young children in this analysis.

The IEUBK model is used in this HHRA to evaluate exposure to lead in soil for a young recreational child 0 to 6 years in age. Young children may be exposed to lead in surface soil currently and in the future in the beach areas of Areas 5, 6, 9 and in the future in Area 2. Young children may also be exposed to lead from the consumption of fish and shellfish caught from waters in the area; these receptors are family

members of anglers and are considered as a separate subpopulation and the consumption of fish and shellfish is evaluated separately.

In general IEUBK model default parameters are used in this analysis with the exception of lead concentrations in soil and dust and the alternate dietary intake pathway as an additional evaluation. Model defaults used include: geometric standard deviation (GSD), 1.6; maternal blood lead concentration, 1.0 µg/dL; concentration of lead in air, 0.1 µg/m^3; concentration in drinking water (for all scenarios except the groundwater evaluation, 4 µg/L),and other sources of lead exposure, 0 µg/day. Parameters used in the IEUBK model are discussed below and are summarized on Table 4-2.

Soil and Dust Lead Concentrations
Soil and dust are the primary sources of lead exposure for recreational receptors at the site. The arithmetic mean lead concentration in surface soil for each exposure area is used as a constant for soil that is applied to all age ranges exposed within the exposure area. The default soil/dust ingestion weighting factor of 45% is used because site specific data are unavailable. The multiple source analysis relationship is used to estimate dust concentrations.

Bioavailability for Gut Absorption Pathways
Site-specific estimates of relative bioavailability of lead in soil is 84% for fine-fraction soil (<250 µm) and 60% for total soil. Bioavailability of lead from the gastrointestinal (GI) tract is thus assumed to be 42% for fine fraction soil and 30% for total soil.

Drinking Water Lead Concentration
The model default concentration in drinking water (4 µg/L) is used for all scenarios except the groundwater evaluation.

Air Data
This analysis uses the IEUBK default outdoor air lead concentration of 0.1 µg/m^3 because site-specific data are not available. The time spent outdoors by the age groups was changed from model defaults to 2 hours per day for each age group.

Maternal Blood Lead Concentration
Maternal data considers the impact of lead transferred from the mother to the fetus in utero. The lead that is stored in the tissues of the newborn child is calculated by entering the maternal blood lead (PbB) value at the time of delivery. The model default of 1.0 µg/dL is used in this analysis.

Geometric Standard Deviation
GSD is a measure of the relative variability in PbB of a child of a specified age, or children from a hypothetical population whose lead exposures are known. The GSD encompasses biological and behavioral differences, measurement variability from repeat sampling, variability as a result of sample locations, and analytical variability. The recommended model default value of 1.6 is used.

Dietary Source
The default daily dietary lead intake values for each age apply to a typical child in the United States. These estimates are derived based upon Food and Drug Administration (FDA) food monitoring data collected 1995-2003 (FDA 2006). The IEUBK model assigns lead intakes in micrograms of lead per day (µg Pb/day) for food items, rather than calculating intakes from ingestion rates (volume or mass/day) and concentrations. The default values for diet vary from 1.95 to 2.26 µg/day. These values are used to determine dietary lead exposure, unless data describing an alternate dietary source are entered.

Alternate Dietary Source
Alternate dietary intake includes ingestion of game animals from hunting, fish from fishing, and home-grown fruits and vegetables. For the evaluation of the angler scenario only alternate dietary ingestion of fish and shellfish is assumed to be a complete exposure pathway for young children. Site-specific data are used to calculate the lead concentration for the alternate dietary source and the percentage of total dietary input that is represented by the alternate dietary source. The alternate dietary data are added to the other source data to derive a combined intake from all sources. For evaluation of the angler scenario, all default parameters recommended for use in the model by EPA were maintained except for the alternate dietary source.

The IEUBK model assumes the substitution of fish for other meat dishes, so an estimate of fish meals as a proportion of total meat meals is required for the exposure calculation. In estimating lead exposure to children from recreational fishing, appropriate inputs for percent of food class would be 10% for recreational fishing or as much as 50% for high-end cases. The site-specific average concentration of lead in fish/shellfish as consumed (either filets or whole fish) is entered as the concentration (µg Pb/g of fish tissue).

Median values for ingestion rates are used per IEUBK model guidelines (EPA 1994). The IEUBK default total meat intake (grams per day) for different age groups is given below; 10% of these values are assumed for the alternate dietary source intake rates for fish/shellfish ingestion.

- 0 to 11 months (29.6 g/day)
- 12 to 23 months (87.4 g/day)
- 24 to 35 months (95.7 g/day)
- 36 to 47 months (101.6 g/day)
- 48 to 59 months (107.4 g/day)
- 60 to 71 months (111.9 g/day)
- 72 to 84 months (121.0 g/day)

4.6.2 Adult Lead Model

Exposure to lead in soil for adults (workers and recreational users) and adolescent recreational users is assessed using the EPA ALM (EPA 2009c). The ALM is based on

protecting the developing fetus of a pregnant woman, the most sensitive subpopulation affected by adult lead exposure and is therefore not directly applicable to adolescents; however, the adolescent population may be considered sensitive since exposures during these years may result in a body burden of lead that is available to transfer to the fetus later in life. Also to be considered is that lead toxicity may occur after only a few months exposure *in utero*, and young women at the upper end of the teenage age range could conceivably be appropriately addressed in the model. Given the limitations of currently available modeling tools, it is reasonable to apply the ALM to adolescent receptors (e.g., recreational scenarios), provided that the appropriate model conditions are met. Important assumptions to be considered for adolescent receptors include: exposure frequency, exposure duration, baseline blood lead (PbB_0), and absorption fraction. Because of the time necessary for blood lead concentrations to stabilize, the ALM is applicable only if the exposure duration exceeds 90 days and the exposure frequency is greater than one day per week. Based on site-specific assumptions, results of the model should be conservative for both age groups.

The ALM does not include inputs for either dermal or inhalation exposure to lead in soil. This is consistent with the IEUBK model for evaluating lead exposure in young children (EPA 2007a). This model does not consider dermal exposure to lead, and demonstrates that even inhalation exposure represents only a small fraction of total lead exposure in residential situations. Neither dermal nor inhalation exposure are considered in the quantitative estimates of possible impacts of lead exposure on blood lead levels.

The ALM (EPA 2009c) is used to assess intermittent or variable exposures to lead in soil at specific site areas for the following receptors:

- Construction/utility workers (all upland areas)
- Adult recreational users (Area 1, Area 2, Areas 5, 6, and beach area of Area 9, and upland area of Area 9)
- Adolescent recreational users, 6 to 18 years in age (Area 1 and upland area of Area 9)
- Pedestrians (adults and adolescents) currently in all areas except 2, 8, and 11 and in the future all areas except 8 and 11

Adult and adolescent trespassers are assumed to trespass currently in Areas 2, 8, and 11 and in the future in Areas 8 and 11. Because of the time necessary for blood lead concentrations to stabilize, the ALM is applicable only if the exposure duration exceeds 90 days and the exposure frequency is greater than one day per week. The exposure frequency of 52 days per year for trespassers does not meet this criterion therefore exposure to lead in soil is not evaluated for trespassers. It should be noted that lead concentrations in surface soil are higher in exposure Areas 8 and 11 than in other exposure areas.

Lead was not selected as a COPC for Areas 3 and 4 where the outdoor workers may be present; therefore, exposure to lead in surface soil is not evaluated for these workers. As discussed previously lead was not selected as a COPC in Areas 3 and 4 because maximum detected concentrations in soil are below the screening criterion of 400 mg/kg for residential soil.

In addition to assessment of exposure to lead in soil the model is applied to evaluate exposure to lead in both fish and shellfish for adult anglers. Adjustments are made to the model to account for seafood intake (EPA 2007d). These adjustments are discussed in the following list of assumptions.

Because there are no models available to assess the health effects for adults exposed to lead in surface water, the potential health effects from exposure to lead in surface water are assessed qualitatively.

Variable values for the model are selected based on recommendations found in the ALM guidance (EPA 2003a, 2009c, 2009d) and site-specific considerations. Exposure assumptions used in the ALM are discussed below and are summarized in Table 4-3.

Target Risks – Fetal Blood Lead Level
Target risks for lead are based on the fetal blood lead level. A fetal blood lead level of 10 µg/dL is the goal for the 95th percentile blood lead concentration among fetuses born to women having exposures to lead in soil. Above this level, adverse health effects to the fetus, the most sensitive receptor affected by adult lead exposure, are expected. This means the likelihood of a fetus blood lead concentration higher than 10 µg/dL would be 5 percent or less.

Background Blood Lead Concentration and Geometric Standard Deviation
The adult PbB_0 concentration is the typical blood lead concentration in women of child bearing age in the absence of exposures to the site that is being assessed. The GSD_i is the estimated value of the individual geometric standard deviation among women of child-bearing age that have exposures to similar onsite lead concentrations but that have non-uniform response to site lead and non-uniform offsite lead exposures. The GSD_i is used to estimate upper percentile blood lead concentrations for an individual and provide a health-protective estimate of the probability of an individual exceeding a given blood lead concentration (target risk goal). GSD_i estimates seem most sensitive to how heterogeneous the population that may use the site is compared to the United States population.

The appropriate PbB_0 for children ages 6 to 18 years is difficult to determine. Brody *et al*. (1994) reported low PbB_0 for children ages 12 to 18 years (which results in preliminary remediation goals ranging from 1,800 to 2,000 parts per million (ppm). The low PbB_0 may be due to a growth spurt in which there is an increase in bone deposition that results in a lower concentration of lead in the blood; however, the total body burden of lead may still be increasing. Other factors may also contribute,

such as increases in blood volume during periods of rapid growth. There is also a potential that lead absorption will be higher in adolescents than in adults.

The TRW (EPA 2003a) currently recommends using a single national estimate instead of the regional or ethnic alternatives previously recommended. Based on the analysis of the National Health and Nutrition Examination Survey (NHANES) 1999–2004 data (Brody *et al*. 1994), the updated values for the $PbB_{adult,0}$ and GSD_i, adult parameters, 1.0 µg/dL and 1.8, respectively, are recommended for all applications of the ALM where current and future use scenarios are assessed. These values are used for adult and adolescent recreational users.

Biokinetic Slope Factor

The biokinetic slope factor relates the increase in adult blood lead concentration to average daily lead uptake (µg/dL blood lead increase per µg/day lead uptake). The default value of 0.4 µg/dL per µg/day provided by EPA (2003a) is based on steady-state conditions. This value is used for all receptors.

Empirical data on biokinetic slope factors appear to be similar for young children and adults; however, there is uncertainty in applying a similar estimate for adolescents. As discussed above reported low baseline blood concentrations for children between the ages of 12 and 18 years of age (Brody *et al*. 1994) may be due to a growth spurt in which there is a shift of lead from blood to bone.

Absorption Fraction

Absorption fraction represents the absolute GI absorption fraction (AF_s) for ingested lead in soil and lead dust derived from soil. For fine fraction soil, the site-specific value of 0.17 (unitless) is used, based on the assumption that the absorption factor for soluble lead is 0.2 ($AF_{soluble}$) and that the relative bioavailability of lead in fine fraction soil compared to soluble lead ($RBF_{soil/soluble}$) is 0.84:

$$AF_s = AF_{soluble}\ (0.2) \times RBF_{soil/soluble}\ (0.84) = 0.17 \qquad (4\text{-}6)$$

For total soil, the site-specific value is the same as the default value of 0.12 (unitless) recommended by the TRW (EPA 2003a), based on a relative bioavailability of lead in soil compared to soluble lead ($RBF_{soil/soluble}$) of 0.6.

Soil/Sediment Ingestion Rate

EPA (2002a) recommends a default value of 330 mg/day for construction/utility workers engaged in short-term activities that may involve intimate contact with soils (e.g., excavation); this value is used to evaluate incidental ingestion of lead for construction workers. EPA does not provide recommendations for soil ingestion rates for recreational receptors. The soil ingestion rate of 100 mg/day for adult workers and residents (EPA 2002a) is used for adult recreational users. This ingestion rate for adults represents more intensive soil contact that would be expected for predominantly outdoor activities than the ALM model default of 50 mg/day.

Adolescent recreational users are also assumed to ingest 100 mg/day soil (EPA 2008a). Adult and adolescent pedestrians are assumed to incidentally ingest 100 mg of soil per day. This ingestion rate is used for recreational users in the wetland area of Area 9 for incidental ingestion of sediment.

Exposure Frequency

Exposure frequency is the number of days per year that an individual may be exposed to site-related contaminants. Construction/utility workers generally participate in only part of the construction or remedial activities, so that a few weeks of exposure are probably all that a single individual might be exposed to, for example, during excavation of a building foundation. Exposures for construction/utility workers are generally short-term and the kinetics of lead exposure require several months before a new equilibrium of blood lead concentration is reached. For this analysis, an exposure frequency of 250 days/year is used for construction/utility workers. The exposure frequency of 100 days per year for a recreational receptor visiting the site (EPA 2009a) is assumed. Adult and adolescent pedestrians are assumed to be exposed to surface soil 350 days per year.

Averaging Time

An averaging time of 365 days is used to calculate PbBs for all receptors.

Lead Exposure Point Concentration

Lead EPCs are calculated for soil and tissue based on the UCL concentrations, as was done for all other chemicals evaluated in the HHRA. However, because ALM guidelines (EPA 2003a) recommend using mean values for calculating risks from lead exposure, mean values are calculated and applied in the ALM.

Fish and Shellfish Ingestion

The ALM analysis can be performed to evaluate the local fish/shellfish contribution to lead exposure (EPA 2007a). In order to evaluate exposure to lead through dietary uptake, reliable site-specific information on fish/shellfish ingestion and bioavailability for lead in fish/shellfish should be available. This approach is applicable to a local or regional source of lead that is not accounted for in nationally based recommendations regarding baseline lead levels, which consider commercially available fish/shellfish species and average fish/shellfish consumption rates. The addition of a specific fish/shellfish exposure pathway may result in a slight overestimation of risk as a result of double-counting of dietary lead, because normal dietary exposure to lead in fish/shellfish is already accounted for by the PbB_0 concentration. The equation from the ALM can be used (with the following modifications) to calculate overall risk posed by consuming fish/shellfish that are contaminated with lead:

$$PbB = \frac{PB_S \times BKSF \times IR_{S+D} \times AF_{S,D} \times EF_S}{AT_{S,D}} + \frac{PB_F \times BKSF \times IR_F \times AF_F \times EF_F}{AT_F} + PbB_0 \quad (4-7)$$

where:

i	=	media (soil [$_S$], soil and dust [$_{S,D}$], or fish/shellfish[$_F$])
Pb_i	=	Media lead concentration (µg/g) (appropriate average concentration)
IR_i	=	Intake rate (g/day)
AF_i	=	Absolute gastrointestinal absorption fraction for ingested lead in media (unitless)
EF_i	=	Exposure frequency (days/year)
PbB_0	=	Baseline blood lead (µg/dL)
BKSF	=	Biokinetic slope factor
AT_i	=	Averaging time (days/year)

Median ingestion rates are calculated for use in the ALM to assess risks from the ingestion of fish and shellfish tissue containing lead. In order to illustrate the range of risks to adults exposed to lead at the site, RME and CTE angler exposure scenarios are evaluated. RME ingestion rate for the adult angler for shellfish is 16 g/day, based on site-specific shellfish ingestion rates from the Burger (2002) study. The CTE ingestion rate for the adult angler for shellfish is 6.6 g/day, based on the recommended mean fish (finfish and shellfish) ingestion rate for freshwater/estuary fish (EPA 1997).

Section 5
Toxicity Assessment

Health criteria used in this risk assessment were obtained from a variety of toxicological sources according to a hierarchy established in the OSWER directive 9285.7-53 (EPA 2003c). The toxicity value hierarchy is as follows:

- Tier 1—EPA's IRIS
- Tier 2—EPA's PPRTVs: The Office of Research and Development/ National Center for Environmental Assessment /Superfund Health Risk Technical Support Center develops PPRTVs on a chemical-specific basis when requested by EPA's Superfund program.
- Tier 3—Other Toxicity Values: Tier 3 includes additional EPA and non-EPA sources of toxicity information, such as the California Environmental Protection Agency (Cal/EPA) and the ATSDR. Priority should be given to those sources of information that are the most current, the basis for which is transparent and publicly available, and which have been peer reviewed.

5.1 Health Effects Criteria for Carcinogens

For chemicals that exhibit carcinogenic effects, EPA and other scientific authorities recognize that one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to malignancy. This non-threshold theory of carcinogenesis purports that any level of exposure to a carcinogen can result in some finite possibility of causing cancer. Generally, regulatory agencies assume the non-threshold hypothesis for carcinogens in the absence of information concerning the mechanisms of carcinogenic action for the chemical. The slope factor (SF) [in units of (mg/kg body weight-day)$^{-1}$] is a number which, when multiplied by the lifetime average daily dose of a potential carcinogen (in mg/kg body weight-day), yields the upper-bound lifetime excess cancer risk associated with exposure at that dose. The SF is developed for exposure through the oral route.

When the units are risk per µg/m^3, it is called the inhalation unit risk (IUR). The IUR is the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to a chemical at a concentration of 1 µg/m^3 in air. Upper-bound is a term used by EPA to reflect the conservative nature of the SFs and IURs—risks estimated using SFs and IURs are considered unlikely to underestimate actual risks and may overestimate risks for a given exposure. Excess lifetime cancer risks are generally expressed in scientific notation and are probabilities. An excess lifetime cancer risk of 1×10^{-6} (one in one million), for example, represents the incremental probability that an individual will develop cancer as a result of exposure to a carcinogenic chemical over a 70-year lifetime under specified exposure conditions.

In practice, SF and IUR estimates are derived from the results of human epidemiology studies or chronic animal bioassays. The animal studies are conducted for a range of doses, including a high dose, in order to detect possible adverse effects.

Since humans are expected to be exposed at lower doses than those used in animal studies, the data are adjusted via mathematical models. The data from animal studies are typically fitted to the linearized multistage model to obtain a dose-response curve. EPA evaluates a range of possible models based on the available data before conducting the extrapolation. The most appropriate model to reflect the data is selected based on an analysis of the data set.

The 95% UCL slope of the dose-response curve, subject to various adjustments and an inter-species scaling factor, is applied to derive the health protective SF and IUR estimate for humans. Dose-response data from human epidemiological studies are fitted to dose-time-response curves. These models provide rough, but reasonable, estimates of the upper limits on lifetime risk. SF and IUR estimates based on human epidemiological data are also derived using health protective assumptions and, as such, they too are considered unlikely to underestimate risks.

Therefore, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using SF and IUR estimates, they could be considerably lower. In addition, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. EPA (1986) has proposed a system for characterizing the overall weight of evidence based on the availability of animal, human, and other supportive data. The weight-of-evidence classification is an attempt to determine the likelihood that an agent is a human carcinogen and thus qualitatively affects the estimation of potential health risks. Three major factors are considered in characterizing the overall weight of evidence for human carcinogenicity:

- The availability and quality of evidence from human studies
- The availability and quality of evidence from animal studies
- Other supportive information that is assessed to determine whether the overall weight of evidence should be modified

Under EPA's risk assessment guidelines (EPA 1986, 1996, 1999), classification of the overall weight of evidence has the following five categories:

- Group A - Human Carcinogen: There is at least sufficient evidence from human epidemiological studies to support a causal association between an agent and cancer.
- Group B - Probable Human Carcinogen: There is at least limited evidence from epidemiological studies of carcinogenicity in humans (Group B1), or, in the absence of adequate data in humans, there is sufficient evidence of carcinogenicity in animals (Group B2).
- Group C - Possible Human Carcinogen: There is inadequate evidence of carcinogenicity in humans.

- Group D - Not Classified: There is inadequate data or no existing data for the chemical.
- Group E - No Evidence of Carcinogenicity in Humans: There is no evidence for carcinogenicity in at least two adequate animal tests in different species, or in both epidemiological and animal studies.

The 2005 (EPA 2005a) Cancer Guidelines provide an update to the Cancer Guidelines (EPA 1986, 1996, 1999). The 2005 Cancer Guidelines emphasize the value of understanding the biological changes that a chemical can cause and how these changes might lead to the development of cancer. They also discuss methods to evaluate and use such information, including information about an agent's postulated *mode of action*, or the series of steps and processes that lead to cancer formation. Mode-of-action data, when available and of sufficient quality, may be useful to draw conclusions about the potency of an agent, its potential effects at low doses, whether findings in animals are relevant to humans, and which populations or life stages may be particularly susceptible. In the absence of mode-of-action information, default options are available to allow the risk assessment to proceed.

The 2005 Guidelines recommend that an agent's human carcinogenic potential be described in a *weight-of-evidence narrative* rather than the previously identified letter categories (A = known, B = probable, C = possible, D = not classifiable, and E = non-human carcinogen). The narrative summarizes the full range of available evidence and describes any conditions associated with conclusions about an agent's hazard potential. For example, the narrative may explain that an agent appears to be carcinogenic by some routes of exposure but not others (e.g., by inhalation but not ingestion). Similarly, a hazard may be attributed to exposures during sensitive life stages of development but not at other times. The narrative also summarizes uncertainties and key default options that have been invoked.

The following are the five recommended standard hazard descriptors:

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

EPA is evaluating the carcinogenic weight of evidence of chemicals through the IRIS chemical process. In this process, chemicals are nominated, and all chemicals are evaluated consistent with the 2005 Guidelines and a narrative developed describing the weight of evidence. The IRIS chemical file is then reviewed, first through internal EPA consensus review and then external peer review. The requirements for in-depth analysis of mode-of-action data and the review process does not allow the equating of a chemical evaluated under the old system with the letter classification using the 2005 Classification narrative; rather, a full analysis of the data is required.

The 2005 Cancer Guidelines also include Supplemental Guidance on the evaluation of early lifetime exposures including the mutagenic mode of action for carcinogenesis. The Supplemental Guidance provides procedures for evaluating chemicals that are carcinogens and either using the data in the development of the potency factors or using age dependent adjustment factors. For chemicals with mutagenic mode of action, the following ratio is applied to the daily intake (EPA 2005b and 2010a):

- Age 0 to less than 2 years: 10
- Age 2 to less than 16 years: 3
- Age greater than or equal to 16 years: 1

The Supplemental Guidance also provides for the evaluation of data on early lifetime exposures where children may be more susceptible. The application of these adjustments for specific chemicals is noted in the risk assessment and, where appropriate, in the presentation of calculated risks.

5.2 Health Effects Criteria for Noncarcinogens

For chemicals that exhibit noncancer (e.g., systemic) effects, many authorities consider organisms to have repair and detoxification capabilities that must be exceeded by some critical concentration (threshold) before the health effect is manifested. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

Health criteria for chemicals exhibiting noncancer health effects for use in risk assessment are generally EPA-derived reference doses (RfDs) and reference concentrations (RfCs). The RfD or RfC is an estimate of average daily exposure to an individual (including sensitive individuals) that is likely to be without appreciable risk of deleterious effects during a lifetime. The RfD is expressed in units of mg chemical per kg body weight per day (mg/kg-day), while the RfC is expressed in units of mg chemical per cubic meter of air (mg/m^3).

RfDs and RfCs are usually derived either from human studies involving work-place exposures or from animal studies, and are adjusted using uncertainty factors to ensure that they are unlikely to underestimate the potential for adverse noncancer health effects to occur. The uncertainty factors reflect scientific judgment regarding the various types of data used to estimate the RfD/RfC and range between 1 and 10. For example, a factor of 10 may be introduced to account for possible differences in response between humans and animals in prolonged exposure studies. Other factors may be used to account for variation in susceptibility among individuals in the human population, use of data from a study with less-than-lifetime exposure, and/or use of data from a study that did not identify a no-observed-adverse-effect level (NOAEL).

RfDs and RfCs provide benchmarks against which estimated doses (i.e., those projected from human exposures to various environmental conditions) might be compared. Doses that are significantly higher than the RfD/RfC may indicate an increased potential of hazard from the exposure, while doses that are less than the RfD/RfC are not likely to be associated with adverse health effects. Note that a dose higher than a reference dose or concentration does not predict a specific disease.

5.3 Toxicity Values

Table 5-1 summarizes the chronic RfDs and Tables 5-2 to 5-4 summarize chronic, subchronic, and acute RfCs used to estimate noncancer effects. In accordance with the inhalation guidance (EPA 2009a), the RfC based on the next longer duration of exposure duration is used as a conservative estimate where the subchronic RfC is not available. For instance, where the subchronic RfC is not available, the chronic RfC is used. Tables 5-5 and 5-6 summarize the cancer SFs and IURs used to estimate cancer risks. These criteria are the most current data, obtained from the May 2011 on-line version of IRIS (EPA 2011c) and PPRTVs (EPA 2011d), the July 2009 on-line version of Cal/EPA Office of Environmental Health Hazard Assessment Toxicity Criteria Database (Cal/EPA 2009), and the December 2010 on-line version of ATSDR (2010). The use of surrogate toxicity values is noted in Tables 5-1 through 5-6.

Seven PAHs have been classified by EPA as Group 2, probable human carcinogens. Toxicity criteria are currently available only for benzo(a)pyrene. The remaining cPAHs are assessed using PAH-specific relative potency factors (RPFs) that express the potency of these cPAHs relative to benzo(a)pyrene (EPA 1993). The RPFs are applied to derive an oral SF for each cPAH.

Section 6
Risk Characterization

In this section of the risk assessment, the human health risks potentially associated with the complete human exposure pathways identified in Section 3 are assessed. Potential risks due to exposures to COPCs in soil, groundwater, surface water, sediment, and fish/shellfish from the site are evaluated by integrating toxicity and exposure assessments into quantitative expressions of cancer risk and noncancer health hazards.

Cancer risk and noncancer health hazard calculations for all COPCs are presented in Tables B-7.1a through B-7.17 in Appendix B and summarized in Tables B-9.1a through B-9.17 and B-10.1a through B-10.17 in Appendix B. Total risks and HIs for each area and receptor are summarized in Table 6-1.

Cancer risks are estimated as the incremental probability of an individual to develop cancer over a lifetime as a result of exposure to a potential carcinogen. The upper-bound excess lifetime cancer risk is estimated by multiplying the lifetime exposure estimated in the exposure assessment (Section 4) by the cancer SF or IUR identified in the toxicity assessment (Section 5).

Excess lifetime cancer risks are generally expressed in scientific notation and are probabilities. An excess lifetime cancer risk of 1×10^{-6} (one in one million), for example, represents the incremental probability that an individual will develop cancer as a result of exposure to a carcinogenic chemical over a 70-year lifetime under specified exposure conditions.

The potential for noncancer health effects is evaluated by comparing an exposure level or concentration over a specified time period with an RfD or RfC derived for a similar exposure period. This ratio of exposure to toxicity is referred to as an HQ. The HI is the sum of the HQs from individual chemicals and exposure routes. If the HI exceeds unity (1), HQs for individual COPCs with similar toxicological effects or mechanism of action may be summed to yield a target organ/effect-specific HI (EPA 1989). The target organ/effect-specific HI is calculated by summing HQs for chemicals with similar toxicological effects (e.g., developmental toxicity) or target organs (e.g., liver). If the sum of all HIs is less than 1, no target organ/effect-specific HIs are calculated because they would not exceed 1. The HI assumes that there is a level of exposure below which it is unlikely even for sensitive populations to experience adverse health effects. However, this value should not be interpreted as a probability; generally, the greater the HI is above unity, the greater the level of concern.

In general, EPA recommends a target HI value of unity (1) and a target cancer risk range of 1×10^{-6} to 1×10^{-4} as threshold values for potential human health impacts. The results presented in the spreadsheet calculations are compared to these target values. These values aid in determining whether additional response action is necessary at the site.

Cancer risks and noncancer HIs are summarized for the site in Tables B-9.1a through B-9.17 and B-10.1a through B-10.17 in Appendix B for the RME scenario and Tables G-2.1a to G-3.3 in Appendix G for the CTE scenario.

6.1 Results of Risk Calculations

Risks for all receptors are estimated using RME assumptions. Risks are also estimated using CTE assumptions in cases where the RME assumptions resulted in risk estimates above EPA thresholds. The comparison of RME and CTE risks provides information about the degree to which variability in and uncertainty about receptor behavior (e.g., amount of water a child ingests per day) influence the risk estimates. CTE risks represent typical exposure patterns rather than the highest possible exposure that is reasonably expected to occur.

Cancer risk and noncancer health hazard estimates for each receptor by exposure area are summarized in Table 6-1.

6.1.1 Current Receptors

Potential risks are estimated for the following receptors under current land use:

- Recreational users in Areas 1, 3 through 6, and 9
- Anglers throughout the site except Areas 3 and 4
- Pedestrians throughout the site except Areas 2, 8, and 11
- Trespassers in Areas 2, 8, and 11
- Outdoor workers in Areas 3 and 4
- Construction/utility workers throughout the site

6.1.1.1 Recreational Users

Recreational users may come into contact with contaminants in surface soil, surface water, and sediment during beach play, water recreation, walking, or playing in the playground. Risk characterization results are summarized below for recreational users by exposure area.

Area 1

The total cancer risks for recreational adults (6×10^{-6}) and adolescents (9×10^{-6}) in Area 1 are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Total noncancer HIs for recreational adults (0.3) and adolescents (0.4) are below the threshold of unity under the RME scenario.

Areas 3 and 4

The total cancer risks for recreational adults (2×10^{-6}) and children (9×10^{-6}) in Areas 3 and 4 are within EPA target cancer risk range; while that for adolescents (3×10^{-7}) is below EPA target cancer risk range under the RME scenario. Total noncancer HIs for recreational adults (0.06), adolescents (0.009), and children (0.6) are below EPA's threshold of unity under the RME scenario.

Areas 5, 6 and Beach Area of Area 9
The total estimated cancer risks for recreational adults (7×10^{-6}) and children (9×10^{-6}) in the beach areas of Area 5, 6, and 9 are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} for the RME scenario. Total noncancer HIs for recreational adults (0.09) and children (0.6) are below EPA's threshold of unity under the RME scenario.

Upland Area of Area 9
The total cancer risks for recreational adults (7×10^{-6}) and adolescents (9×10^{-6}) in the upland area of Area 9 are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} for the RME scenario. Total noncancer HIs for recreational adults (0.3) and adolescents (0.4) are below EPA's threshold of unity for the RME scenario.

6.1.1.2 Pedestrians

Pedestrians may come into contact with contaminants in surface soil. The total estimated cancer risks for pedestrian adults (6×10^{-6}) and adolescents (8×10^{-6}) are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} for the RME scenario. Total noncancer HIs for pedestrian adults (0.4) and adolescents (0.5) are below EPA's threshold of unity under the RME scenario, respectively.

6.1.1.3 Anglers

Anglers may be exposed to contaminants through consumption of fish and shellfish caught at the site. Risks are calculated for consuming fish, hard clam, blue crab (muscle tissue), blue crab (muscle tissue and hepatopancreas), and ribbed mussel separately.

Fish: The total estimated cancer risk for adult anglers (2×10^{-4}) is slightly above EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Cancer risk is entirely attributed to arsenic. When a more typical exposure is considered under the CTE scenario, cancer risk for adult anglers (4×10^{-5}) is within EPA's target range of 1×10^{-6} to 1×10^{-4}. The total estimated cancer risk for children (6×10^{-5}) is within EPA target cancer risk range for the RME scenario.

Total noncancer HI for adult anglers (1) is at EPA's threshold of unity under the RME scenario. Total noncancer HI for children who consume fish caught at the site by anglers (2) is above EPA's threshold of unity under the RME scenario. The target organ/effect HI for the skin also exceeds the EPA threshold. When a more typical exposure is considered under the CTE scenario, total noncancer HI (0.6) is below the threshold of unity.

Hard Clam: The total estimated cancer risk for adult anglers (2×10^{-4}) is slightly above EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Cancer risk is entirely attributed to arsenic. When a more typical exposure is considered under the CTE scenario, cancer risk for adult anglers (3×10^{-5}) is within EPA's target range of 1×10^{-6} to 1×10^{-4}. The total estimated cancer risk for children (7×10^{-5}) is within EPA target cancer risk range for the RME scenario.

Total noncancer HI for adult anglers (1) is at EPA's threshold of unity under the RME scenario. Total noncancer HI for children who consume hard clam caught at the site by anglers (2) is above the threshold of unity under the RME scenario. The target organ/effect HIs for the skin also exceeds the EPA threshold. When a more typical exposure is considered under the CTE scenario, total noncancer HI (0.9) is below EPA's threshold of unity.

Ribbed Mussel: The total estimated cancer risk for adult anglers (1×10^{-4}) is at the upper end of EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} for the RME scenario. Cancer risk is entirely attributed to arsenic. The total estimated cancer risk for child who consumes ribbed mussel caught at the site by anglers (4×10^{-5}) is within EPA target cancer risk range under the RME scenario.

Total noncancer HIs for adult anglers (0.7) and child who consumes ribbed mussel caught at the site by anglers (1) are below and at EPA's threshold under the RME scenario, respectively.

Blue Crab (Muscle Tissue): The total estimated cancer risks for adult anglers (3×10^{-5}) and child who consumes muscle tissue of blue crabs caught at the site by anglers (1×10^{-5}) are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Total noncancer HIs for adult anglers (0.2) and children who consume muscle tissue of blue crab caught at the site by anglers (0.3) are below EPA's threshold of unity under the RME scenario.

Blue Crab (Muscle Tissue and Hepatopancreas): The total estimated cancer risks for adult anglers (4×10^{-5}) and child who consumes muscle tissue and hepatopancreas of blue crabs caught at the site by anglers (2×10^{-5}) are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Total noncancer HIs for adult anglers (0.6) and children who eat muscle tissue and hepatopancreas of blue crab caught by anglers (1) are below and at the threshold of unity, respectively, under the RME scenario, respectively.

Arsenic is the risk driver for consumption of fish and shellfish. The concentrations of arsenic in hard clam and ribbed mussel tissue samples correlate with arsenic concentrations in sediment samples. The highest arsenic concentrations in shellfish tissues (e.g., hard clam sample MER-3 and ribbed mussel sample RM-6) were found in samples collected in Area 1, which also contained the highest subtidal sediment arsenic concentrations (e.g., 40.2 J mg/kg in A63) (Figure 2-4). Thus, the presence of arsenic in shellfish is most likely attributable to arsenic contamination in Area 1.

It is noted that the toxicity among the different arsenic compounds varies greatly. Inorganic arsenic is the most toxic, whereas organoarsenic compounds are generally less toxic (ATSDR 2007). Most arsenic found in fish, and in marine animals in general, is arsenobetaine, often constituting more than 90% of the total arsenic (Irvin and Irgolic 1988, ATSDR 2007, and Peshut *et al*. 2008). Arsenobetaine is an organic

arsenic compound, which is regarded as less toxic than inorganic arsenic and does not pose a concern for seafood safety (National Institute of Nutrition and Seafood Research [NIFES] 2011 and ATSDR 2007). Since arsenic speciation analysis was not performed for this HHRA, it is conservatively assumed that all arsenic in fish and shellfish is in inorganic forms. This assumption can be excessively conservative and lead to overestimate potential risks to anglers and people who consume fish or shellfish caught at the site by anglers. More discussion of risks associated with arsenic in fish and shellfish is provided in Section 6.4.3.

6.1.1.4 Trespassers

Trespassers may come into contact with contaminants in surface soil. Risk characterization results are summarized below for trespassers by exposure area.

Area 2: The total estimated cancer risks for adult trespassers (1×10^{-6}) and adolescent trespassers (2×10^{-6}) for the RME scenario are at and within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}, respectively. Total noncancer HIs for adult trespassers (0.06) and adolescent trespassers (0.07) are below EPA's threshold of unity under the RME scenario.

Areas 8 and 11: The total estimated cancer risks for adult trespassers (6×10^{-6}) and adolescent trespassers (8×10^{-6}) are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Total noncancer HIs for both adult trespassers (0.2) and adolescent trespassers (0.3) are below EPA's threshold of unity under the RME scenario.

6.1.1.5 Outdoor Workers

Outdoor workers may come into contact with contaminants in surface soil. The total estimated cancer risk for outdoor workers (6×10^{-6}) is within EPA target cancer risk range under the RME scenario. The total noncancer HI for outdoor workers (0.08) is below EPA's threshold under the RME scenario.

6.1.1.6 Construction/Utility Workers

Construction/utility workers may come into contact with contaminants in soil and groundwater. The total cancer risk for construction/utility workers (2×10^{-6}) is within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. The total noncancer HI for construction/utility workers (1) is at EPA's threshold of unity under the RME scenario.

6.1.2 Future Receptors

Potential risks are estimated for the following receptors under future land use:

- Recreational users in Areas 1 through 6, and 9
- Anglers throughout the site except Areas 3 and 4
- Pedestrians thought the site except Areas 8, and 11

- Trespassers in Areas 8 and 11
- Outdoor workers in Areas 3 and 4
- Construction/Utility Workers throughout the site
- Residents throughout the site

6.1.2.1 Recreational Users

Risk characterization results for future recreational users in Area 1, Areas 3 and 4, Areas 5 and 6, the beach area of Area 9, and the upland area of Area 9 are the same as those for current recreational users in these exposure areas (Section 6.1.1).

At Area 2, the total estimated cancer risks for recreational adults (1×10^{-5}) and children (2×10^{-5}) are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} for the RME scenario. Total noncancer HIs for recreational adults (0.2) and children (1) are below and at EPA's threshold of unity, respectively, under the RME scenario.

6.1.2.2 Pedestrians

The total estimated cancer risks for pedestrians exposed to contaminants in all areas, except Areas 8 and 11, adults (6×10^{-6}) and adolescents (8×10^{-6}) are within EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} under the RME scenario. Total noncancer HIs for recreational adults (0.4) and adolescents (0.5) are below EPA threshold of unity under the RME scenario.

6.1.2.3 Anglers

Risk characterization results for future anglers and children who consume fish and shellfish (blue crab, hard clam, and ribbed mussel) are the same as those for current angler scenario (Section 6.1.1.3).

6.1.2.4 Trespassers

At Areas 8 and 11, the total estimated cancer risks and noncancer health hazards for adult and adolescent trespassers are the same as those under current land use conditions (Section 6.1.1.4), -within EPA target cancer risk range and below EPA noncancer threshold under the RME scenario.

6.1.2.5 Outdoor Workers

Risk characterization results for future outdoor workers are the same as those for current outdoor workers (Section 6.1.1.5). Cancer risk is within EPA target risk range and noncancer HI is below EPA noncancer threshold.

6.1.2.6 Construction/Utility Workers

Risk characterization results for future construction/utility workers are the same as those for current construction/utility workers (Section 6.1.1.6). Cancer risk is within EPA target risk range and noncancer HI is at EPA noncancer threshold.

6.1.2.7 Residents

Under future land use scenario, if a private potable well is installed at the site, future hypothetical residents may consume groundwater beneath the site as drinking water. Cancer and noncancer risk estimates for future residents from potential exposure to groundwater via drinking water uses are discussed below.

Under the RME scenario, the total estimated cancer risk for future residents (9×10^{-5}) is within EPA's target range of 1×10^{-6} to 1×10^{-4} and the total noncancer HI for future residents (15) is above EPA's threshold of unity (1). The target organ/effect HIs for the respiratory system (5), thyroid gland (5), and GI system (7) are greater than one for residents. The potential health hazards to the respiratory system and thyroid gland are attributed to cobalt. The potential for adverse health effect to the GI system is a result of future exposure to iron in groundwater. When a more typical exposure is considered under the CTE scenario, the target organ/effect HIs for the respiratory system (2), thyroid gland (2), and GI system (3) still exceeds EPA's threshold.

Although iron is a major component of the slag at site, iron oxyhydroxide is typically stable or insoluble in water. It becomes soluble under reducing and low pH conditions while ferric iron is reduced to the more soluble ferrous iron. The high levels of iron in groundwater are attributable to the anaerobic conditions in that portion of the aquifer likely a result of the organic rich water from the wetland. Cobalt is a naturally occurring metal and is not a major component of the slag. Cobalt may be released from soil under acidic conditions in groundwater in Areas 1, 4, and the upland area of Area 9.

6.2 Risks Associated with Exposure to Lead

As described in Section 4.6 risks from exposure to lead were not quantified following the methods used for other COPCs. Because the toxicokinetics of lead (absorption, distribution, metabolism, and excretion) of lead are well understood, health risks from lead exposure were evaluated based on blood lead concentration, which can be modeled. Results of blood lead modeling for children (IEUBK) and adults and adolescents (ALM) are presented in the following subsections for each exposure area where lead was selected as a COPC.

6.2.1 IEUBK Model for Young Children

The IEUBK model is a software package which allows the user to estimate, for a hypothetical child or population of children, a plausible distribution of blood lead concentrations centered on the geometric mean blood lead concentration predicted by the model from available information about children's exposure to lead. Model output is provided in the form of a probability density curve that describes the probability of blood lead concentrations occurring in a hypothetical population of children.

The Centers for Disease Control and Prevention (CDC) has established 10 µg/dL as a level-of-concern threshold for blood lead concentrations for children. Protection of young children is considered achieved if the odds of a typical or hypothetical child (or group of similarly exposed children) with blood lead levels of 10 µg/dL or greater is no more than 5 percent (EPA 1994). The probability density curve designates the percentage of children that are predicted to have blood lead concentrations that may exceed the threshold. Results of the IEUBK model are discussed below and are summarized on Table 6-2. Parameters used in the IEUBK model were summarized on Table 4-2 and are provided in Appendix E for each scenario evaluated.

Areas 5, 6, and Beach Area of Area 9

Current and future recreational children are assumed to be exposed to lead in surface soil in Areas 5, 6, and beach area of Area 9. The EPC for soil in these areas for both current and future scenarios was 67.96 mg/kg. Based on this level of exposure, much less than 1% (which is shown in Appendix E, Figure E-1 as the area under the curve to the right of the vertical line which represents 10 µg/dL) of the modeled child population would have blood lead concentrations that exceeded the CDC level of concern for these areas. EPA's risk reduction goal for contaminated sites is that no more than 5% of the population of children exposed to lead will have blood lead concentrations greater than 10 µg/dL. Based on the results of the IEUBK model for Areas 5, 6, and the beach area of Area 9, lead in surface soil is not considered a chemical of concern for these areas.

Area 2

In the future recreational children are also assumed to be exposed to lead in surface soil in Area 2. The IEUBK model was run using results for the fine and total fraction of lead in soil. Site-specific estimates of relative bioavailability of lead in soil is 84% for fine fraction soil (<250 µm) and 60% for total soil. Bioavailability of lead from the GI tract is thus assumed to be 42% for fine fraction soil and 30% for total soil. EPCs for the fine fraction and total lead fractions were 685 mg/kg and 485 mg/kg, respectively.

Considering only exposure to the fine fraction of lead in soil and its increased bioavailability, 42% of children exposed to the fine fraction of lead in Area 2 may have blood lead concentrations greater than 10 µg/dL (Appendix E, Figure E-2). Based on exposure to total lead in surface soil 9.9% of children exposed to lead in Area 2 may have blood lead concentrations greater than 10 µg/dL (Appendix E, Figure E-3). These results indicate that young children exposed to lead in surface soil in Area 2 may be at risk to develop blood lead concentrations above the threshold of concern.

Groundwater

The IEUBK model was run for future hypothetical child residents consuming groundwater beneath the site as drinking water. The EPC for groundwater is 10.57 µg/L. Using all model defaults with the exception of drinking water intake, the IEUBK model predicts that 1% of children will have blood lead concentrations greater than 10 µg/dL (Appendix E, Figure E-4). These results suggest that, based on available data children, would not be exposed to lead in drinking water at levels above the threshold of concern.

Angler Scenario

The IEUBK model was run using alternative dietary data for seafood consumption using site-specific tissue concentration data and model defaults for other parameters. Young children were evaluated for exposure to lead from the consumption of shellfish caught from waters in the area; these receptors are considered family members of anglers and are considered as a separate subpopulation.

Probability curves were generated for children consuming hard clam tissue, blue crab muscle tissue, blue crab muscle tissue including the hepatopancreas, and ribbed mussel tissue separately assuming ingestion of these species was 10% of the total meat ingestion rate for children. Lead was not selected as a COPC for fish tissue samples collected and therefore exposure to lead in fish was not evaluated. For all shellfish consumption scenarios, concentrations of lead in shellfish do not result in more than 5% of children with blood lead levels above 10 µg/dL (Table 6-2).

The IEUBK model predicts that 2% of children consuming hard clams would have blood lead levels that are above the level of concern of 10 µg/dL (Appendix E, Figure E-5). For children consuming blue crab muscle tissue and blue crab muscle tissue plus the hepatopancreas, the IEUBK model predicts 0.4% of children would have blood lead levels that are above the level of concern of 10 µg/dL (Appendix E Figure E-6 and Figure E-7, respectively). The IEUBK model predicts that 0.6% of children consuming ribbed mussels would have blood lead levels that are above the level of concern of 10 µg/dL (Appendix E Figure E-8).

6.2.2 Adult Lead Model Results for Adults and Adolescents

Exposure to lead in soil for adults (construction/utility workers, pedestrians, and recreational users) and adolescent recreational users and pedestrians is assessed using the EPA ALM (EPA 2009c). Lead risks were assessed by estimating the probability of exceeding the threshold blood lead concentration of 10 µg/dL in the fetus through the evaluation of the exposure of the pregnant mother.

The ALM (EPA 2009c) is used to assess intermittent or variable exposures to lead in soil at specific site areas for the following receptors:

- Construction/utility workers (all upland areas)

- Adult recreational users (Area 1, Area 2, Areas 5, 6, beach area of Area 9, and upland area of Area 9)
- Adolescent recreational users, 6-18 years in age (area 1 and upland area of area 9)
- Pedestrians (adults and adolescents), all areas except 2, 8, and 11 for the current scenario and all areas except Areas 8 and 11 in the future

Results of blood lead modeling for adults and adolescents are presented in the following subsections. A summary of the results of the ALM model is provided on Table 6-3; individual modeling results are provided in Appendix E.

6.2.2.1 Recreational Users Exposed to Lead in Surface Soil

Adult and adolescent recreational users were evaluated for exposure to lead in soil in Area 1, Area 2, Areas 5, 6, beach area of Area 9, and upland area of Area 9. Future recreational adult users were also evaluated for exposure to lead in Area 2. For all recreational scenarios probabilities for fetal blood lead concentrations to exceed the target threshold value of 10 µg/dL were below the level of concern (i.e., less than 5 percent). Results for each exposure area are summarized below.

Area 1

The ALM was used to assess lead exposures for adult and adolescent recreational users exposed to lead in surface soil currently and in the future. For exposure area 1 the 95% percentile of the predicted blood lead concentration for the developing fetus of adult and adolescent recreational users was 4.1 µg/dL. The probability of exceeding the 10 µg/dL blood lead threshold for adult and adolescent recreational users was 0.08%. These levels are below the target threshold levels, indicating that adverse health effects to the fetus, the most sensitive receptor affected by adult lead exposure, are not expected.

Area 2

For future adult recreational users of exposure Area 2 the 95% percentile of the predicted blood lead concentration for the developing fetus was 3.9 µg/dL based on the total lead concentration and 5.4 µg/dL based on the fine fraction. The probability of exceeding the 10 µg/dL blood lead threshold for adult recreational users was 0.06% and 0.35% for the total and fine fraction, respectively. These levels are below the target threshold levels, indicating that adverse health effects to the fetus, the most sensitive receptor affected by adult lead exposure, are not expected.

Areas 5, 6, and the Beach Area of Area 9

For current and future adult and adolescent recreational users of exposure Areas 5, 6, and the beach area of Area 9 the 95% percentile of the predicted blood lead concentration for the developing fetus was 2.6 µg/dL. The probability of exceeding the 10 µg/dL blood lead threshold for adult and adolescent recreational users was 0.004%. These results suggest that adverse health effects to the fetus, the most sensitive receptor affected by adult lead exposure, are not expected.

Upland Area of Area 9

For current and future adult and adolescent recreational users of upland area of Area 9 the 95% percentile of the predicted blood lead concentration for the developing fetus was 3.1 µg/dL. The probability of exceeding the 10 µg/dL blood lead threshold for adult and adolescent recreational users was 0.02%. These results indicate that adverse health effects to the fetus, the most sensitive receptor affected by adult lead exposure, are not expected.

6.2.2.2 Pedestrians Exposed to Lead in Surface Soil

The ALM was used to assess lead exposures for current and future pedestrians assumed to be exposed to lead in surface soil in all areas except Areas 2, 8, and 11 for the current scenario and Areas 8 and 11 for future scenarios. The 95% percentile of the predicted blood lead concentration for the developing fetus for all pedestrian scenarios were below 10 µg/dL (Table 6-3). The probability of exceeding the 10 µg/dL blood lead threshold was below 1% for all pedestrian scenarios. These results indicate that adverse health effects for pedestrians exposed to lead in surface soil are not expected.

6.2.2.3 Construction/Utility Workers

The ALM was used to assess lead exposures for construction/utility workers assumed to be exposed to lead in surface and subsurface soil in all upland areas currently and in the future. All exposure assumptions are the same for current and future scenarios; therefore, risk estimates for current and future scenarios are the same. The 95% percentile of the predicted blood lead concentration for the developing fetus of adult construction/utility workers was 12.8 µg/dL (Table 6-3). The probability of exceeding the 10 µg/dL blood lead threshold for current and future construction/utility workers was 11%. This level is above target threshold levels, indicating that adverse health effects to the fetus, the most sensitive receptor affected by adult lead exposure, may be expected. This conclusion is based on the conservative assumption that construction/utility workers are exposed to soil in upland areas for 250 days per year and incidentally ingest 330 mg/kg of soil per day.

Construction/utility workers may also be exposed to lead in shallow groundwater in Areas 6, 8, and 9; however, exposure to lead in water medium cannot be evaluated using the ALM model. Because workers are assumed to ingest only small amounts of water while working in contact with groundwater and the exposure point concentration for lead in shallow groundwater is 6.33 µg/L (which is below the EPA action level of 15 µg/L) risks to workers exposed to lead in groundwater are not expected to be above levels of concern.

6.2.2.4 Anglers

In addition to assessment of exposure to lead in soil the ALM model is applied to evaluate exposure to lead in shellfish for adult anglers. Adjustments are made to the model to account for seafood intake (EPA 2007d). Median ingestion rates are

calculated for use in the ALM to assess risks from the ingestion of shellfish tissue containing lead. In order to illustrate the range of risks to adults exposed to lead at the site, RME and CTE angler exposure scenarios are evaluated. RME ingestion rates for the adult angler for shellfish are 16 g/day. The CTE ingestion rate for the adult angler shellfish is 6.6 g/day; CTE is evaluated if RME risks are above levels of concern. The addition of a specific fish/shellfish exposure pathway may result in a slight overestimate of risk as a result of double-counting of dietary lead, because normal dietary exposure to lead in fish is already accounted for by the PbB_0 concentration.

The ALM was used to evaluate lead exposure for adults who consume hard clam tissue, blue crab muscle tissue, blue crab muscle tissue including the hepatopancreas, and the ribbed mussel tissue caught at the site. For all shellfish consumption scenarios, the probability of fetal blood lead concentrations exceeding 10 µg/dL was less than 1% (Table 6-3). These results indicate that adverse health effects are not expected for anglers exposed to lead in shellfish based on the available data.

6.2.2.5 Sediment

Adult and adolescent recreational users were evaluated for exposure to lead in sediment in wetland areas of Area 9. The probability of the fetal blood lead level exceeding the 10 µg/dL blood lead threshold was below 1% for adults and adolescents exposed to sediment (Table 6-3). These results indicate that adverse health effects for recreational users exposed to lead in sediment in the wetlands of Area 9 are not expected.

6.2.2.6 Surface Water

Because there are no models available to assess the health effects for adults and adolescents exposed to lead in surface water, the potential health effects from exposure to lead in surface water are assessed qualitatively. Recreational users may be exposed to lead in surface water while swimming and playing in water at the site. Important considerations for exposure to lead in surface water are the effects of winds, currents, and tides on contaminant concentrations and the chemical form of lead in surface water. The chemical form in surface water affects the solubility and absorption of lead.

Incidental ingestion rates for surface water are assumed to a fraction of the drinking water ingestion rate. The maximum incidental ingestion rate for recreational users assumed in the HHRA was 0.05 liter per hour for 1 hour per day. Most agencies (including EPA) assume consumption of 2 liters of drinking water per day. Using a simple screening approach, a surface water concentration exceeding 40 times that stipulated in drinking-water guidelines may merit further consideration. The surface water exposure point concentration was 106.2 µg/L which is below 40 times the EPA action level for lead in groundwater (40×15 µg/L=600 µg/L). This suggests adverse

health effects due to exposure to lead in surface water site wide are not anticipated for recreational users who incidentally ingest surface water.

6.2.3 Summary of Lead Risk

The IEUBK and the ALM models were used to assess risks to current and future receptors from exposure to lead in surface soil, sediment, groundwater, and biota. Exposure to lead in surface water was evaluated qualitatively.

For young children, 0 to 6 years in age, the IEUBK model was used to evaluate risks from exposure to lead in surface soil, groundwater, and biota. Protection of young children is considered achieved if the odds of a typical or hypothetical child (or group of similarly exposed children) with blood lead levels of 10 µg/dL (the threshold of concern) or greater is no more than 5 percent. Less than 5% of young children recreating in exposure Areas 5, 6, and the beach area of Area 9 were predicted to have blood levels above areas 10 µg/dL. This result suggests that exposure to lead in surface soil in these areas is not a concern for recreational children. Forty-two percent of children recreating in Area 2 exposed to the fine fraction of lead in surface soil may have blood lead levels above 10 µg/dL. Based on exposure to total lead in soil, 9.9% of children exposed to lead in surface soil in Area 2 may have blood lead levels exceeding 10 µg/dL. These results indicate that children recreating in Area 2 could be at risk to develop blood lead levels above the threshold of concern. For all shellfish consumption scenarios, concentrations of lead in shellfish result in less than 5% of children with blood lead levels above 10 µg/dL. This suggests that, based on the scenarios evaluated, young children are not at risk from lead exposure due to consuming shellfish from the site. The IEUBK model predicted 1% of children consuming groundwater beneath the site may have blood lead levels above 10 µg/dL; this probability is below the threshold level of concern.

Exposure to lead in soil for adults and adolescents was assessed using the EPA ALM. Lead risks are assessed by estimating the probability of exceeding the fetal blood lead concentration threshold of 10 µg/dL through the evaluation of the exposure of the pregnant mother. Adult and adolescent recreational users were evaluated for exposure to lead in surface soil in Areas 1, 2, 5, 6, the beach area of Area 9, and the upland area of Area 9. Future recreational adult users were also evaluated for exposure to lead in Area 2. Pedestrians were assumed to be exposed to lead in surface soil in all areas except Areas 2, 8, and 11 currently and all areas except 8 and 11 in the future. The probabilities for fetal blood concentrations to exceed the threshold of concern for all current and future pedestrians, recreational adults and adolescents were less than 1%, indicating that exposure to lead in surface soil is not a concern for these receptors in the exposure areas evaluated. Results of the ALM indicate that exposure to lead in sediment in the upland areas of Area 9 for recreational receptors would not result in blood lead levels above a level of concern. The probability that fetal blood lead level would be above a level of concern were

about 11% for construction/utility workers exposed to lead in surface and subsurface soil in upland areas; this result is above the threshold level of concern.

In addition to assessment of exposure to lead in soil, the ALM model was used to evaluate exposure to lead in shellfish for adult anglers. For all shellfish consumption scenarios, the probability of fetal blood lead concentrations exceeding 10 µg/dL was less than 1%. These results indicate that adverse health effects are not expected for anglers exposed to lead in shellfish based on the available data.

Recreational users were assumed to be incidentally ingest lead in surface water while swimming or playing in waters at the site. The drinking-water guideline for lead was adjusted to account for the reduced incidental ingestion rate of surface water (drinking water guideline = 15 µg/L, surface water incidental ingestion screening level = 600 µg/L). The lead EPC for surface water was significantly below the estimated screening level, which suggests the recreational receptor exposed to lead in surface water is not a significant exposure pathway.

6.3 Risks from Background Concentrations

Many chemicals, such as metals and PAHs, occur naturally in the environment and are commonly present in all environmental samples. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program includes provisions for evaluating chemical concentrations in background areas. The program distinguishes between natural background and anthropogenic background. Natural background is defined as "substances present in the environment in the forms that have not been influenced by human activities." Anthropogenic background is defined as the combination of both natural and anthropogenic substances present in the environment as a result of human activities not specifically related to the CERCLA release in question (EPA 2002c).

Results of this HHRA indicate that lead is the risk driver in soil, arsenic is the risk driver in fish/shellfish, and iron and cobalt are risk drivers in groundwater for the future hypothetical drinking water scenario. Lead, arsenic, and iron are related to battery casing and slag wastes at the site. They are also known to be present in soil and sediment from background areas of Raritan Bay. PAHs are among the diverse products of the incomplete oxidation of organic fuels, such as coal, oil, wood, and organic wastes. PAHs are ubiquitous in soil and risk-based criteria are typically below anthropogenic background. Since PAHs are not risk drivers at the site, risk contributed from background PAH concentrations is not discussed herein.

An evaluation of soil background concentrations was conducted as part of the RI. The evaluation established soil and sediment background concentrations for assessment of potential environmental impacts from slag and wastes on soils at the site. The 95 percent upper prediction limit values were derived for soil, sediment, and wetland sediment.

- Arsenic - 16 mg/kg in soil, 11 mg/kg in subtidal sediment, and 46 mg/kg in wetland sediment
- Lead - 21 mg/kg in soil, 20 mg/kg in subtidal sediment, and 193 mg/kg in wetland sediment

Site-specific lead background levels in soil and sediment are below the EPA's screening level of 400 mg/kg for residential soil. Therefore, risks contributed from background lead are minimal.

Site-specific arsenic background levels in soil and subtidal sediment are comparable to the natural soil arsenic background level of 19 mg/kg in New Jersey (N.J.A.C 7:26D). The site-specific and New Jersey natural soil arsenic background levels are 30 to 50 times the EPA risk-based screening level of 0.39 mg/kg. Similar to natural arsenic background concentrations were found in soils in Areas 3 and 4, Areas 5 and 6, and the beach area of Area 9, while above background levels of arsenic were found in soils in Area 1, Area 2, Areas 8 and 11, and the upland area of Area 9. The presence of elevated arsenic levels in soils in these areas is apparently due to past disposal of slag and battery casing.

The cancer risk estimates associated with fish and shellfish consumption are entirely driven by arsenic. These risk estimates do not consider the percent of the total arsenic risk that may be attributable to background sources, such as arsenic that occurs naturally in the sediment. Concentrations of arsenic in subtidal sediment at the site are generally below or comparable to site-specific background of 11 mg/kg and the New Jersey natural background level of 19 mg/kg, with the exception of few high concentrations in Area 1. It is noted that the highest arsenic concentrations in hard clam (MER-3) and ribbed mussel (RM-6) tissues correlate with the highest arsenic concentrations in subtidal sediment. Clams and mussels are good indicators of contamination in marine environments because they are sessile or sedentary, are filter feeders, and are in constant or frequent contact with bottom sediment. The presence of arsenic in clam and mussel tissues is most likely attributable to arsenic contamination in Area 1.

Iron is identified as a COPC in soils in all areas (Table 3-1). The arithmetic mean and the 95%UCL of the mean iron concentrations in soil in all areas, however, are below the Middlesex County background iron concentration of 42,200 mg/kg (USGS 2011). Although iron is a site-related metal and there are elevated iron concentrations in soils related to slag and other waste material, on average, iron is present in site soil at concentrations comparable to or less than the Middlesex County background iron concentration.

Elevated iron concentrations in groundwater were observed in several wells at the site, but the most highly affected wells are located in the vicinity or downgradient of wetland areas. Although the slag at the site could have contributed some iron, several lines of evidence indicate the elevated iron concentrations in groundwater are

also from existing geochemical conditions in the area. The concentrations of iron in groundwater at the 21 wells sampled across the site varied significantly and ranged from 64.2 µg/L to 372,000 µg/L. The site-specific groundwater background concentration for iron from upgradient well MW-11S is 4,980 µg/L, indicating that iron is naturally occurring at a significant level. The high level iron in groundwater is attributable to reducing conditions in groundwater, not related to iron concentrations in soil.

6.4 Uncertainty in Risk Assessment

As in any risk assessment, the estimates of potential health threats (cancer risks and noncancer health hazards) have numerous associated uncertainties. The primary areas of uncertainty and limitations are qualitatively discussed here. The main areas of uncertainty in this HHRA include environmental data, exposure parameter assumptions, toxicological data, and risk characterization.

6.4.1 Environmental Data

Uncertainty is always involved in the estimation of chemical concentrations. Errors in the analytical data may stem from errors inherent in sampling and/or laboratory procedures. One of the most effective methods to minimize procedural or systematic error is to subject the data to a strict quality control (QC) review. The QC review procedure helps to eliminate many laboratory errors. However, even with all data rigorously validated, it must be realized that error is inherent in all laboratory procedures.

Samples were collected from known and suspected areas of contamination (biased sampling) to delineate the nature and extent of contamination. Although this sampling methodology provided a reasonable estimation of the level of confidence at known or suspected contaminated areas within the site, the possibility exists that the data sets formed by these samples do not accurately represent the level of overall contamination at the site.

The large amount of soil, surface water, and sediment, and to a lesser degree, groundwater and biota samples taken from the site, reduces uncertainty to an acceptable level in most cases. For Area 2 sediment, only one sample was collected from the area. This was a result of the definition of sediment for the site as defined by the spring low tide line. However, the greater direct contact risk to human health is expected to be from contact with soils than from sediments, since soils are more readily accessible and are in closer contact with slag materials. The uncertainty associated with the limited sediment dataset is low.

6.4.1.1 Nondetected Chemicals

Uncertainty is associated with nondetected chemicals. As shown in Table H-1a to Table H-6e in Appendix H, several chemicals were not detected in any samples, but reporting limits exceeded screening levels in a large number of sample results. When

a chemical is not detected and the reporting limit exceeds the screening levels, some degree of uncertainty exists regarding the presence or absence of the chemical.

Soil: All reporting limits for n-nitroso-di-n-propylamine, and reporting limits for some samples for 1,2-dibromo-3-chloropropane (DBCP), 1,2-dibromoethane (EDB), bis(2-chloroethyl)ether, 4,6-dinitro-2-methylphenol, and hexachlorobenzene exceeded their respective soil screening levels. These VOCs and SVOCs are not related to releases from slag and wastes at the site. The uncertainty surrounding the presence of these undetected chemicals in soil is low.

Groundwater: Reporting limits for 18 VOCs, 19 SVOCs, all PCB Aroclors, 3 pesticides, and chromium VI exceeded their respective groundwater screening levels in all samples. Note that, although the reporting limits exceeded screening levels, they are below the federal MCL except for EDB and pentachlorophenol. MCLs are not available for 2 VOCs, 16 SVOCs, all PCB Aroclors, one pesticide, and two metals (chromium VI and cobalt).

High molecular weight PAHs, PCBs, and pesticides are virtually insoluble in water and adsorb tightly to organic matter in soil and sediment. It unlikely that they are present in groundwater at levels that would cause significant health risks to human. The uncertainty surrounding the presence of these undetected chemicals in groundwater is low. VOCs and SVOCs are not related to releases from slag and wastes at the site. The uncertainty surrounding the presence of these undetected chemicals in groundwater is also low. Chromium VI has been identified as a COPC in soil and sediment. It is unknown whether the lack of detection of chromium VI in all groundwater samples with elevated reporting limits truly indicates the absence of chromium VI. Chromium VI may be present at concentrations below the reporting limits, and risks associated with groundwater for construction/utility workers and future residents could be somewhat underestimated.

Surface Water: Reporting limits for 18 VOCs, 17 SVOCs, all PCB Aroclors, 8 pesticides, and chromium VI exceeded their respective surface water screening levels in all samples. Additionally, reporting limits for antimony, selenium, and silver exceeded their respective surface water screening levels in all samples from wetland areas of Area 9.

Screening levels for surface water are based on RSLs for tap water, which are the chemical concentrations in drinking water below which any impacts to human health are negligible or absent (EPA 2010a). The June 2011 RSL provides an updated method of calculating a site-specific screening level for surface water based on recreational uses (EPA 2011e). Site-specific surface water screening levels are calculated based on a young child swimming scenario in the beach areas (e.g., Areas 5, 6 and 9), based on a hazard quotient of 0.1, to account for exposure to multiple chemicals, or a cancer risk of 1×10^{-6}. Computations of site-specific screening levels are facilitated by the use of the Online Screening Level Calculator (EPA 2011b) and

exposure assumptions defined in Section 4.2.1.1. These site-specific screening levels are provided in Table H-4a and Table H-4b in Appendix H.

When compared to site-specific surface water RSLs calculated by the Online Screening Level Calculator (EPA2011b), reporting limits for one VOC (vinyl chloride), two SVOCs, two Aroclors, three pesticides, and chromium VI exceeded their respective screening levels in all samples. Reporting limits for antimony, arsenic, beryllium, cadmium, cobalt, and vanadium exceeded their respective calculated site-specific screening levels in some of samples. As mentioned earlier, with the exception of metals, all other nondetected chemicals are not site-related and are not likely present in surface water. The uncertainty associated with the presence of these undetected chemicals in surface water is low. It is unknown whether the lack of detection of chromium VI in all surface water samples and the lack of detection of antimony, arsenic, beryllium, cadmium, cobalt, and vanadium in some samples with elevated reporting limits truly indicates the absence of these metals. They may be present at concentrations below the reporting limits, and risks associated with surface water for recreational users could be somewhat underestimated.

Sediment: All reporting limits for n-nitroso-di-n-propylamine, and reporting limits for some samples for DBCP, bis(2-chloroethyl)ether, 4,6-dinitro-2-methylphenol, hexachlorobenzene, and pentachlorophenol exceeded their respective sediment screening levels. These VOCs and SVOCs are not related to releases from slag and wastes at the site. The uncertainty associated with the presence of these undetected chemicals in soil is low.

Fish/Shellfish: Reporting limits for antimony and cobalt exceeded the screening levels in all fish and blue crab (muscle tissue) samples, and in some hard clam samples. Reporting limits for vanadium exceeded the screening level in all fish samples and some blue crab (muscle tissue) samples. The reporting limits for mercury exceeded the screening level in all hard clam samples. The reporting limits for selenium exceeded the screening level in some blue crab (hepatopancreas) samples. It is unknown whether the lack of detections of these metals in fish/shellfish at the site truly indicates the absence of these metals. Some metals may be present at concentrations below the reporting limits, and risks associated with consumption of fish/shellfish for anglers could be somewhat underestimated.

6.4.1.2 Rejected Data

Some of the metals results were rejected because several ICP serial dilutions did not yield acceptable percent difference of within 10%. Thirty-seven metals results were rejected for lead and copper, including some very high detections of lead in the upland area of Area 9 (e.g., 67,600 mg/kg in A9-109C). Although the presence of elevated lead concentrations in soil in the upland area of Area 9 is apparent through direct observation of battery casing, smelter wastes, and slag in the area and the very high lead concentrations (e.g., up to 34,697 mg/kg) found in the fine fraction soil samples (Bioavailability Study in Appendix D), the rejected lead data were not used

in the risk assessment. The exclusion of these high detections can result in underestimating potential risks from lead exposure in the upland area of Area 9.

A greater degree of analytical dilution was required for some surface water samples due to matrix interference from sodium. This resulted in higher reporting limits of metals in some surface water samples. Nondetected results with elevated reporting limits were rejected because they are not usable for their intended purpose. It is unknown whether the lack of detections of metals in these rejected surface water samples truly indicates the absence of these metals. Some metals may be present at concentrations below the reporting limits, and risks associated with surface water for recreational users could be somewhat underestimated.

6.4.1.3 Fish/Shellfish Data

Fish: All species collected at the site and used for risk evaluation are highly mobile, meaning that during the limited time they reside in Raritan Bay, they are not likely to be closely associated with the site as they are expected to move freely about Raritan Bay foraging and seeking refuge. Some uncertainties are associated with the representativeness of these fish species.

The concentration in fish is obtained by analyzing skin-on fish fillet. Most consumption will be of fish fillet tissues, but there may be groups of anglers that use or consume all portions of the fish in broth or stews for example. Metals such as lead accumulate in bones while methyl mercury accumulates in muscle tissue. The use of fillet tissue data in the risk assessment may underestimate risks associated with lead to people that consume whole fish.

Use of Ribbed Mussel as a Surrogate for Blue Mussel: Ribbed mussel is generally not consumed by people. The edible blue mussels were not found during the biota sampling, nor are expected to occur at the site because of their intolerance of extreme environmental conditions such as temperature and salinity (Nelson et al. 1995 and Paulson et al. 2003). Because of the same intolerance of environmental conditions, blue mussels were also absent in Arthur Kill, a saltwater channel approximately three miles north of Raritan Bay (Paulson et al. 2003). However, following a conservative approach, ribbed mussels are used as a surrogate for blue mussel. Using ribbed mussel as a surrogate overestimate risks to anglers.

Cooking Methods: The tissue samples used in this HHRA were uncooked portions of the total organism (e.g., skin-on fillets for fish, tissues for clams and mussel, and muscle tissue and hepatopancreas for crab) on a wet weight basis. These portions represent the consumption habits of many, but not all, of the potentially exposed populations. For example, most people cook fish or shellfish before eating them. Risk estimates may be either increased or decreased when cooking is considered. Because there are no standard cooking practices, the assumption that risks would be uniformly reduced by cooking is inappropriate. For example, preparation of smoked or dried fish would likely to increase chemical concentrations while broiling would

likely reduce chemical concentrations as fats drip away. Given the uncertainties in both chemical concentration reduction or concentration associated with different cooking practices, as well as the cooking practices employed by different groups, uncooked tissue samples were used for risk assessment purposes.

6.4.1.4 Screening Levels

The screening levels used in the risk assessment are based on the November 2010 RSLs developed by EPA. Uncertainties associated with screening levels are discussed below.

Surrogate Screening Levels

Risk-based RSLs are not available for many chemicals. Based on similarities in chemical structure and physiological activities, surrogate screening levels are used for several pesticides and PAHs. These surrogate values may result in over- or underestimating risks.

Updated RSLs

This HHRA used the November 2010 RSLs as screening levels. During the time of preparing the risk assessment, an updated RSL dated June 2011 became available (EPA 2011e). The use of a previous version of RSLs (November 2010) generally results in more conservative screening levels, in particular for surface water and sediment. However, the June 2011 RSL version provides a RSL for thallium, which was not available in the previous version. If the June 2011 RSLs were used, thallium would have been identified as a COPC in soil, groundwater, and sediment. It is also noted that RSLs for 1,1-biphenol and xylenes are more stringent in the June 2011 version than the previous ones. If the June 2011 RSL version was used, 1,1-biphenyl would have been retained as a COPC in groundwater. However, these chemicals are not site-related.

Comparison of EPA Screening Levels to New Jersey Standards

In accordance with EPA guidance, this HHRA used EPA risk-based RSLs as screening levels. Applicable or Relevant and Appropriate Requirement, such as Soil Remediation Standards for residential direct contact (N.J.A.C 7:26D) or New Jersey Groundwater Quality Standards for Class IIA groundwater (N.J.A.C 7:9C) developed by NJDEP were not used for screening. In general, RSLs are more stringent than NJDEP Soil Remediation Standards or Groundwater Quality Standards. For example, RSL for arsenic for residential soil is 0.39 mg/kg while the Soil Remediation Standard is 19 mg/kg. Thus, the use of EPA RSL for screening is a more conservative approach.

6.4.2 Exposure Parameter Estimation

There are two major areas of uncertainty associated with exposure parameter estimation. The first relates to the estimation of EPCs. The second relates to parameter values used to estimate chemical intake (e.g., ingestion rate, exposure

frequency).

6.4.2.1 Exposure Point Concentrations

A baseline risk assessment evaluates mean concentrations over an exposure unit, considering all exposures within that area as equally possible. Risks associated with exposures are then assessed by evaluating those average or mean concentrations with exposure factors and the appropriate exposure/toxicity values. In accordance with EPA guidance (1989), when 10 or more samples are collected, the EPC for a specific chemical in a particular medium is based on the 95 percent or higher UCL on the mean, or the maximum detected concentration, whichever is less. Use of a 95% or higher UCL of the mean is simply to ensure that the average concentration is not underestimated.

When calculating EPCs from sampling data, one-half the reporting limits for non-detected chemicals are included in the calculation of the UCL. Any approach dealing with nondetected chemical concentrations is associated with some degree of uncertainty. This is because the nondetected result does not indicate whether the chemical is absent from the medium, present at a concentration just above zero, or present at a concentration just below the reporting limit. For chemicals that are infrequently detected, many of the values used to estimate the EPCs are based on reporting limits. High reporting limits for non-detects can lead to overestimate risk if the actual concentrations are well below the reporting limit.

Site-related metals such as lead, arsenic, and copper were detected in greater than 95% of the soil samples, greater than 80% of the sediment samples, and almost all groundwater samples. The use of ½ the reporting limits for nondetected results would have minimal impact to the UCL calculations for these metals in soil, groundwater, and sediment. Antimony was less frequently detected in soil (40%), groundwater (65%), and sediment (18%). The UCL calculations for antimony in soil, groundwater, and sediment are associated with more uncertainty. Similarly, chromium VI was less frequently detected in soil (50%) and sediment (29%) and was not detected in groundwater. The UCL calculations for chromium VI in soil and sediment are associated with some uncertainty. All of the metals were detected in less than 30% of the surface water samples and chromium VI was not detected. The uncertainty associated with the UCL calculations for metals in surface water is high.

The HHRA evaluated surface water in Raritan Bay as a whole based on the consideration that Raritan Bay is a highly dynamic system. Surface water is constantly mixed and moved around by tidal currents and wave-driven currents. Because hydrodynamic forces constantly distribute and redistribute dissolved metals in the bay, the approach of evaluating surface water samples as a whole is more representative of the condition in the bay. It is possible that an individual could be exposed to an area of surface water with elevated concentrations of site related contaminants, such as in Area 2. Concentrations of lead in surface water samples collected from Area 2 ranged from 867 µg/L to 1,450 J µg/L, much higher than the

EPC of 106 µg/L used in the risk assessment. The lead concentrations in Area 2 are at least 60 times the federal MCL of 15 µg/L. This may indicate a concern for individuals who incidentally ingest surface water in Area 2. The EPCs of antimony, arsenic, and copper in surface water used in the risk assessment were higher than the maximum concentrations of these metals detected in Area 2. Total chromium was detected in surface water but was not evaluated quantitatively due to lack of toxicity values.

In summary, the approach of evaluating surface water in Raritan Bay as a whole is protective and is unlikely to underestimate possible risks of site-related metals with the exception of lead. Risks from lead may be underestimated to future recreational users in Area 2.

Additional samples were collected in Area 2 in April 2011 in order to further delineate nature and extent of contamination in the area. These included eight surface soil, five surface water, and two sediment samples. These recent data were not included in the risk assessment. The results of the April 2011 sampling event were compared to those used in the HHRA for the five site-related metals (i.e., arsenic, lead, copper, antimony, and chromium). The metal concentrations were generally lower in the April 2011 data, as shown in Table 6-4. For example, lead concentrations in surface soil ranged from 3.6 to 296 mg/kg in the April 2011 data, compared to 6.7 to 3,000 mg/kg used in the risk assessment. Lead ranged in concentrations from 2.4 J µg/L to 3.8 J µg/L in the surface water in the April 2011 data, compared to 867 µg/L to 1,450 J µg/L used in the risk assessment. The lead concentrations in the sediment samples collected in April 2011 were 21.5 mg/kg, similar to the concentration of 18.5 mg/kg used in the risk assessment. The lead concentrations in surface water collected in April 2011 were below the federal MCL of 15 µg/L, compared to the lead EPC of 106 µg/L used in the risk assessment. Similar trends are observed for other metals. Thus, not including the April 2011 data in the risk assessment would not underestimate potential risks for current trespassers and future recreations users in Area 2.

6.4.2.2 Exposure Parameters

Uncertainty is associated with the exposure parameter values used; however, assumptions are chosen to be conservative so as not to underestimate risk. For example, assumptions are made for the exposure time, frequency, and duration of potential chemical exposures, as well as for the quantity of material ingested, inhaled, or absorbed. In general, assumptions are made based on reasonable maximum exposures and, in most cases, values are specified by EPA Region 2, general EPA guidance documents, or site-specific information.

The choices made for exposure parameters are protective and are unlikely to underestimate possible risks. Cancer risks and health hazards could be overestimated based on use of conservative exposure parameters in estimating risks. Certainly, the goal of estimating a risk well above the average and at the upper end of

those possible was likely achieved. Such estimates typically form the basis for risk management and are not atypical of CERCLA risk assessments.

Exposure Frequency

As mentioned in Section 4, access to the wetlands in Area 9 is limited by overgrown dense stands of common reed (*Phragmites australis*), which form dense impenetrable stands throughout the wetlands. It is conservative to assume that recreational users will visit the wetland areas for 100 days per year for 12 years. Risks for recreational users visiting the upland area of Area 9 may be overestimated.

The HHRA assumes that construction/utility workers would come into contact with groundwater during the entire duration of a project, or 250 days per year. This assumption is very conservative. Groundwater generally occurs deeper than 10 feet bgs at the upland area except in Areas 6, 8, and the upland area of Area 9. Construction/utility workers are unlikely to encounter groundwater except working in these areas. Furthermore, exposure to groundwater is unlikely to occur except during excavation and foundation work, which would be very unlikely to require an entire year to complete. Risks for construction/utility workers exposure to groundwater may be overestimated.

The HHRA assumes that pedestrians would visit the site 350 days per year. This assumption is also very conservative, since pedestrians would likely stay away from the site during extreme weather such as storms, heavy rain, snow, or extreme heat. Additionally, during conditions of deep snow cover, extreme cold, or extreme heat, pedestrians could be expected to have minimal or no contact with outside soil.

Ingestion Rates

***Incidental Ingestion of Sediment Rate*:** Incidental sediment ingestion rates for recreations users in the beach areas (i.e., Areas 1, 2, 5, 6, and 9) were evaluated using one tenth of soil ingestion rates identified in EPA guidance. Incidental sediment ingestion rates for recreational users visiting the wetland area of Area 9 were evaluated using soil ingestion rates.

***Fish/Shellfish Ingestion Rates*:** This HHRA conservatively assumes that anglers and their children would consume equal amount of self-caught blue crab, mussel, or hard clam from the site, based on mean crab ingestion rate within the Newark Bay Complex (Burger 2002). Actual consumption rates of blue mussel and hard clam are expected to be much lower. A shellfish license is required for recreational clamming and the amount of clam to be harvested is regulated (NJDEP 2010). Crabbing, on the other hand, does not require a license and there is no limitation on the amount crab that can be collected. Blue mussels were not found during the biota sampling nor are they expected to occur at the site. The assumption could overestimate risks to anglers from consumption of mussel and hard clam.

Dermal Adherence Factors

Dermal adherence factors are used to estimate the amount of soil and sediment that adheres to exposed skin in the assessment of risks posed by dermal exposure to soil and sediment. The main source of uncertainty regarding the dermal adherence factor relates to the differences in the particulate make-up of soil and sediment. Intertidal soils generally have a higher sand fraction than upland soils and may potentially have a greater percentage of larger particles, which are less prone to dermal adherence than small particles. However, higher moisture content in intertidal soil will likely increase the adherence of particles of all sizes. Also important in the discussion of particle size and skin adherence is the concept of monolayer loading of the skin surface. As soil loading of the skin surface increases, the fraction of a chemical that is available to be absorbed will remain constant until all of the skin is covered by a thin layer of soil (known as the mono-layer) (Duff and Kissel 1996). The fraction of a chemical that can be absorbed across the skin will increase as dermal loading increases until the point when the mono-layer threshold is crossed. At that point, the fraction of a chemical that can be absorbed will decrease because not all of the soil is in constant, direct contact with the skin. Both the amount of soil required to form the mono-layer and the associated adherence capability of the soil depend directly on the size of the soil particles and the moisture content of the soil. In general, larger, drier particles will have a lower adherence factor than smaller, moister particles.

The surface area weighted sediment dermal adherence factor for children engaged in beach play based on sediment loadings reported in the study conducted by Shoaf *et al*. is 2.6 mg/cm^2 (EPA 2008a). The Shoaf *et al*. (EPA 2008a) study is the most relevant study to the children's beach play scenarios evaluated in this risk assessment. Using the Shoaf *et al.* (EPA 2008a) dermal adherence factor of 2.6 as an alternative value for intertidal soil and subtidal sediment would lead to a two-folds increase (from 9×10^{-6} to 2×10^{-5} of the total cancer risk for the child recreational users at beach areas (e.g., Areas 5 and 6 and the beach area of Area 9) and a three-folds increase (from 2×10^{-5} to 5×10^{-5}) of the total cancer risks for future child recreational users in Area 2 under the RME scenarios. The higher value for dermal adherence would result in an increase of noncancer HI from 0.6 and 1 at beach areas (e.g., Areas 5 and 6 and the beach area of Area 9) and Area 2 to 0.8 and 3, respectively. Use of the Shoaf *et al*. (EPA 2008a) dermal adherence factor may be inappropriate given the monolayer concept (Duff and Kissel 1996), which limits the dermal adherence to 0.2 mg/cm^2.

Permeability Constants for Contact with Water

Dermal permeability constants (K_p) are used for evaluating the dermal absorbed dose from groundwater and surface water. EPA uses Effective Predictive Domain (EPD) to predict K_p based on octanol/water partition coefficients (K_{ow}) and molecular weight of organic compounds (EPA 2004a). There are, however, many chemicals outside of the EPD, including halogenated organic compounds (e.g., PCE in groundwater and chloroform in surface water) and highly lipophilic molecules (e.g., PAHs in groundwater and surface water). Because of uncertainties and difficulties associated

with estimation of dermal intake using K_p, EPA did not include dermal exposure to tap water in the development of RSLs (EPA 2010a). For the hypothetical use of groundwater as drinking water scenario, contribution from the dermal route accounts for 12% of total excess cancer risk for future residents, with 11% came from PCE. Contribution from the dermal route accounts for less than 0.5% of noncancer HI for future residents. Thus, dermal intake adds to the uncertainty for the evaluation of exposure to cancer risk to future residents.

Dermal Adsorption Factors

In the case of the dermal absorption factor, chemical-specific values based on EPA guidance are not available for most metals. The speciation of the metal is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value. Therefore, dermal risk associated with these chemicals cannot be quantitatively evaluated for the risk assessment, which introduces some uncertainty in total risk and total hazard estimates. However, for most important site-related metals, ingestion is expected to be the primary exposure pathway of concern.

6.4.3 Toxicological Data

A potentially large source of uncertainty is inherent in the derivation of the EPA toxicity criteria (i.e., RfDs, RfCs, and SFs and IURs). In many cases, data must be extrapolated from animals to sensitive humans by the application of uncertainty factors to an estimated NOAEL or lowest-observed-adverse-effect level for noncancer health effects. While designed to be protective, it is likely in many cases that uncertainty factors overestimate the magnitude of differences that may exist between humans and animals, and among humans.

In some cases, however, toxicity criteria may be based on studies that did not detect the most sensitive adverse effects. For example, many past studies have not measured possible toxic effects on the immune system. Moreover, some chemicals may cause subtle effects not easily recognized in animal studies.

In addition, derivation of cancer SFs often involves linear extrapolation of effects at high doses to potential effects at lower doses commonly seen in environmental exposure settings. Currently, it is not known whether linear extrapolation is appropriate. Probably, the shape of the dose response curve for carcinogenesis varies with different chemicals and mechanisms of action. It is not possible at this time, however, to describe such differences in quantitative terms.

It is likely that the assumption of linearity is conservative and yields SFs that are unlikely to lead to underestimation of risks. Yet, for specific chemicals, current methodology could cause SFs and, hence, risks to be underestimated.

6.4.3.1 Arsenic

Arsenic can occur in the environment in several oxidation states. Among the commonly encountered forms inorganic trivalent arsenite (As[III]) is more mobile,

more soluble, more toxic than pentavalent inorganic arsenate (As[V]), and much more toxic than monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA) (Jain and Ali, 2000).

Most arsenic found in fish, and in marine animals in general, is arsenobetaine, arsenoribosides, and arsenocholin. Arsenobetaine, the trimethyl(carboxymethyl)arsonium cation, often constitutes more than 90% of the total arsenic in fish and shellfish (Irvin and Irgolic 1988, ATSDR 2007, Peshut *et al*. 2008). Arsenobetaine is not as toxic as inorganic arsenic and does not pose a problem for seafood safety (Irvin and Irgolic 1988, Shrain *et al*. 1999, ATSDR 2007, NIFES 2011).

The arsenic-carbon bond in organic arsenic compounds is quite strong and most mammalian species do not have the capacity to break this bond; thus, inorganic arsenic is not formed when arsenobetaine is ingested in fish and shellfish. This is in contrast to inorganic arsenic, which undergoes sequential reduction and methylation reactions leading to the formation of MMA and DMA. Inorganic As(V) is readily reduced to inorganic As(III), which is taken up by the cell. Within the cell (primarily in the liver), As(III) is methylated to form MMA(V), which is reduced to MMA(III); MMA(III) subsequently undergoes oxidative methylations to form DMA(V). Methylation of inorganic arsenic in the body is a detoxification process, which reduces the affinity of the compound for tissue (ATSDR 2007). DMA(V) is the primary excretion product in humans (ATSDR 2007). Because inorganic and organic arsenicals exhibit distinct toxicokinetic characteristics, the health effects are very different.

Toxicity values for arsenic are mostly available for inorganic arsenic. Inorganic arsenic is the most toxic, whereas organoarsenic compounds are generally less toxic, although not all compounds have been evaluated at the present. EPA (2011c) has derived a chronic oral RfD of 0.0003 mg/kg-day for inorganic arsenic based on dermal effects in a Taiwanese farming population exposed to arsenic in well water. ATSDR (2007) has derived a same chronic MRL (equivalent to RfD) based on the same Taiwanese study. The chronic MRLs for MMA and DMA are 0.01 mg/kg-day and 0.02 mg/kg-day, respectively, much higher (or less stringent) than the RfD for inorganic arsenic (ATSDR 2007). Using the MRL for MMA of 0.01 mg/kg-day as an alternative RfD for arsenic would lead to a decrease of the total noncancer HIs from 2 to 0.4 and 0.2 for children consuming fish or hard calm under the RME scenario, respectively. An oral SF of 1.5 per mg/kg-day for inorganic arsenic developed by EPA (2011c) is also based on the Taiwanese population study mentioned above.

Arsenic speciation analysis was not performed for the site. In this risk assessment, it is conservatively assumed that all arsenic in environmental media is in the inorganic form. This assumption, in particular for fish and shellfish, can be extremely conservative and could lead to overestimate of potential risks to anglers.

EPA is in the process of reevaluating cancer risk of inorganic arsenic. EPA released

an external review draft of the *IRIS Toxicological Review of Inorganic Arsenic (Cancer)* in February 2010 (EPA 2010e). The draft document derived a much higher (more stringent) SF of 25.7 per mg/kg-day. The draft document has not, at the time of preparing the HHRA, been finalized by EPA. The toxicity values used in the HHRA for arsenic may change in the future.

6.4.3.2 Acute and Subchronic Exposure

Inhalation RfCs are derived for acute, subchronic, and chronic exposures, based on the exposure duration and exposure pattern (EPA 2009a). Chronic exposure is generally used for continuous or near-continuous inhalation exposures that occur for 7 years or longer, such as for resident and site worker exposure. Subchronic exposure refers to repeated exposures for more than 30 days up to 7 years, such as for the construction/utility worker exposure. Acute exposure includes exposures lasting 24 hours or less or intermittent exposures that occur for a series of short periods (e.g., 4 hours) separated by several days of no exposure, such as for trespassers.

Subchronic or acute RfCs are not available for some metals. In accordance with RAGS Part F (EPA 2009a), the RfC based on the next longer exposure duration is used as a conservative estimate that would be protective for the shorter exposure duration. This source of uncertainty may overestimate the potential inhalation hazard for construction/utility workers and trespassers.

6.4.3.3 Chemicals without Toxicity Values

Carbazole, di-n-octyl phthalate, and thallium were detected in soil, groundwater, and sediment samples. They are not quantitatively evaluated in the risk assessment due to the lack of toxicity values.

Carbazole was detected in Area 1 and Area 9 soil at a maximum detected concentration of 890 J µg/kg, below the New Jersey Residential Direct Contact Soil Remediation Standard of 24,000 µg/kg. Potential risk associated with the presence of carbazole in soil is likely to be minimal.

Di-n-octyl phthalate was detected in soil in Areas 3 and 4. Several human studies have reported associations of exposure to phthalates with adverse reproductive outcomes and developmental effects similar to those observed in rats (National Science Academy 2007). Di-n-butyl phthalate is structurally similar to di-n-octyl phthalate. The maximum concentration of di-n-octyl phthalate was 790 J µg/kg, well below the screening level of 61,000 µg/kg for di-n-butyl phthalate (EPA 2011e). Potential risk associated with the presence of di-n-octyl phthalate in soil is likely to be minimal.

Symptoms of thallium toxicity are diverse in both humans and animals. The nervous system is a target organ of thallium, supported by observations from human case reports and animal studies. Previously, the IRIS database contained separate IRIS summaries for each of the five soluble thallium salts (thallium [I] acetate, thallium [I]

carbonate, thallium [I] chloride, thallium [I] nitrate, and thallium [I] sulfate) that were posted in 1988. The previous RfD values for these soluble salts range from 8×10^{-5} to 9×10^{-5} mg/kg-day. These RfDs were withdrawn from the IRIS database due to concerns of poor database quality (EPA 2011c). EPA published a screening PPRTV RfD of 1×10^{-5} mg/kg-day for thallium salts (EPA 2010f) and subsequently developed RSLs for thallium (EPA 2011e). If these RSLs are used, thallium would be identified as a COPC in soil, groundwater, and sediment. This source of uncertainty may underestimate the potential risk to the nervous system for recreational users, pedestrians, and construction/utility workers.

6.4.3.4 Bioavailability

Another important source of uncertainty is bioavailability. Toxicity values are often based on observed dose-response relationships when the chemical is dissolved in water or is in some other readily soluble form. For instance, the oral SF for arsenic is based on exposure of a large Taiwanese population to dissolved arsenic in drinking water. However, trace elements such as arsenic in soil may exist in forms that are not readily absorbed. In this risk assessment, a bioavailability study has been performed for lead and arsenic. The recommended RBA for arsenic is the EPA default value of 60%, which is at the upper end IVBAs observed in the site-specific bioavailability study. The recommended RBAs for lead in total soil samples and in fine soil fraction samples are also based on the upper end of site-specific RBAs. The use of these upper end RBA values makes sure that risk from lead and arsenic will not be underestimated. Intakes from other metals and PAHs are not adjusted for relative bioavailability, which may cause overestimation of risks.

6.4.4 Risk Characterization

There is also uncertainty in assessing the risks associated with a mixture of chemicals. In this assessment, the effects of exposure to each contaminant present have initially been considered separately. However, these substances occur together at the site, and individuals may be exposed to mixtures of the chemicals. Prediction of how these mixtures of chemicals will interact must be based on an understanding of the mechanisms of such interactions. Individual chemicals may interact chemically in the body, yielding a new toxic component or causing different effects at different target organs. Suitable data are not currently available to rigorously characterize the effects of chemical mixtures. Consequently, as recommended by EPA (1989), chemicals present at the site are assumed to act additively, and potential health risks are evaluated by summing excess lifetime cancer risks and calculating HIs for noncancer health effects.

This approach to assessing risk associated with mixtures of chemicals assumes that there are no synergistic or antagonistic interactions among the chemicals and that all chemicals have the same toxic endpoint and mechanisms of action. To the extent that these assumptions are correct, the actual risks could be underestimated or overestimated. As a result of the uncertainties described above, this risk assessment

should not be construed as presenting absolute risks or hazards. Rather, it is a conservative analysis intended to indicate the potential for adverse impacts to occur based on the RME and the CTE scenarios.

Uncertainty exists in assessing risks associated with mixtures of chemicals. In this assessment, the effects of exposure to each contaminant present have initially been considered separately. However, these substances occur together at the site, and individuals may be exposed to mixtures of the chemicals. Prediction of how these mixtures of chemicals will interact must be based on an understanding of the mechanisms of such interactions. Individual chemicals may interact chemically in the body, yielding a new toxic component or causing different effects at different target organs. Suitable data are not available to rigorously characterize the effects of chemical mixtures. Consequently, as recommended by EPA (1989), chemicals present at the site are assumed to act additively, and potential health risks are evaluated by summing excess lifetime cancer risks and calculating HIs for noncancer health effects.

This approach to assessing risk associated with mixtures of chemicals assumes that no notable synergistic or antagonistic interactions occur among the chemicals. To the extent that these assumptions are incorrect, actual risks could be underestimated or overestimated. As a result of the uncertainties described, this risk assessment should not be construed as presenting absolute risks or hazards. Rather, the risk assessment is designed to present a conservative analysis that allows for interpretation of site-related risks under a standard set of guidelines, defined target risks and federal policy.

6.4.4.1 Evaluation of Lead

Several important areas of uncertainty affecting the interpretation of results for the IEUBK and ALM model used to assess exposure to lead have been discussed in previous sections including: bioavailability of lead, exposure point concentrations, exposure assumptions, and available data for fish and shellfish.

Exposure Point Concentrations

The EPC used in the IEUBK and ALM model was the arithmetic mean lead concentration in surface soil for each exposure area and was used as a constant for soil that is applied to all age ranges exposed within the exposure area. Receptors including young children are anticipated to recreate in areas in a random fashion and therefore the average concentration is representative of potential exposure. There is some uncertainty associated with this assumption because in each area there are elevated concentrations of lead reported in some samples. However, for most areas, all samples with elevated concentrations of lead are not located in a single area or hot spot. It should be noted that young children are not assumed to be exposed in every area and for some areas where mean concentrations of lead are higher than in other areas because young children are not assumed to be exposed, exposure to lead above thresholds of concern was not estimated.

Lead concentrations in surface soil samples in Area 1 ranged from 8.2 mg/kg to 47,000 mg/kg; the arithmetic mean for lead in surface soil in Area 1 is 557 mg/kg and the 95% UCL is 1,553 mg/kg. The majority (74%) of lead results in Area 1 surface soil samples were above the site-specific lead in background soil (21 mg/kg). Twelve samples or about 5% of the soil samples exceeded the 95% UCL concentration. Five out of the 12 samples are located within approximately 150 feet of each other; this area includes the sample where lead was detected at a concentration of 47,000 mg/kg (Figure 2-3). This area appears to be a hot spot.

Lead concentrations in surface soil samples in Area 2 ranged from 6.7 mg/kg to 2,000 mg/kg. The arithmetic mean concentration for Area 2 is 485 mg/kg and the 95% UCL is 594 mg/kg. Most of the lead concentrations reported in soil were above the site-specific lead in background soil. Seventeen out of 94 surface soil samples in Area 2 contained concentrations of lead above 1,000 mg/kg; most of these samples were taken from the center of the beach (Figure 2-4).

Lead concentrations in soil samples in Area 9 ranged from 5.3 mg/kg to 10,200 mg/kg. The arithmetic mean for the upland area of Area 9 is 251 mg/kg and the 95% UCL is 676 mg/kg. Highly elevated lead concentrations were found in an area to the west of the main path in the upland area of Area 9 (e.g., A9-107C and A9-109B) (Figure 2-10), and at the southern end of the main path (e.g., 22,287 mg/kg at A9-B7 and 34,697 mg/kg at A9-B7) (Figure 2-15). In addition some analytical results for lead were rejected including some of the highest reported values for this area (e.g., 67,600 mg/kg at A9-109-C). These rejected data add to the uncertainty for the evaluation of exposure to lead in this area.

Analytical results for lead in surface water collected in April 2011 from Area 2 were not used to in the estimation of the surface water exposure point concentration. Lead concentrations in Area 2 surface water used in the HHRA ranged from 867 µg/L to 1450 µg/L; lead ranged in concentration from 2.4 J µg/L to 3.8 J µg/L in the April 2011 sampling event. These results indicate that exposure to lead in surface water is likely overestimated in the HHRA.

Exposure Assumptions

Several parameters used in the IEUBK model and the ALM were default assumptions which add to the uncertainty of the evaluation of lead exposure. The IEUBK model was used to assess the possibility of children at risk and cannot be assumed to replace medical monitoring or to take into account specific behavior and risk factors such as nutritional status. Default parameters used in the model are conservative and based on current scientific knowledge and studies reducing the overall uncertainty. The default baseline blood lead concentration and the geometric standard deviation used in the ALM were determined by EPA using data from NHANES 1999–2004 data (Brody *et al*., 1994), and the updated values for the $PbB_{adult,0}$ and GSD_i, adult parameters, 1.0 µg/dL and 1.8; because site specific data are unavailable these values are considered the most scientifically appropriate.

Sensitivity Analysis

An important uncertainty is the use of the ALM to evaluate exposure to lead for adolescents. Adolescents may be more sensitive to lead than adults and likely do not absorb lead in the same manner as an adult; therefore, a sensitivity analysis was performed for younger adolescents assuming the highest site-specific absorption fraction of 42% and an absorption fraction of 30% which is the default value in IEUBK model for a young child. This analysis provides an additional line of evidence to evaluate the impact on the overall risk from exposure to lead for the adolescent age group. It should be noted for areas where exposure to young children and adolescents was assessed exposure estimates for young children are considered protective of adolescents. Adolescent recreational users were evaluated for exposure to lead in soil in Area 1 and upland area of Area 9 using the alternate absorption fractions. Results of this analysis are summarized in Table 6-5 and in Tables E-15 through E-20 in Appendix E.

For all adolescent recreational scenarios probabilities for fetal blood lead concentrations to exceed the target threshold value of 10 µg/dL were below the level of concern (i.e., less than 5 percent); this is true for both scenarios assuming alternate absorption fractions of 0.42 and 0.30. The ALM was also used to assess lead exposures for current and future adolescent pedestrians assumed to be exposed to lead in surface soil in all areas except Areas 2, 8, and 11 for the current scenario and Areas 8 and 11 for future scenarios. The probability of exceeding the 10 µg/dL blood lead threshold assuming an absorption fraction of 0.42 was 6.02% and 7.54% for current and future adolescent pedestrians, respectively (Table 6-5). These levels are above target threshold levels, indicating that adverse affects due to exposure to lead in soil may be possible based on the assumptions used in the model (e.g., absorption fraction of 0.42, pedestrians spend 350 days per year in an exposure area and ingest 100 mg/kg of soil per day).

It is important to note that the exposure point concentration for the current scenario was 215.7 mg/kg and 234.2 mg/kg for the future scenario, both below the EPA screening level of 400 mg/kg for residential soil. The probability of exceeding the 10 µg/dL blood lead level assuming an absorption fraction of 0.30 were below the target threshold and were 2.39% and 3.06% for current and future adolescent pedestrians, respectively (Table 6-5). The sensitivity analysis suggests that adolescent receptors are likely more sensitive to exposure to lead than adults based on the assumption that adolescents absorb lead at a higher fraction than adults; however, results of the ALM should be interpreted with caution when drawing conclusions about exposure to lead in soil for young adolescents.

Additive Effect of Lead Exposure

In general current and future receptors are not expected to be exposed to site-related lead contamination via multiple exposure pathways. For example, recreational users are defined as those individuals who visit the waterfront park, playground, and Margaret's Creek. They are assumed to come into contact with contaminants in

surface soil, surface water, and sediment while playing or walking at the beach or other areas and during water recreation. Exposure to contaminants in various media differed by exposure area. Recreational receptors are assumed to be exposed to lead in either soil or sediment and exposure to lead in surface water was evaluated qualitatively. Anglers are evaluated as a unique receptor group although they could also be recreational receptors; however, based on available data inclusion of the fish/shellfish ingestion pathway would not result in a major change to conclusions concerning lead exposures for recreational receptors or residents. Results of the adult lead model and the IEUBK indicated that adverse health effects are not expected for anglers exposed to lead in fish/shellfish.

For those scenarios where modeling indicates that a potential adverse affect may be expected from exposure to lead, an analysis of additive effects would not change that conclusion, but may increase the percentage of children with blood lead level above10 µg/dL. For receptors and areas where results indicate that hazards are below a level of concern, additive effects may be an important consideration in determining if exposure via multiple exposure pathways may result in a level of concern. For example, Area 2 surface water data indicate that incidental ingestion of lead in surface water may be of concern for young children in Area 2 as well as exposure to lead in soil.

For some areas because the site specific EPC for lead in soil is less than the default IEUBK soil concentration (i.e. 200 mg/kg), the percentage of children with blood lead concentrations above 10 µg/dL will not change significantly if site specific groundwater concentrations and ingestion of shellfish are also considered. For example, young children who recreate in Areas 5, 6, and the beach of Area 9 were assumed to be exposed to lead (Soil EPC = 67.96 mg/kg) in soil in these areas. The IEUBK model estimated that the percentage of children with blood lead concentrations above 10 µg/dL was 0.004%. If these receptors were also considered to ingest groundwater (site-specific groundwater EPC = 10.57 µg/L) and consume hard clams, the percentage of children with blood lead concentrations above 10 µg/dL would be 0.043% (Appendix E, Figure 9).

For recreational adults exposed to lead in soil, the probability of fetal blood lead concentrations exceeding 10 µg/dL ranged from 0.01% to 0.35%. The probability of fetal blood lead concentrations exceeding 10 µg/dL ranged from 0.004% to 0.52% for adult anglers. Assuming the maximum exposure for a recreational adult who also consumes shellfish caught at the site, the probability of fetal blood lead concentrations exceeding 10 µg/dL (0.87%) is still be below the target threshold of less than 5 %.

These results indicate that incidental ingestion of soil/sediment is the primary contributor to hazards associated with exposure to lead at the site.

6.4.4.2 Evaluation of Arsenic

Similar to lead, highly elevated levels of arsenic, mostly co-located with lead, were found in soils in Area 1, Area 2, and the upland are of Area 9. Arsenic concentrations in surface soil samples in Area 1 ranged from 0.73 J mg/kg to 760 J mg/kg; the 95% UCL is 35 mg/kg. Seventeen samples or about 7% of the soil samples exceeded the 95% UCL concentration.

Arsenic concentrations in surface soil samples in Area 2 ranged from 1.5 mg/kg to 150 mg/kg; the 95% UCL is 29 mg/kg. Eighteen out of 94 surface soil samples in Area 2 contained concentrations of arsenic above 29 mg/kg; most of these samples were taken from the center of the beach (Figure 2-4).

Arsenic concentrations in soil samples in Area 9 ranged from 0.23 mg/kg to 594 mg/kg. The 95% UCL is 35 mg/kg. Highly elevated arsenic concentrations were found in an area to the west of the main path in the upland area of Area 9 (e.g., A9-109B and A9-109C) and along the main path (e.g., A9-23C) (Figure 2-10).

Arsenic is the risk driver for the consumption of fish and shellfish scenarios. Above site-specific arsenic background level was observed in sediments in Area 1, where the highest hard clam (MER-3) and ribbed mussel (RM-6) concentrations were observed. Thus, the presence of arsenic in shellfish at the site is likely to be attributable to arsenic contamination in Area 1.

It should be noted that the identification of arsenic as a risk driver in fish and shellfish is based on the assumption that all arsenic is present as the most toxic inorganic forms. It is well documented that more than 90% of arsenic found in fish, and in marine animals in general, is arsenobetaine (ATSDR 2007). Arsenobetaine is an organic arsenic compound that is much less toxic than inorganic arsenic and does not pose a problem for seafood safety. Risks to anglers and children consuming fish/shellfish are likely to be overestimated.

Section 7
Summary of Risk Assessment

7.1 Approach

COPCs are identified based on criteria outlined in RAGS (EPA 1989), primarily through comparison to risk-based screening levels. COPCs identified for further quantitative evaluation in the HHRA are listed below.

- VOCs: chloroform and tetrachloroethene
- SVOCs: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenz(a,h)anthracene, dibenzofuran, indeno(1,2,3-cd)pyrene, naphthalene, and pentachlorophenol
- PCB: Aroclor 1254
- Metals: aluminum, antimony, arsenic, cadmium, chromium VI, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium, and zinc

In the HHRA, contaminants in various media at the site are evaluated for potential health threats to the following receptors:

- Current Land Use Scenario:
  - Recreational users in Area 1, Areas 3 through 6, and Area 9
  - Anglers throughout the site except Areas 3 and 4
  - Pedestrians throughout the site except Areas 2, 8, and 11
  - Trespassers in Areas 2, 8, and 11
  - Outdoor workers in Areas 3 and 4
  - Construction/utility Workers throughout the site

- Future Land Use Scenario:
  - Recreational users in Area 1 through 6 and Area 9
  - Anglers throughout the site except Areas 3 and 4
  - Pedestrians thought the site except Areas 8 and 11
  - Trespassers in Areas 8 and 11
  - Outdoor workers in Areas 3 and 4
  - Construction/utility workers throughout the site
  - Residents throughout the site

Exposure routes and human receptor groups are identified and quantitative estimates of the magnitude, frequency, and duration of exposure are made. Exposure point concentrations are estimated using the minimum of the UCL and the maximum detected concentration. Daily intakes are calculated based on the RME scenario (the highest exposure reasonably expected to occur at a site). The intent is to estimate a conservative exposure case that is still within the range of possible exposures. CTE assumptions are also developed, which reflect more typical exposures. Exposure to lead is evaluated using models developed by EPA.

In the toxicity assessment, current toxicological human health data (i.e., RfDs, RfCs, SFs, and IURs) are obtained from various sources and are utilized in the order as specified by EPA (2003).

Risk characterization involves integrating the exposure and toxicity assessments into quantitative expressions of risks/health effects. Specifically, daily intakes are compared with concentrations known or suspected to present health risks or hazards. The estimates of cancer risk and noncancer health hazards, and the greatest chemical contributors to these estimates, are identified.

In general, EPA recommends target values or ranges (i.e., cancer risk of 10^{-6} to 10^{-4} or HI of 1) as threshold values for potential human health impacts (EPA 1989). These target values aid in determining whether additional response action is necessary at the site.

7.2 Site Risks

This section presents a summary of the cancer risks and noncancer health hazards for exposures to contaminants in various media at the site that are quantitatively evaluated for potential health threats.

7.2.1 Current Receptors

Potential risks are estimated for the following receptor scenarios:

- Recreational users in Area 1, Areas 3 through 6, and Area 9
- Anglers throughout the site except Areas 3 and 4
- Pedestrians throughout the site except Areas 2, 8, and 11
- Trespassers in Areas 2, 8, and 11
- Outdoor workers in Areas 3 and 4
- Construction/Utility Workers throughout the site

Risk characterization results are summarized below for cancer and noncancer health effects for each receptor population by exposure area.

7.2.1.1 Cancer Risk

The total incremental lifetime cancer risk estimates for recreational users are listed below.

RECREATIONAL USERS

Area 1:

- Adults: RME cancer risk: 6×10^{-6}
- Adolescents: RME cancer risk: 9×10^{-6}

Areas 3 and 4:

- Adults: RME cancer risk: 2×10^{-6}
- Adolescents: RME cancer risk: 3×10^{-7}
- Children (6 to 11 years old): RME cancer risk: 9×10^{-6}

Areas 5, 6, and the Beach Area of Area 9:

- Adults: RME cancer risk: 7×10^{-6}
- Children: RME cancer risk: 9×10^{-6}

Upland Area of Area 9:

- Adults: RME cancer risk: 7×10^{-6}
- Adolescents: RME cancer risk: 9×10^{-6}

PEDESTRIANS

- Adults: RME cancer risk: 6×10^{-6}
- Adolescents: RME cancer risk: 8×10^{-6}

ANGLERS

Fish:

- Adults: RME cancer risk: 2×10^{-4} and CTE cancer risk 4×10^{-5}
- Children: RME cancer risk: 6×10^{-5}

Hard Clam:

- Adults: RME cancer risk 2×10^{-4} and CTE cancer risk 3×10^{-5}
- Children: RME cancer risk: 7×10^{-5}

Ribbed Mussel:

- Adults: RME cancer risk 1×10^{-4}
- Children: RME cancer risk: 4×10^{-5}

Blue Crab (Muscle):

- Adults: RME: cancer risk 3×10^{-5}
- Children: RME cancer risk: 1×10^{-5}

Blue Crab (Muscle and Hepatopancreas):

- Adults: RME: cancer risk 4×10^{-5}
- Children: RME cancer risk: 2×10^{-5}

TRESPASSERS

Area 2:

- Adults: RME: cancer risk 1×10^{-6}
- Adolescents: RME cancer risk: 2×10^{-6}

Areas 8 and 11:

- Adults: RME: cancer risk 6×10^{-6}
- Adolescents: RME cancer risk: 8×10^{-6}

OUTDOOR WORKERS

- Adults: RME cancer risk: 6×10^{-6}

CONSTRUCTION/UTILITY WORKERS

- Adults: RME cancer risk: 2×10^{-6}

The estimated cancer risks for all current receptors are either below or within EPA's target range of 1×10^{-6} to 1×10^{-4} for the RME scenario except adult anglers for consumption of fish or hard clam. The estimated cancer risk for adult anglers consuming fish or hard clam exceeds EPA's target range of 1×10^{-6} to 1×10^{-4}. When a more typical exposure is considered under the CTE scenario, cancer risks for consumption of fish or hard clam for adult anglers are within EPA's target range of 1×10^{-6} to 1×10^{-4}. Exposure to arsenic accounts for all the excess cancer risks for consumption of fish or hard clam.

7.2.1.2 Noncancer Health Hazard

HIs greater than 1 indicate the potential for noncancer health hazards. The estimated HIs are listed below.

RECREATIONAL USERS

Area 1:

RME HI:

- Adults: total 0.3
- Adolescents: total 0.4

Areas 3 and 4:

RME HI:

- Adults: total 0.06
- Adolescents: total 0.009
- Children: total 0.6

Areas 5, 6, and the Beach Area of Area 9:

RME HI:

- Adults: total 0.09
- Children: total 0.6

Upland Area of Area 9:

RME HI:

- Adults: total 0.3
- Adolescents: total 0.4

PEDESTRIANS

RME HI:

- Adults: total 0.4
- Adolescents: total 0.5

ANGLERS

Fish:

RME HI:

- Adults: total 1
- Children: total 2, skin 2

CTE HI:

- Children: total 1

Hard Clam:

RME HI:

- Adults: total 1
- Children: total 2, skin 2

CTE HI:

- Children: total 0.2

Ribbed Mussel:

RME HI:

- Adults: total 0.7
- Children: total 1

Blue Crab (Muscle):

RME HI:

- Adults: total 0.2
- Children: total 0.3

Blue Crab (Muscle and Hepatopancreas):

RME HI:

- Adults: total 0.6
- Children: total 1

TRESPASSERS

Area 2:

RME HI:

- Adults: total 0.05
- Adolescents: total 0.07

Areas 8 and 11:
RME HI:
- Adults: total 0.2
- Adolescents: total 0.3

OUTDOOR WORKERS
RME HI:
- Adults: total 0.08

CONSTRUCTION/UTILITY WORKERS
RME HI:
- Adults: total 1

The total noncancer HIs for the RME scenario are either below or at the EPA's threshold of unity (1) for all receptor scenarios except children consuming fish or hard clam. Children consuming fish or hard clam have noncancer HIs for the skin exceeding the EPA threshold of 1 under the RME scenario. The potential health hazards are almost entirely attributed to arsenic. When a more typical exposure is considered under the CTE scenario, the total HIs for children consuming fish or hard clam are below the EPA noncancer threshold.

7.2.2 Future Receptors

Potential risks are estimated for the following future receptor scenarios:

- Recreational users in Areas 1 through 6, and Area 9
- Anglers throughout the site except Areas 3 and 4
- Pedestrians thought the site except Areas 8 and 11
- Trespassers in Areas 8 and 11
- Outdoor workers in Areas 3 and 4
- Construction/utility workers throughout the site
- Residents throughout the site

Risk characterization results for all future receptors remain the same as those for the current receptors except recreational users in Area 2, pedestrians, and residents. These results are summarized in Section 7.2.1. Thus, only results for future recreational users in Area 2, pedestrians in Areas 8 and 11, and future residents are summarized below.

7.2.2.1 Cancer Risk

The total incremental lifetime cancer risk estimates for recreational users are listed below.

RECREATIONAL USERS
Area 2:
- Adults: RME cancer risk: 1×10^{-5}
- Children: RME cancer risk: 2×10^{-5}

PEDESTRIANS
Areas 8 and 11:
- Adults: RME cancer risk: 6×10^{-6}
- Adolescents: RME cancer risk: 8×10^{-6}

RESIDENTS
All Areas:
- Adults and Children: RME cancer risk: 9×10^{-5}

Based on the results above and results presented in Section 7.2.1, the estimated cancer risks for all future receptors are either below or within EPA's target range of 1×10^{-6} to 1×10^{-4} for the RME scenario except adult anglers for consumption of fish or hard clam. The estimated cancer risk for adult anglers consuming fish or hard clam exceeds EPA's target range of 1×10^{-6} to 1×10^{-4}. When a more typical exposure is considered under the CTE scenario, cancer risks for consumption of fish or hard clam for adult anglers are within EPA's target range of 1×10^{-6} to 1×10^{-4}. Exposure to arsenic accounts for all the excess cancer risks for consumption of fish or hard clam.

7.2.2.2 Noncancer Health Hazard

HIs greater than 1 indicate the potential for noncancer health hazards. The estimated HIs are listed below.

RECREATIONAL USERS
Area 2:
RME HI:
- Adults: total 0.2
- Children: total 1

PEDESTRIANS
Areas 8 and 11:
RME HI:
- Adults: total 0.4
- Adolescents: total 0.5

RESIDENTS
All Areas:
RME HI:
- Adults and Children: total 15, respiratory system 5, thyroid gland 5, GI tract 7

CTE HI:

- Adults and Children: total 5, respiratory system 2, thyroid gland 2, GI tract 3

Based on the results above and results presented in Section 7.2.1, the total HIs for all future receptors except children consuming fish or hard clam and residents are either below or at the EPA threshold of 1.

Children consuming fish or hard clam have noncancer HIs for the skin exceeding the EPA threshold of 1 under the RME scenario. The potential health hazards are almost entirely attributed to arsenic. When a more typical exposure is considered under the CTE scenario, the total HIs for children consuming fish or hard clam are below the EPA noncancer threshold.

The future hypothetical residents have noncancer HIs for the respiratory system, thyroid gland, and GI system exceeding the EPA threshold of 1 under the RME scenario. The potential health hazards to the respiratory system and thyroid gland are attributed to cobalt. The potential for adverse health effect to the GI system is a result of future exposure to iron in groundwater. When a more typical exposure is considered under the CTE scenario, the HIs for the respiratory system, thyroid gland, and GI system still exceeds the EPA noncancer threshold.

7.3 Risks from Lead

The IEUBK and the ALM models were used to assess risks to current and future receptors from exposure to lead in surface soil, sediment, groundwater, and biota. Exposure to lead in surface water was evaluated qualitatively. Potential risks for children, adolescents, and adults are summarized below.

7.3.1 Children

For all current and future recreational users in Areas 5, 6, and the beach area of Area 9, anglers, and future resident children, the probabilities for blood concentrations for children to exceed the threshold of 10 µg/dL were less than 5%. These results indicate that exposure to lead for recreating in Areas 5, 6, and the beach area of Area 9, consumption of fish/shellfish caught from the site, and groundwater ingestion is not a concern for children. However, 42% of children recreating in Area 2 exposed to the fine fraction of lead in surface soil may have blood lead levels above 10 µg/dL. This result indicates that children recreating in Area 2 could be at risk to develop blood lead levels above the threshold of concern.

7.3.2 Adolescents and Adults

For all current and future pedestrians, recreational adults and adolescents, the probabilities for fetal blood concentrations to exceed the threshold of concern were less than 1%. These results indicate that exposure to lead in surface soil is not a concern for these receptors in the exposure areas evaluated. Results of the ALM indicate that exposure to lead in sediment in the upland areas of Area 9 for

recreational receptors would not result in blood lead levels above a level of concern. The probability that fetal blood lead level would be above a level of concern were about 11% for construction/utility workers exposed to lead in surface and subsurface soil in upland areas; this result is above the threshold level of concern.

For all shellfish consumption scenarios, the probability of fetal blood lead concentrations exceeding 10 µg/dL was less than 1%. These results indicate that adverse health effects are not expected for anglers exposed to lead in shellfish based on the available data. Additionally, recreational receptors exposed to lead in surface water are not of concern.

7.4 Summary and Conclusions

Total estimated cancer risks and noncancer health hazards are within EPA's target thresholds (cancer risk of 1×10^{-6} to 1×10^{-4} and noncancer HI of 1) for all receptor scenarios except the following:

- Current/Future Scenario:
  - Construction/utility workers
  - Adult anglers consuming fish or hard clam
  - Children consuming fish or hard clam
- Future Scenario:
  - Child recreational users in Area 2
  - Residents using groundwater as drinking water

Forty-two percent of future child recreational users in Area 2 may have blood lead levels above 10 µg/dL. This result indicates that children recreating in Area 2 could be at risk to develop blood lead levels above the threshold of concern. Additionally, the probability that the fetal blood lead level would be above a level of concern is approximately 11% for construction/utility workers; this result is above the threshold level of concern.

For the RME scenario, the estimated cancer risks for current and future adult anglers consuming fish or hard clam are 2×10^{-4}, exceeding EPA's target range of 1×10^{-6} to 1×10^{-4}. Arsenic is the cancer risk driver. When a more typical exposure is considered under the CTE scenario, the estimated cancer risks are within EPA's target range. Children consuming fish or hard clam have noncancer HIs for the skin at 2, exceeding EPA's threshold of unity under the RME scenario. The potential health hazards are almost entirely attributed to arsenic. When a more typical exposure is considered under the CTE scenario, the total HIs for children consuming fish or hard clam are below the EPA noncancer threshold. Risks to anglers and children could be overestimated since arsenic is present in fish and shellfish predominately in much less toxic organic forms when toxicity criteria for the most toxic inorganic arsenic are used in the risk assessment.

For the RME scenario, the future hypothetical resident drinking water scenario has noncancer HIs for the respiratory system, thyroid gland, and GI system at 5, 5, and 7, respectively. These HIs exceed the EPA threshold of 1. The noncancer health hazards are associated with exposure to cobalt and iron in groundwater. When a more typical exposure is considered under the CTE scenario, the HIs for the respiratory system, thyroid gland, and GI system are 2, 2, and 3, respectively, still exceeding the EPA threshold. Although the slag at the site could have contributed some iron, several lines of evidence indicate that the elevated iron concentrations in groundwater are also from existing geochemical conditions in the area. Cobalt is a naturally occurring metal and is not a major component of the slag. Cobalt may be released from soil under acidic conditions in groundwater in Areas 1, 4, and the upland area of Area 9.

Lead is a multitargeted toxicant, causing effects in the GI tract, hematopoietic system, cardiovascular system, central and peripheral nervous systems, kidneys, immune system, and reproductive system. Lead exposure has been linked to impaired cognitive ability and intelligence quotient deficits in children. Since exposures to lead is not evaluated using the same methods as other COPCs, it is possible that additional risks from lead would increase noncancer health hazard. For those scenarios where target/effect-specific HIs exceeding EPA threshold of 1 (i.e., children consuming fish or hard clam), additional risks from lead would not change that conclusion, but may increase the noncancer hazard to the multiple target organs lead may affect. For receptor scenarios where the noncancer HIs are at or near the EPA target threshold, the possibility exists that additional risks from lead may result in health hazard exceeding EPA's target threshold. These receptor scenarios are further discussed below.

The total noncancer HI for future child recreational users in Area 2 is unity. Potential exposure to lead would result in 42% of the children to have blood lead levels above10 µg/dL. Thus, additional risks from lead at Area 2 would likely result in health hazard exceeding EPA's target threshold for future child recreational users. The total noncancer HIs for anglers consuming fish or hard clam are 1. Lead is not identified as a COPC in fish. The probability that the fetal blood lead level would be above a level of concern for anglers consuming hard clam is 0.37%, well below the threshold of concern. The noncancer risk driver in fish/shellfish is arsenic, which unlike lead, may cause systematic effects in skin. Thus contribution from lead to the health hazard to the skin of anglers is minimal. The total noncancer HI for construction/utility workers is 1. The ALM model indicated that the probability that the fetal blood lead level would be above a level of concern is approximately 11% for construction/utility workers. Thus, additional risks from lead for construction/utility workers would likely result in health hazard exceeding EPA's target threshold.

In conclusion, 42% of future child recreational users in Area 2 may have blood lead levels above 10 µg/dL. Additionally, the probability that the fetal blood lead level would be above a level of concern is approximately 11% for construction/utility

workers. These results are above the threshold level of concern.

Cancer risk and noncancer health hazards exceed EPA's target threshold due to the presence of arsenic in fish and hard clam tissue from the site. Lead and arsenic are the risk drivers and they are apparently associated with past disposal of slag and battery casing wastes. Additionally, elevated levels of lead (up to 47,000 mg/kg) and arsenic (up to 760 J mg/kg) are present in soils in Area 1, Area 2, and the upland area of Area 9.

Noncancer health hazard in groundwater exceeds EPA's target threshold due to future hypothetical use of groundwater as drinking water. Groundwater is not currently used for drinking water at the site. Future potable use of groundwater is unlikely because of high salinity and a municipal water supply is readily available and serves the site and vicinity.

Section 8
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Tables

TABLE 3-1
STATISTICAL SUMMARY OF *IN VITRO* BIOAVAILABILITY RESULTS FOR LEAD AND ARSENIC IN SOILS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Metal	Area	No. of Samples	Concentration[1] (mg/kg)			% *In Vitro* Bioaccessibility			% Relative Bioavailability		
			Minimum	Maximum	Average[2]	Minimum	Maximum	Average[2]	Minimum	Maximum	Average[2]
Lead	Area 2	5	32	1,602	555	26	83	65	23	73	57
	Area 3	10	17	116	52	53	83	70	47	73	62
	Area 5	10	8	403	146	13	84	65	12	74	57
	Area 6	4	6	18	12	15	62	38	13	54	33
	Area 9	10	41	34,697	6,406	22	94	64	19	82	56
	All Areas	39	6	34,697	1,766	13	94	63	12	82	56
Arsenic	Area 2	5	2	39	16	1.2	38	21	NA	NA	NA
	Area 3	10	2	9	5	0.5	56	24	NA	NA	NA
	Area 5	10	3	22	8	0.3	63	14	NA	NA	NA
	Area 6	4	1	3	2	1.0	2	2	NA	NA	NA
	Area 9	10	3	23	11	0.3	57	9	NA	NA	NA
	All Areas	39	1	39	9	0.3	63	14	NA	NA	NA

NA - not available
[1] Total concentration in less than 250 micron sized particles
[2] Averaged over all samples within the category

TABLE 3-2

LIST OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical	Surface Soil								Surface/ Subsurface Soil	Groundwater		Surface Water		Sediment				Biota				
	Area 1	Area 2	Areas 3 and 4	Areas 5, 6 and Beach Area of Area 9	Upland Area of Area 9	All Areas (except Areas 2, 8, and 11)	All Areas (except Areas 8 and 11)	Areas 8 and 11	All Upland Areas	Groundwater (<10 feet bgs)	Groundwater (All Wells)	All Areas (except Wetland Area of Area 9)	Wetland Area of Area 9	Area 1	Area 2	Area 5, 6 and Beach Area of Area 9	Wetland Area of Area 9	Fish	Hard Clam	Ribbed Mussel	Blue Crab (Muscle)	Blue Crab (Muscle plus Hepatopancreas)
Volatile Organic Compounds																						
Chloroform	--	--	--	--	No	No	No	--	No	--	--	--	Yes	--	--	--	--	--	--	--	--	--
Tetrachloroethene	No	--	--	--	--	No	No	--	No	--	Yes	--	--	--	--	--	--	--	--	--	--	--
Semi-volatile Organic Compounds																						
Benzo(a)anthracene	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	--	No	Yes	--	--	--	--	--
Benzo(a)pyrene	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--	--	--	Yes	--	Yes	Yes	--	--	--	--	--
Benzo(b)fluoranthene	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	--	--	Yes	--	No	--	No	Yes	--	--	--	--	--
Dibenzo(a,h)anthracene	Yes	--	No	No	Yes	Yes	Yes	Yes	Yes	--	--	--	--	--	--	--	Yes	--	--	--	--	--
Dibenzofuran	No	--	--	--	No	No	No	No	No	Yes	No	--	--	--	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Yes	--	No	No	Yes	Yes	Yes	Yes	Yes	--	--	--	--	--	--	No	Yes	--	--	--	--	--
Naphthalene	No	--	--	--	No	No	No	No	No	Yes	No	--	--	No	--	No	No	--	--	--	--	--
Pentachlorophenol	--	--	No	--	No	No	No	No	No	--	--	--	Yes	--	--	--	--	--	--	--	--	--
PCBs/Pesticides																						
Aroclor 1254	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	--	--	--	--	--	--	No	No	--	--	--	--	--
Inorganics																						
Aluminum	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No	No	No	No
Antimony	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	No	--	Yes	Yes	--	--	No	--	--
Arsenic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cadmium	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	--	No	No	--	Yes	No	--	Yes
Chromium VI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--	--	--	Yes	Yes	Yes	Yes	--	--	--	--	--
Cobalt	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	--	Yes	No	--	Yes
Copper	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	--	No	No	No	Yes
Iron	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	No	No	No	No
Lead	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes
Manganese	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No	No	No
Mercury	No	No	No	No	No	No	No	No	No	--	--	--	No	No	No	No	Yes	Yes	--	--	No	No
Nickel	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	--	No	No	No	No
Vanadium	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	No	Yes	Yes	--	No	No	--	No
Zinc	No	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No

Yes = Selected as COPC
No = Not Selected as COPC
-- = Not Detected

PCB = polychlorinated biphenyl
bgs = below ground surface

TABLE 4-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Area 1.
						Ingestion	Quant	
						Inhalation	Quant	
			Area 2	Trespassers	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Access to Area 2 is currently restricted by a fence. Public health hazard signs are posted warning no swimming, no sunbathing, and no fishing in the area. However, trespassers may gain access to the fenced area. While trespassing, trespassers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil .
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 3 and 4	Recreational Users	Adult, Adolescent (6-18 yrs), and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting playground and the surrounding area.
						Ingestion	Quant	
						Inhalation	Quant	
				Outdoor Worker	Adult	Dermal	Quant	Outdoor workers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the area.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting beach in these areas.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 8 and 11	Trespassers	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Access to Areas 8 and 11 is currently restricted by a fence. However, trespassers may gain access to the fenced area. While trespassing, trespassers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil.
						Ingestion	Quant	
						Inhalation	Quant	
			Upland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Margaret's Creek.
						Ingestion	Quant	
						Inhalation	Quant	
			All Areas (except Areas 2, 8, and 11)	Pedestrian	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Pedestrians may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting the site.
						Ingestion	Quant	
						Inhalation	Quant	

TABLE 4-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (cont'd)	Soil	Surface and Subsurface Soil	All Upland Areas	Construction/Utility Worker	Adult	Dermal	Quant	Construction/Utility workers may come into contact with contaminants in soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the upland areas.
						Ingestion	Quant	
						Inhalation	Quant	
	Groundwater	Groundwater	All Areas	Resident	Adult and Child (0-6 yrs)	Dermal	None	Residents in the area are connected to the municipal water system. Groundwater is not used as a potable drinking water supply due to high salinity.
						Ingestion	None	
						Inhalation	None	
			All Upland Areas	Construction/Utility Worker	Adult	Dermal	Quant	Construction/utility workers may encounter shallow groundwater at upland areas of Areas 6, 8, and 9 where depth to groundwater is 10 feet or less. Routes of exposure include incidental ingestion of and dermal contact with groundwater.
						Ingestion	Quant	
						Inhalation	None	
	Surface Water	Surface Water	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
	Sediment	Sediment	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
	Biota	Biota	All Areas (except Areas 3 and 4)	Angler	Adult and Child (0-6 yrs)	Ingestion	Quant	People may consume self-caught fish and shellfish from the site. The angler scenario assesses exposure to adult anglers and young children (0 to 6 years old) who may consume fish and shellfish caught at the site by anglers.

TABLE 4-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Soil	Surface Soil	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Area 1.
						Ingestion	Quant	
						Inhalation	Quant	
			Area 2	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Area 2 may be open to the public in the future. Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil .
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 3 and 4	Recreational Users	Adult, Adolescent (6-18 yrs), and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting playground and the surrounding area.
						Ingestion	Quant	
						Inhalation	Quant	
				Outdoor Worker	Adult	Dermal	Quant	Outdoor workers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the area.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting beach in these areas.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 8 and 11	Trespassers	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Trespassers may gain access to restricted areas. Trespassers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil.
						Ingestion	Quant	
						Inhalation	Quant	
			Upland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Margaret's Creek.
						Ingestion	Quant	
						Inhalation	Quant	
			All Areas (except Areas 8 and 11)	Pedestrian	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Pedestrians may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting the site.
						Ingestion	Quant	
						Inhalation	Quant	

TABLE 4-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont'd)	Soil	Surface and Subsurface Soil	All Upland Areas	Construction/Utility Worker	Adult	Dermal	Quant	Construction/Utility workers may come into contact with contaminants in soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the upland areas.
						Ingestion	Quant	
						Inhalation	Quant	
	Groundwater	Groundwater	All Areas	Resident	Adult and Child (0-6 yrs)	Dermal	Quant	Future development of the groundwater resource at the site is unlikely; however, in theory, potable water wells could be installed in the future. Future residents may come into contact with contaminants through ingestion of and dermal contact with groundwater, and inhalation of VOCs in groundwater while bathing or showering.
						Ingestion	Quant	
						Inhalation	Quant	
			All Upland Areas	Construction/Utility Worker	Adult	Dermal	Quant	Construction/utility workers may encounter shallow groundwater at upland areas of Areas 6, 8, and 9 where depth to groundwater is 10 feet or less. Routes of exposure include incidental ingestion of and dermal contact with groundwater.
						Ingestion	Quant	
						Inhalation	None	
	Surface Water	Surface Water	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Areas 2, 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
	Sediment	Sediment	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Areas 2, 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
	Biota	Biota	All Areas (except Areas 3 and 4)	Angler	Adult and Child (0-6 yrs)	Ingestion	Quant	People may consume self-caught fish and shellfish from the site. The angler scenario assesses exposure to adult anglers and young children (0 to 6 years old) who may consume fish and shellfish caught at the site by anglers.

Quant = Quantitative risk analysis performed
None = Risk analysis not performed

TABLE 4-2
INPUT PARAMETERS USED IN THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Parameter	Value Used	Comment
Concentration of lead in air	0.1 µg/m^3	Model default; no site-specific air data available
Lung absorption	32%	Model default
Time spent outdoors (all age groups)	2 hours/day	EPA 2009
Concentration of lead in soil/dust	Area specific mean lead concentration µg/g	Soil lead concentrations are calculated for each exposure area
Soil/dust ingestion weighting factor (percent soil)	45%	Model default; no site-specific data available
Contact rates (inhalation rates, soil ingestion rates, water and food consumption rates)	Varies by age	Model default; no site-specific contact rate data are available
Soil/dust ingestion rate by age		
0-1 year (0-1 months)	0.085 g/day	Model default
1-2 years (12-23 months)	0.135 g/day	Model default
2-3 years (24-35 months)	0.135 g/day	Model default
3-4 years (36-47 months)	0.135 g/day	Model default
4-5 years (48-59 months)	0.100 g/day	Model default
5-6 years (60-71 months)	0.090 g/day	Model default
Lead concentration in drinking water	4 µg/L	Model default; for all scenarios except evaluation of groundwater as drinking water
	10.57 µg/L	Groundwater as drinking water scenario
Lead concentrations in alternate diet sources		
Hard clam	1.696 mg/kg	Site specific estimate
Blue crab muscle	0.1114 mg/kg	Site specific estimate
Blue crab muscle plus hepatopancreas	0.102 mg/kg	Site specific estimate
Ribbed mussel	0.361 mg/kg	Site specific estimate
Percent of food class from fishing	10%	
Alternate dietary intake rates by age		
0-1 year (0-1 months)	2.96 g/day	10% of total meat intake
1-2 years (12-23 months)	8.74 g/day	10% of total meat intake
2-3 years (24-35 months)	9.57 g/day	10% of total meat intake
3-4 years (36-47 months)	10.16 g/day	10% of total meat intake
4-5 years (48-59 months)	10.74 g/day	10% of total meat intake
5-6 years (60-71 months)	11.19 g/day	10% of total meat intake

TABLE 4-2
INPUT PARAMETERS USED IN THE INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

µg/m^3 = microgram per cubic meter
µg/g = microgram per gram
g/day = gram per day
µg/L = microgram per liter
mg/kg = milligram per kilogram

Source:
EPA 2009: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment. EPA-540-R-070-002
EPA. 2010. Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® version (IEUBKwin v1.1 build 11).

TABLE 4-3
INPUT PARAMETERS USED IN THE ADULT LEAD MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Exposure Parameter	Value	Source
Target fetal blood lead (PbB) – no more than 5% should exceed	10 µg/dL	EPA 2003
Soil ingestion rate (IR)		
Recreational User - Adult	100 mg/day	EPA 2002a
Recreational User - Adolescent	100 mg/day	EPA 2008
Pedestrian - Adult	100 mg/day	EPA 2002a
Pedestrian - Adolescent	100 mg/day	EPA 2008
Construction/ Utility Worker	330 mg/day	EPA 2002a
Fish and shellfish ingestion rate (IR)		
Angler - Fish	33 g/day	(1)
Angler - Shellfish	16 g/day	(1)
Ratio (R) of fetal to maternal blood lead (R fetal/maternal)	0.9	EPA 2003
Background adult blood lead concentration (PbB adult, 0)		
Recreational User - Adult	1.0 µg/dL	EPA 2009a
Recreational User - Adolescent	1.0 µg/dL	EPA 2009a
Pedestrian - Adult	1.0 µg/dL	EPA 2009a
Pedestrian - Adolescent	1.0 µg/dL	EPA 2009a
Construction/ Utility Worker	1.0 µg/dL	EPA 2009a
Biokinetic slope factor (BKSF)	0.4 µg/dL/µg/day	EPA 2003
Geometric standard deviation (GSD)	1.8	EPA 2009a
Exposure Frequency (EF)		
Recreational User - Adult	100 days/year	EPA 2009b
Recreational User - Adolescent	100 days/year	EPA 2009b
Pedestrian - Adult	350 days/year	EPA 1991
Pedestrian - Adolescent	350 days/year	EPA 1991
Construction/ Utility Worker	250 days/year	EPA 2002a
Angler	365 days/year	EPA 2002b
Averaging time (AT)		
Recreational User - Adult	365 days/year	EPA 2003
Recreational User - Adolescent	365 days/year	EPA 2003
Pedestrian - Adult	365 days/year	EPA 2003
Pedestrian - Adolescent	365 days/year	EPA 2003
Construction/ Utility Worker	365 days/year	EPA 2003
Angler	365 days/year	EPA 2002b
Absorption Fraction (AF)		
Total Soil	0.12	EPA 2003
Fine Fraction (TRW)	0.17	Site-specific

TABLE 4-3
INPUT PARAMETERS USED IN THE ADULT LEAD MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

µg/dL = microgram per deciliter
mg/day = milligram per day
µg/day = microgram per day
g/day = gram per day

(1) The fish ingestion rates are based on site-specific fish ingestion rate for Raritan Bay, based on Burger (2002) and May and Burger (1996) studies. The shellfish ingestion rate is based on the mean crab ingestion rate for the Newark Bay Complex (Burger 2002).

References:

Burger, J. 2002. Consumption Patterns and Why People Fish. Environmental Research Section A, 90, 125-135.
EPA. 1991. Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Supplemental Guidance, Final. OSWER Directive 9285.6-03, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.
EPA. 2002a. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.
EPA. 2002b. Fish Consumption and Environmental Justice. The National Environmental Justice Advisory Council.
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EPA. 2008. Child Specific Exposure Factors Handbook. EPA/600/R-06/096F. September.
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EPA. 2009b. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment.
May, H. and Burger, J. 1996. Fishing in a Polluted Estuary: Fishing Behavior, Fish Consumption, and Potential Risk. Risk Analysis, 16, 459-471.

TABLE 5-1

NONCANCER TOXICITY DATA - ORAL/DERMAL

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal [1]	Absorbed RfD for Dermal [1]		Primary Target Organ	Combined Uncertainty/ Modifying Factor	Source	Date [2] (MM/DD/YYYY)
		Value	Unit		Value	Unit				
Volatile Organic Compounds										
Chloroform	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	100	IRIS	7/19/2011
Tetrachloroethene	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	1000	IRIS	7/19/2011
Semi-volatile Organic Compounds										
Benzo(a)anthracene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Dibenzofuran	Chronic	1.0E-03	mg/kg-day	1	1.0E-03	mg/kg-day	Developmental/Organ Weight	10000	S-PPRTV	6/11/2007
Indeno(1,2,3-cd)pyrene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Body Weight	3000	IRIS	7/19/2011
Pentachlorophenol	Chronic	5.0E-03	mg/kg-day	1	5.0E-03	mg/kg-day	Liver	300	IRIS	7/19/2011
PCBs/Pesticides										
Aroclor 1254	Chronic	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	Eyes/Fingernails/Immune System	300	IRIS	5/23/2011
Inorganics										
Aluminum	Chronic	1.0E+00	mg/kg-day	1	1.0E+00	mg/kg-day	Neurological	100	PPRTV	10/23/2006
Antimony	Chronic	4.0E-04	mg/kg-day	0.15	6.0E-05	mg/kg-day	Longevity/Blood	1000	IRIS	5/23/2011
Arsenic	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Skin	3	IRIS	5/23/2011
Cadmium[3]	Chronic	1.0E-03	mg/kg-day	0.025	2.5E-05	mg/kg-day	Kidney	10	IRIS	5/23/2011
Chromium VI	Chronic	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	NA	900	IRIS	5/23/2011
Cobalt	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Thyroid Gland	3000	PPRTV	8/25/2008
Copper	Chronic	4.0E-02	mg/kg-day	1	4.0E-02	mg/kg-day	GI Tract	NA	HEAST	7/1/1997
Iron	Chronic	7.0E-01	mg/kg-day	1	7.0E-01	mg/kg-day	GI Tract	1.5	PPRTV	9/11/2006
Lead	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Manganese[4]	Chronic	1.4E-01	mg/kg-day	1	1.4E-01	mg/kg-day	CNS	1	IRIS	5/23/2011
Mercury[5]	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Immune System	1000	IRIS	5/23/2011
Nickel	Chronic	2.0E-02	mg/kg-day	0.04	8.0E-04	mg/kg-day	Body Weight/Organ Weight	300	IRIS	7/19/2011
Vanadium	Chronic	5.0E-03	mg/kg-day	1	5.0E-03	mg/kg-day	Kidney	3000	PPRTV	9/30/2009
Zinc	Chronic	3.0E-01	mg/kg-day	1	3.0E-01	mg/kg-day	Fetus	3	IRIS	5/23/2011

[1] Adjusted RfD for Dermal = Oral RfD x Oral Absorption Efficiency for Dermal. From Regional Screening Levels (RSL), November 2010, http://www.epa.gov/region09/waste/sfund/prg/index.html

[2] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/ Date shown for other sources is the publication date.

[3] Based on RfD for cadmium (diet)
Cadmium (water) RfD is $5x10^{-4}$ mg/kg-day with an oral absorption efficiency for dermal of 5%.

[4] Based on RfD for manganese (diet)

[5] Based on RfD for mercuric chloride
For fish/shellfish, the RfD of $1x10^{-4}$ mg/kg-day is based on methyl mercury.

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
CNS = central nervous system
GI = gastrointestinal
HEAST = Health Effect Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
S-PPRTV = Screening Provisional Peer Reviewed Toxicity Value
RfD = reference dose
RSL = Regional Screening Level

TABLE 5-2
NONCANCER TOXICITY DATA - INHALATION (CHRONIC)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source [1]	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	9.8E-02	mg/m^3	Liver	100	ATSDR	12/10/2010
Tetrachloroethene	2.7E-01	mg/m^3	CNS	100	ATSDR	12/10/2010
Semi-volatile Organic Compounds						
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Naphthalene	3.0E-03	mg/m^3	Respiratory	3000	IRIS	7/19/2011
Pentachlorophenol	NA	NA	NA	NA	NA	NA
PCBs/Pesticides						
Aroclor 1254	NA	NA	NA	NA	NA	NA
Inorganics						
Aluminum	5.0E-03	mg/m^3	Neurological	300	PPRTV	10/23/2006
Antimony	NA	NA	NA	NA	NA	NA
Arsenic	1.5E-05	mg/m^3	Developmental/Cardiovascular System/CNS	30	Cal/EPA	12/18/2008
Cadmium	1.0E-05	mg/m^3	Kidney	9	ATSDR	12/10/2010
Chromium VI	1.0E-04	mg/m^3	Lungs	300	IRIS	5/23/2011
Cobalt	6.0E-06	mg/m^3	Respiratory System	300	PPRTV	8/25/2008
Copper	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	5.0E-05	mg/m^3	CNS	1000	IRIS	5/23/2011
Mercury	3.0E-04	mg/m^3	Motor Coordination/CNS	30	IRIS	5/23/2011
Nickel	9.0E-05	mg/m3	Respiratory System	30	ATSDR	12/10/2010
Vanadium	1.0E-04	mg/m^3	Respiratory System	30	ATSDR	12/10/2010
Zinc	NA	NA	NA	NA	NA	NA

[1] ATSDR chronic inhalation minimal risk level (MRL)
MRL is converted from units in ppmv to mg/m^3 using the following equation:
MRL (mg/m^3) = (ppmv)(1 kg/1000 g)(P/RT)(molecular weight)
where:
P = ambient air pressure, 1 atmosphere (atm)
R = ideal gas constant, 8.2×10^{-5} atm-m^3/mol-^{0}K
T = absolute temperature, 298.15 Kelvin (^{0}K)

[2] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris
Date shown for other sources is the publication date.

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
RfC = reference concentration

TABLE 5-3
NONCANCER TOXICITY DATA - INHALATION (SUBCHRONIC)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source [1]	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	2.4E-01	mg/m^3	Liver	300	ATSDR	12/10/2010
Tetrachloroethene	NA	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds						
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
PCBs/Pesticides						
Aroclor 1254	NA	NA	NA	NA	NA	NA
Inorganics						
Aluminum	NA	NA	NA	NA	NA	NA
Antimony[3]	2.0E-04	mg/m^3	NA	100	PPRTV	8/5/2008
Arsenic	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Chromium VI	3.0E-04	mg/m^3	Respiratory System	30	ATSDR	12/10/2010
Cobalt	2.0E-05	mg/m^3	Respiratory System	100	PPRTV	8/25/2008
Copper	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA
Nickel	2.0E-04	mg/m^3	Respiratory System	30	ATSDR	12/10/2010
Vanadium [4]	1.0E-04	mg/m^3	Lung	1000	PPRTV	4/30/2008
Zinc	NA	NA	NA	NA	NA	NA

[1] ATSDR chronic inhalation minimal risk level (MRL)
MRL is converted from units in ppmv to mg/m^3 using the following equation:
MRL (mg/m^3) = (ppmv)(1 kg/1000 g)(P/RT)(molecular weight)
where:
P = ambient air pressure, 1 atmosphere (atm)
R = ideal gas constant, 8.2×10^{-5} atm-m^3/mol-^{0}K
T = absolute temperature, 298.15 Kelvin (^{0}K)
[2] Date shown is the publication date.
[3] Based on antimony trioxide
[4] Based on vanadium pentoxide

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
RfC = reference concentration

TABLE 5-4
NONCANCER TOXICITY DATA - INHALATION (ACUTE)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source [1]	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	4.9E-01	mg/m^3	Liver	30	ATSDR	12/10/2010
Tetrachloroethene	2.0E+01	mg/m^3	CNS/Respiratory System	60	Cal/EPA	12/18/2008
Semi-volatile Organic Compounds						
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
PCBs/Pesticides						
Aroclor 1254	NA	NA	NA	NA	NA	NA
Inorganics						
Aluminum	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA
Arsenic	2.0E-04	mg/m^3	Developmental/Cardiovascular System/CNS	1,000	Cal/EPA	12/18/2008
Cadmium	3.0E-05	mg/m^3	Respiratory System	300	ATSDR	12/10/2010
Chromium VI	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA
Copper	1.0E-01	mg/m^3	Respiratory System	10	Cal/EPA	12/18/2008
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	1.7E-04	mg/m^3	CNS	300	Cal/EPA	12/18/2008
Mercury	6.0E-04	mg/m^3	CNS	3,000	Cal/EPA	12/18/2008
Nickel	6.0E-03	mg/m^3	Respiratory System/Immune System	6	Cal/EPA	12/18/2008
Vanadium [3]	3.0E-02	mg/m^3	Respiratory System/Eyes	10	Cal/EPA	12/18/2008
Zinc	NA	NA	NA	NA	NA	NA

[1] ATSDR chronic inhalation minimal risk level (MRL)
MRL is converted from units in ppmv to mg/m^3 using the following equation:

$$MRL\ (mg/m^3) = (ppmv)(1\ kg/1000\ g)(P/RT)(molecular\ weight)$$

where:
P = ambient air pressure, 1 atmosphere (atm)
R = ideal gas constant, 8.2×10^{-5} atm-m^3/mol-^{0}K
T = absolute temperature, 298.15 Kelvin (^{0}K)

[2] Date shown is the publication date.
[3] Based on vanadium pentoxide

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
NA = not available
RfC = reference concentration

TABLE 5-5
CANCER TOXICITY DATA - ORAL/DERMAL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Oral Slope Factor		Oral Absorption Efficiency for Dermal [1]	Absorbed Slope Factor for Dermal [1]		Mutagen [2]	Weight of Evidence/ Cancer Guideline Description	Source	Date [3]
	Value	Unit		Value	Unit				(MM/DD/YYYY)
Volatile Organic Compounds									
Chloroform	3.1E-02	$(mg/kg\text{-}day)^{-1}$	1	3.1E-02	$(mg/kg\text{-}day)^{-1}$	--	B2 / 2B	Cal/EPA	12/18/2008
Tetrachloroethene	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1	5.4E-01	$(mg/kg\text{-}day)^{-1}$	--	2B	Cal/EPA	12/18/2008
Semi-volatile Organic Compounds									
Benzo(a)anthracene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	M	B2	IRIS	5/23/2011
Benzo(b)fluoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Dibenzo(a,h)anthracene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Dibenzofuran	NA	NA	1	NA	NA	--	D	IRIS	7/19/2011
Indeno(1,2,3-cd)pyrene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Naphthalene	NA	NA	1	NA	NA	--	C	IRIS	7/19/2011
Pentachlorophenol	4.0E-01	$(mg/kg\text{-}day)^{-1}$	1	4.0E-01	$(mg/kg\text{-}day)^{-1}$	--	Likely to be carcinogenic to humans	IRIS	7/19/2011
PCBs/Pesticides									
Aroclor 1254[4]	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	5/23/2011
Inorganics									
Aluminum	NA	NA	1	NA	NA	--	NA	NA	NA
Antimony[5]	NA	NA	0.15	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	8/5/2008
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	--	A	IRIS	5/23/2011
Cadmium	NA	NA	0.025	NA	NA	--	NA	NA	NA
Chromium VI	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	1.3E-02	$(mg/kg\text{-}day)^{-1}$	M	Likely to be carcinogenic to humans	NJDEP	5/23/2011
Cobalt	NA	NA	1	NA	NA	--	NA	NA	NA
Copper	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Iron	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Lead	NA	NA	NA	NA	NA	--	NA	NA	NA
Manganese	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Mercury	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Nickel	NA	NA	0.04	NA	NA	--	NA	NA	NA
Vanadium	NA	NA	1	NA	NA	--	NA	NA	NA
Zinc	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011

[1] Adjusted oral cancer slope factor (CSF) for Dermal = Oral CSF x Oral Absorption Efficiency for Dermal
[2] Idenitified as a mutagen on the Regional Screening Level (RSL) Table, November 2010
http://www.epa.gov/region09/waste/sfund/prg/index.html
[3] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.
[4] Based on oral slope factor for polychlorinated biphenyls (PCBs)
[5] Based on antimony trioxide

EPA Weight of Evidence (EPA 1986, EPA 1996):
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

Definition:
Cal/EPA = California Environmental Protection Agency
EPA = EPA Provisional Guidance for Quantitative Assessment of Polycyclic Aromatic Hydrocarbons
IRIS = Integrated Risk Information System
M = mutagen
NA = not available
NJDEP = New Jersey Department of
Environmental Protection

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE 5-6
CANCER TOXICITY DATA - INHALATION
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation Unit Risk		Mutagen [1]	Weight of Evidence/ Cancer Guideline Description	Inhalation Unit Risk	
	Value	Unit			Source	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	2.3E-05	$(\mu g/m^3)^{-1}$	--	B2	IRIS	7/19/2011
Tetrachloroethene	5.9E-06	$(\mu g/m^3)^{-1}$	--	2A	Cal/EPA	12/18/2008
Semi-volatile Organic Compounds						
Benzo(a)anthracene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Benzo(a)pyrene	1.1E-03	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Benzo(b)fluoranthene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Dibenzo(a,h)anthracene	1.2E-03	$(\mu g/m^3)^{-1}$	M	NA	Cal/EPA	12/18/2008
Dibenzofuran	NA	NA	--	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Naphthalene	3.4E-05	$(\mu g/m^3)^{-1}$	--	2B	Cal/EPA	12/18/2008
Pentachlorophenol	5.1E-06	$(\mu g/m^3)^{-1}$		Likely to be carcinogenic to humans	Cal/EPA	12/18/2008
PCBs/Pesticides						
Aroclor 1254	5.7E-04	$(\mu g/m^3)^{-1}$	--	B2	IRIS	5/23/2011
Heptachlor Epoxide	2.6E-03	$(\mu g/m^3)^{-1}$	--	B2	IRIS	7/19/2011
Inorganics						
Aluminum	NA	NA	--	NA	NA	NA
Antimony[3]	NA	NA	--	Suggestive evidence of the carcinogenic potential	PPRTV	8/5/2008
Arsenic	4.3E-03	$(\mu g/m^3)^{-1}$	--	A	IRIS	5/23/2011
Cadmium	1.8E-03	$(\mu g/m^3)^{-1}$	--	B1	IRIS	5/23/2011
Chromium VI	1.2E-02	$(\mu g/m^3)^{-1}$	M	A	IRIS	5/23/2011
Cobalt	9.0E-03	$(\mu g/m^3)^{-1}$	--	Likely to be carcinogenic to humans	PPRTV	8/25/2008
Copper	NA	NA	--	D	IRIS	5/23/2011
Iron	NA	NA	--	NA	NA	NA
Lead	NA	NA	--	NA	NA	NA
Manganese	NA	NA	--	D	IRIS	5/23/2011
Mercury	NA	NA	--	D	IRIS	5/23/2011
Nickel	2.6E-04	$(\mu g/m^3)^{-1}$	--	A	Cal/EPA	12/18/2008
Silver	NA	NA	--	D	IRIS	5/23/2011
Vanadium[4]	8.0E-03	$(\mu g/m^3)^{-1}$	--	Suggestive evidence of carcinogenic potential	PPRTV	4/30/2008
Zinc	NA	NA	--	D	IRIS	5/23/2011

[1] Idenitified as a mutagen on the Regional Screening Level (RSL) Table, November 2010, http://www.epa.gov/region09/waste/sfund/prg/index.html
[2] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/ Date shown for other sources is the publication date.
[3] Based on antimony trioxide
[4] Based on vanadium pentoxide

Definition:
Cal/EPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
M = mutagen
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value

EPA Weight of Evidence (EPA 1986, EPA 1996):
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

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE 6-1
SUMMARY OF CANCER RISKS AND NONCANCER HEALTH HAZARDS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Time Frame	Receptor Population	Exposure Area	Receptor	Cancer Risk			Noncancer Hazard Index (HI)		
				RME	CTE	Risk Driver	RME	CTE	HI for Target Organ/Effect/Risk Driver
Current	Recreational User	Area 1	Adult	6×10^{-6}	--	--	0.3	--	--
			Adolescent	9×10^{-6}	--	--	0.4	--	--
		Areas 3 and 4	Adult	2×10^{-6}	--	--	0.06	--	--
			Adolescent	3×10^{-7}	--	--	0.009	--	--
			Child	9×10^{-6}	--	--	0.6	--	--
		Areas 5, 6 and Beach Area of Area 9	Adult	7×10^{-6}	--	--	0.09	--	--
			Child	9×10^{-6}	--	--	0.6	--	--
		Upland Area of Area 9	Adult	7×10^{-6}	--	--	0.3	--	--
			Adolescent	9×10^{-6}	--	--	0.4	--	--
	Pedestrian	All Areas (except Areas 2, 8 and 11)	Adult	6×10^{-6}	--	--	0.4	--	--
			Adolescent	8×10^{-6}	--	--	0.5	--	--
	Angler (Fish)	All Areas (except Areas 3 and 4)	Adult	**2×10^{-4}**	4×10^{-5}	Arsenic	1	--	--
			Child*	6×10^{-5}	--	--	**2**	0.6	HI due to arsenic: - skin: RME (2), CTE (0.6)
	Angler (Hard Clam)		Adult	**2×10^{-4}**	3×10^{-5}	Arsenic	1	--	--
			Child*	7×10^{-5}	--	--	**2**	0.9	HI due to arsenic: - skin: RME (2), CTE (0.9)
	Angler (Ribbed Mussel)		Adult	1×10^{-4}	--	--	0.7	--	--
			Child*	4×10^{-5}	--	--	1	--	--
	Angler (Blue Crab Muscle)		Adult	3×10^{-5}	--	--	0.2	--	--
			Child*	1×10^{-5}	--	--	0.3	--	--
	Angler (Blue Crab Muscle and Hepatopancreas)		Adult	4×10^{-5}	--	--	0.6	--	--
			Child*	2×10^{-5}	--	--	1	--	--
	Trespasser	Area 2	Adult	1×10^{-6}	--	--	0.05	--	--
			Adolescent	2×10^{-6}	--	--	0.07	--	--
		Areas 8 and 11	Adult	6×10^{-6}	--	--	0.2	--	--
			Adolescent	8×10^{-6}	--	--	0.3	--	--
	Outdoor Worker	Areas 3 and 4	Adult	6×10^{-6}	--	--	0.08	--	--
	Construction/Utility Worker	All Upland Areas	Adult	2×10^{-6}	--	--	1	--	--

TABLE 6-1
SUMMARY OF CANCER RISKS AND NONCANCER HEALTH HAZARDS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Time Frame	Receptor Population	Exposure Area	Receptor	Cancer Risk			Noncancer Hazard Index (HI)		
				RME	CTE	Risk Driver	RME	CTE	HI for Target Organ/Effect/Risk Driver
Future	Recreational User	Area 1	Adult	6×10^{-6}	--	--	0.3	--	--
			Adolescent	9×10^{-6}	--	--	0.4	--	--
		Area 2	Adult	1×10^{-5}	--	--	0.2	--	--
			Child	2×10^{-5}	--	--	1	--	--
		Areas 3 and 4	Adult	2×10^{-6}	--	--	0.06	--	--
			Adolescent	3×10^{-7}	--	--	0.009	--	--
			Child	9×10^{-6}	--	--	0.6	--	--
		Areas 5, 6 and Beach Area of Area 9	Adult	7×10^{-6}	--	--	0.09	--	--
			Child	9×10^{-6}	--	--	0.6	--	--
		Upland Area of Area 9	Adult	7×10^{-6}	--	--	0.3	--	--
			Adolescent	9×10^{-6}	--	--	0.4	--	--
	Pedestrian	All Areas (except Areas 8 and 11)	Adult	6×10^{-6}	--	--	0.4	--	--
			Adolescent	8×10^{-6}	--	--	0.5	--	--
	Angler (Fish)	All Areas (except Areas 3 and 4)	Adult	**2×10^{-4}**	4×10^{-5}	Arsenic	1	--	--
			Child*	6×10^{-5}	--	--	**2**	0.6	HI due to arsenic: - skin: RME (2), CTE (0.6)
	Angler (Hard Clam)		Adult	**2×10^{-4}**	3×10^{-5}	Arsenic	1	--	--
			Child*	7×10^{-5}	--	--	**2**	0.9	HI due to arsenic: - skin: RME (2), CTE (0.9)
	Angler (Ribbed Mussel)		Adult	1×10^{-4}	--	--	0.7	--	--
			Child*	4×10^{-5}	--	--	1	--	--
	Angler (Blue Crab Muscle)		Adult	3×10^{-5}	--	--	0.2	--	--
			Child*	1×10^{-5}	--	--	0.3	--	--
	Angler (Blue Crab Muscle and Hepatopancreas)		Adult	4×10^{-5}	--	--	0.6	--	--
			Child*	2×10^{-5}	--	--	1	--	--
	Trespasser	Areas 8 and 11	Adult	6×10^{-6}	--	--	0.2	--	--
			Adolescent	8×10^{-6}	--	--	0.3	--	--
	Outdoor Worker	Areas 3 and 4	Adult	6×10^{-6}	--	--	0.08	--	--
	Construction/Utility Worker	All Upland Areas	Adult	2×10^{-6}	--	--	1	--	--
	Resident	All Areas	Adult/Child**	9×10^{-5}	--	--	**15**	**5**	HI due to cobalt: - respiratory system: RME (5), CTE (2) - thyroid gland: RME (5), CTE (2) HI due to iron: - GI system: RME (7), CTE (3)

RME = reasonable maximum exposure CTE = central tendency exposure GI = gastrointestinal

Bold indicates cancer risk is above EPA's target cancer risk range of 1×10^{-6} to 1×10^{-4} or noncancer HI is above EPA's threshold of unity (1)

*The angler scenario for children (0 to 6 years old) assumes children will consume fish and shellfish caught at the site by anglers

**For resident, cancer risk is based on age-adjusted exposure scenario and noncancer HI is based on the more sensitive child (0 to 6 years old) receptor.

TABLE 6-2
SUMMARY OF INTEGRATED EXPOSURE UPTAKE BIOKINETIC MODEL RESULTS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Time Frame	Receptor Population	Exposure Area	Model Output Categories	Lead Concentration			Geomean Blood Lead Concentration (µg/dL)	Percentage of Children with Blood Lead Concentrations Above 10 µg/dL [1]
				Soil (mg/kg)	Groundwater (µg/L)	Tissue (mg/kg)		
Current	Recreational User	Areas 5, 6, and Beach Area of Area 9	Incidental Ingestion of Soil	68	--	--	1.6	0.004%
	Angler	All Areas (except Areas 3 and 4)	Ingestion of Hard Clam	--	--	1.696	3.8	1.85%
			Ingestion of Ribbed Mussel	--	--	0.361	3.1	0.58%
			Ingestion of Blue Crab Muscle	--	--	0.111	2.9	0.44%
			Ingestion of Blue Crab Muscle Plus Hepatopancreas	--	--	0.102	2.9	0.44%
Future	Recreational User	Area 2	Incidental Ingestion of Soil	485 (total lead)	--	--	5.4	**9.68%**
			Incidental Ingestion of Soil	685 (fine fraction, bioavailability 42%)	--	--	9.1	**42.16%**
		Areas 5, 6, and Beach Area of Area 9	Incidental Ingestion of Soil	67.96	--	--	1.6	0.004%
	Resident	All Areas	Ingestion of Groundwater as Drinking Water Source	--	10.57	--	3.4	1.007%
	Angler	All Areas (except Areas 3 and 4)	Ingestion of Hard Clam	--	--	1.696	3.8	1.85%
			Ingestion of Ribbed Mussel	--	--	0.36	3.1	0.58%
			Ingestion of Blue Crab Muscle	--	--	0.111	2.9	0.44%
			Ingestion of Blue Crab Muscle Plus Hepatopancreas	--	--	0.102	2.9	0.44%

mg/kg = milligram per kilogram
µg/dL = microgram per deciliter
µg/L = micrograms per liter
-- = not applicable
[1] Target blood lead level of concern = 10 µg/dL
Bold indicates value exceeds the 5% probability threshold of concern

TABLE 6-3
SUMMARY OF PREDICTED FETAL AND ADULT/ADOLESCENT BLOOD LEAD CONCENTRATIONS USING THE ADULT LEAD MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Time Frame	Receptor Population	Exposure Area	Receptor	Model Output Categories	Lead Concentration		Estimated Adult/ Adolescent Blood Lead Concentrations	Estimated Fetal Blood Concentrations (µg/dL)	Probability of Fetal Blood Lead Concentrations Exceeding 10 µg/dL[1]
					Soil (mg/kg)	Tissue (mg/kg)			
Current	Recreational User	Area 1	Adult	Incidental Ingestion of Soil	557	--	1.7	4.1	0.08%
			Adolescent	Incidental Ingestion of Soil	557	--	1.7	4.1	0.08%
		Area 5, Area 6, and Beach Area of Area 9	Adult	Incidental Ingestion of Soil	68	--	1.1	2.6	0.004%
		Upland Area of Area 9	Adult	Incidental Ingestion of Soil	251	--	1.3	3.1	0.02%
			Adolescent	Incidental Ingestion of Soil	251	--	1.3	3.1	0.02%
		Wetland Area of Area 9	Adult	Incidental Ingestion of Sediment	117	--	1.2	2.7	0.01%
			Adolescent	Incidental Ingestion of Sediment	117	--	1.0	2.4	0.002%
	Pedestrian	All Areas (except Areas 2, 8 and 11)	Adult	Incidental Ingestion of Soil	215	--	2.0	4.7	0.17%
			Adolescent	Incidental Ingestion of Soil	215	--	2.0	4.7	0.17%
	Construction/ Utility Worker	All Upland Areas	Adult	Incidental Ingestion of Soil (Surface and Subsurface)	408	--	5.4	12.8	**11.14%**
	Angler	All Areas (except Areas 3 and 4)	Adult	Ingestion of Hard Clam	--	1.7	2.3	5.4	0.37%
				Ingestion of Ribbed Mussel	--	0.36	1.3	3.0	0.01%
				Ingestion of Blue Crab Muscle	--	0.11	1.1	2.6	0.004%
				Ingestion of Blue Crab Muscle Plus Hepatopancreas	--	0.11	1.1	2.6	0.004%

TABLE 6-3
SUMMARY OF PREDICTED FETAL AND ADULT/ADOLESCENT BLOOD LEAD CONCENTRATIONS USING THE ADULT LEAD MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Time Frame	Receptor Population	Exposure Area	Receptor	Model Output Categories	Lead Concentration		Estimated Adult/ Adolescent Blood Lead Concentrations	Estimated Fetal Blood Concentrations (µg/dL)	Probability of Fetal Blood Lead Concentrations Exceeding 10 µg/dL[1]
					Soil (mg/kg)	Tissue (mg/kg)			
Future	Recreational User	Area 1	Adult	Incidental Ingestion of Soil	557	--	1.7	4.1	0.08%
			Adolescent	Incidental Ingestion of Soil	557	--	1.7	4.1	0.08%
		Area 2	Adult	Incidental Ingestion of Soil, total lead	485	--	1.6	3.9	0.06%
				Incidental Ingestion of Soil, fine fraction	685	--	2.3	5.4	0.35%
		Area 5, Area 6, and Beach Area of Area 9	Adult	Incidental Ingestion of Soil	68	--	1.1	2.6	0.004%
		Upland Area of Area 9	Adult	Incidental Ingestion of Soil	251	--	1.3	3.1	0.02%
			Adolescent	Incidental Ingestion of Soil	251	--	1.3	3.1	0.02%
		Wetland Area of Area 9	Adult	Incidental Ingestion of Sediment	117	--	1.2	2.7	0.01%
			Adolescent	Incidental Ingestion of Sediment	117	--	1.0	2.4	0.002%
	Pedestrian	All Areas (except Areas 8 and 11)	Adult	Incidental Ingestion of Soil	234	--	2.1	4.9	0.22%
			Adolescent	Incidental Ingestion of Soil	234	--	2.1	4.9	0.22%
	Construction/ Utility Worker	All Upland Areas	Adult	Incidental Ingestion of Soil (Surface and Subsurface)	408	--	5.4	12.8	**11.14%**
	Angler	All Areas (except Areas 3 and 4)	Adult	Ingestion of Hard Clam	--	1.7	2.3	5.4	0.37%
				Ingestion of Ribbed Mussel	--	0.36	1.3	3.0	0.01%
				Ingestion of Blue Crab Muscle	--	0.11	1.1	2.6	0.004%
				Ingestion of Blue Crab Muscle Plus Hepatopancreas	--	0.11	1.1	2.6	0.004%

mg/kg = milligram per kilogram µg/dL = microgram per deciliter -- = not applicable
[1] Target blood lead level of concern = 10 µg/dL
Bold indicates value exceeds the 5% probability threshold of concern
Adult exposure to groundwater is covered under Integrated Exposure Uptake Biokinetic Model for Lead in Children

TABLE 6-4
COMPARISON OF AREA 2 DATA
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical	Unit	Data Used in HHRA			April 2011 Data		
		Minimum Concentration Detected	Maximum Concentration Detected	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Frequency of Detection
Surface Soil							
Antimony	mg/kg	0.77 J	190	83 / 94	0.2 J	11.8	7 / 8
Arsenic	mg/kg	1.5	150	94 / 94	1.5	11.1	7 / 8
Chromium	mg/kg	2.5	32.6	94 / 94	1.5 J	16.4	8 / 8
Chromium VI	mg/kg	0.12	2	5 / 21	0.35 J	2.2 J	4 / 8
Copper	mg/kg	2.8	330	94 / 94	1.9 J	14.7	8 / 8
Lead	mg/kg	6.7	3000	94 / 94	3.6	296	8 / 8
Surface Water							
Antimony	µg/L	11.7 J	29 J	3 / 3	ND	ND	0 / 5
Arsenic	µg/L	29.3	34.5	3 / 3	2.7 J	4.4 J	2 / 5
Chromium	µg/L	16.5	25	3 / 3	ND	ND	0 / 5
Copper	µg/L	53.3	67.7 J	3 / 3	ND	ND	0 / 5
Lead	µg/L	867	1450 J	3 / 3	2.4 J	3.8 J	2 / 5
Sediment							
Antimony	mg/kg	ND	ND	0 / 1	0.41 J	0.43 J	2 / 2
Arsenic	mg/kg	6.9 J	6.9 J	1 / 1	1.7	2	2 / 2
Chromium	mg/kg	12.3 J	12.3 J	1 / 1	3.8 J	4.3 J	2 / 2
Chromium VI[(1)]	mg/kg	1.8	1.8	1 / 1	2.1 J	2.1 J	1 / 2
Copper	mg/kg	13.7 J	13.7 J	1 / 1	12	12.6	2 / 2
Lead	mg/kg	18.5	18.5	1 / 1	21.5	21.5	2 / 2

ND - not detected
J - estimated concentration
HHRA - human health risk assessment

mg/kg - milligram per kilogram
µg/L - microgram per liter

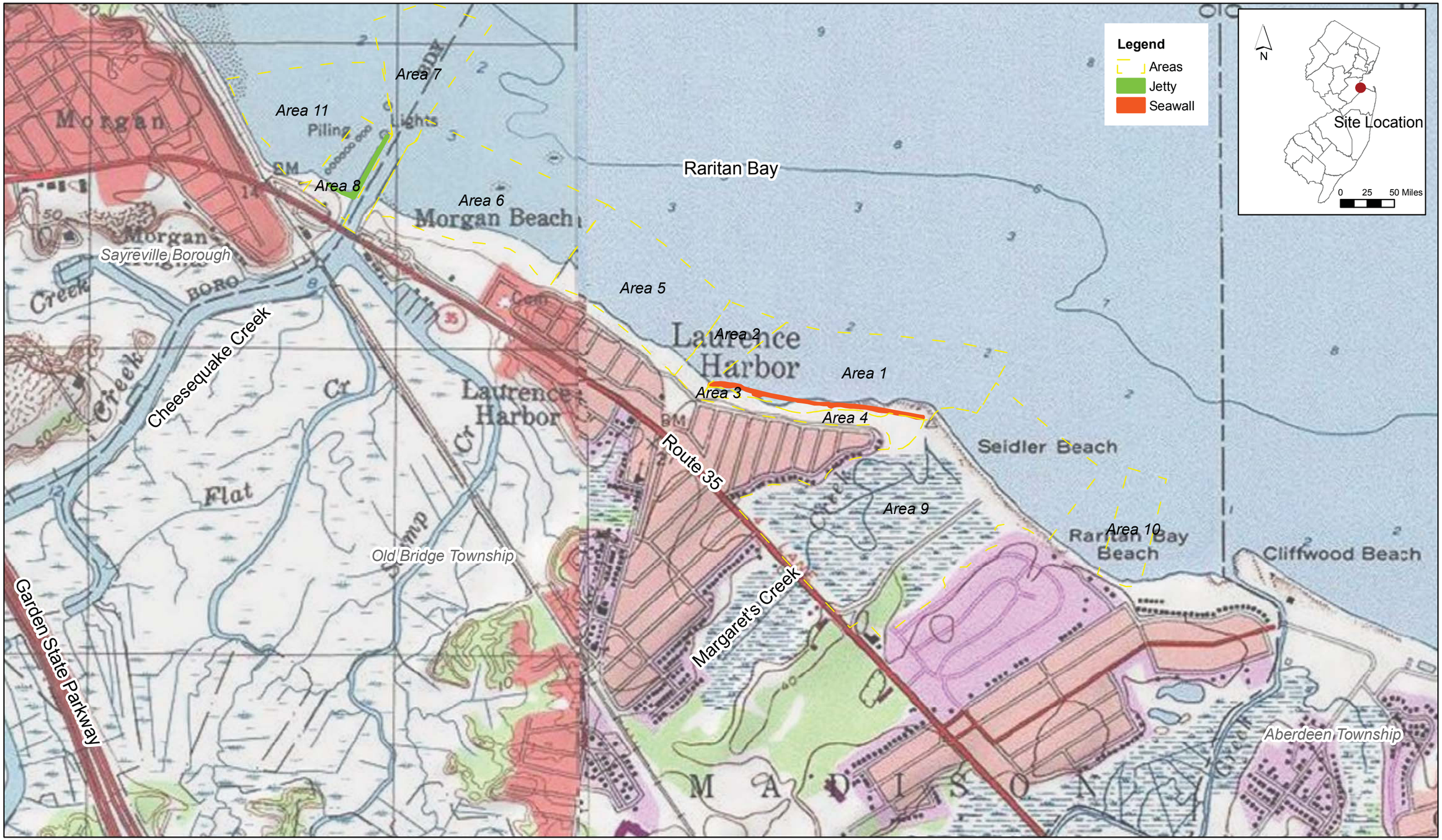
[(1)] Chromium VI was not analyzed in the sediment sample used in the HHRA. The chromium VI concentration was estimated from total chromium concentration using a chromium VI to chromium III ratio of 1:6.

TABLE 6-5
UNCERTAINTY ANALYSIS FOR PREDICTED FETAL AND ADOLESCENT BLOOD LEAD CONCENTRATIONS USING THE ADULT LEAD MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Model Output Categories	Exposure Area	Receptor	Soil Lead Concentration (ppm)	Absorption Fraction	Estimated Adult/Adolescent Blood Lead Concentrations	Estimated Fetal Blood Concentrations (µg/dl)	Probability of Fetal Blood Lead Concentrations Exceeding 10 µg/dl
Incidental Ingestion of Soil	Area 1	Current and Future Adolescent Recreational Users	557	0.42	3.6	8.4	2.65%
			557	0.3	2.8	6.7	1.00%
Incidental Ingestion of Soil	Upland Area of Area 9	Current and Future Adolescent Recreational Users	250.6	0.42	2.2	5.1	0.26%
			250.6	0.3	1.8	4.3	0.11%
Incidental Ingestion of Sediment	Wetland Area of Area 9	Adolescent Recreational Users	117.3	0.42	1.0	2.4	0.002%
			117.3	0.3	1.0	2.4	0.002%
Incidental Ingestion of Soil	All areas except Areas 2, 8 and 11	Current Adolescent Pedestrians	214.7	0.42	4.5	10.6	**6.02%**
			214.7	0.3	3.5	8.2	2.39%
Incidental Ingestion of Soil	All areas except Areas 8 and 11	Future Adolescent Pedestrians	234.3	0.42	4.8	11.3	**7.54%**
			234.3	0.3	3.7	8.7	3.06%

Target PbB fetal blood lead level of concern = 10 ug/dL
ppm =parts per million
µg/dL = microgram per deciliter
Bold indicates exceeding the threshold of concern

Figures



Source: USGS Topographic Quadrangle

0 500 1,000 2,000 3,000 Feet

N

EPA

Figure 2-1
Site Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

R2-0005601

\\Ednfedsvr1\gis\Raritan_Bay\MXD\RI Workplan\Figure 2-2 Investigation_Areas.mxd

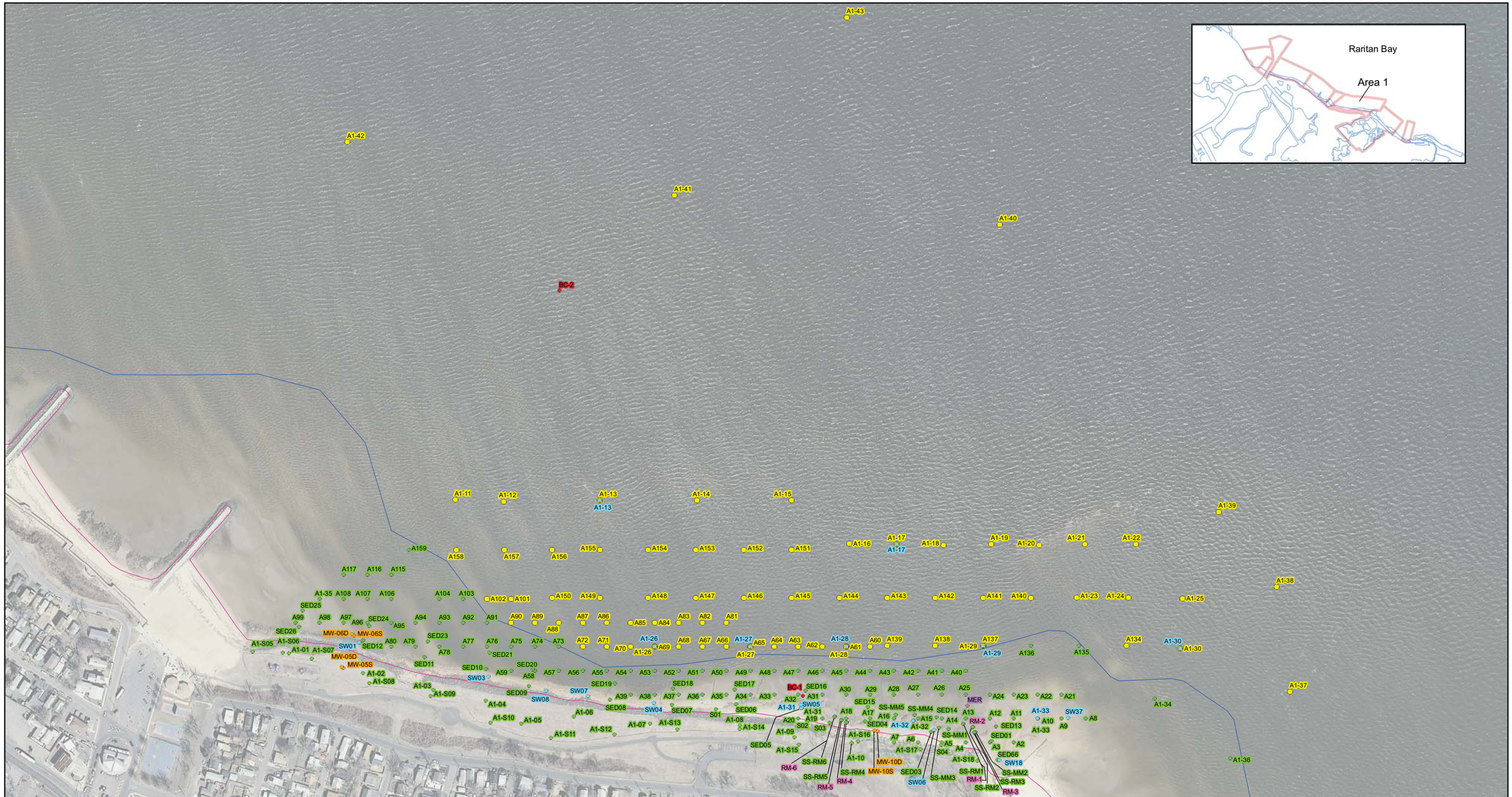
AREA	DESCRIPTION
Area 1 Laurence Harbor Seawall	The seawall along Old Bridge Waterfront Park west of Margaret's Creek to the beach area at the foot of Laurence Parkway.
Area 2 Laurence Harbor Beach	The beach area at the foot of Laurence Parkway between the western end of the seawall and the first jetty.
Area 3 Laurence Harbor Playground	The park playground adjacent to the western end of the seawall.
Area 4 Old Bridge Waterfront Park	The park area along the seawall (not including the playground) from the fence to the roadway.
Area 5 Laurence Harbor Beach	The beach area between the first and third jetty.
Area 6 Laurence Harbor Beach	The beach area between the third jetty and Cheesequake Creek Inlet eastern jetty.
Area 7 Cheesequake Creek Inlet	The inlet between the eastern and western jetties from the Route 35 bridge to the extent of sediment deposition.
Area 8 Cheesequake Creek Inlet Western Jetty	The jetty west of the inlet in Sayreville.
Area 9 Margaret's Creek	The wetlands associated with the Creek (between the beach and Route 35), including the adjacent beach (east of the Creek to the Middlesex County Pumping Station).
Area 10 Background Area	The historical background sampling location.
Area 11 Depositional Areas	The potential depositional areas associated with Areas 7 and 8.

0 400 800 1,600 2,400 Feet

N W E S

EPA

Figure 2-2
Site Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Legend

- Soil Location
- Groundwater Location
- Surface Water Location
- Sediment Location
- Hard Clam
- Ribbed Mussel
- Mean High Tide Line
- Spring Low Tide Line
- Blue Crab

N

0 125 250 500 Feet

EPA

Figure 2-3
Area 1 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Legend

- Soil Location
- Surface Water Location
- Sediment Location
- Hard Clam
- Mean High Tide Line
- Spring Low Tide Line

EPA

N

0 45 90 180 Feet

Figure 2-4
Area 2 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

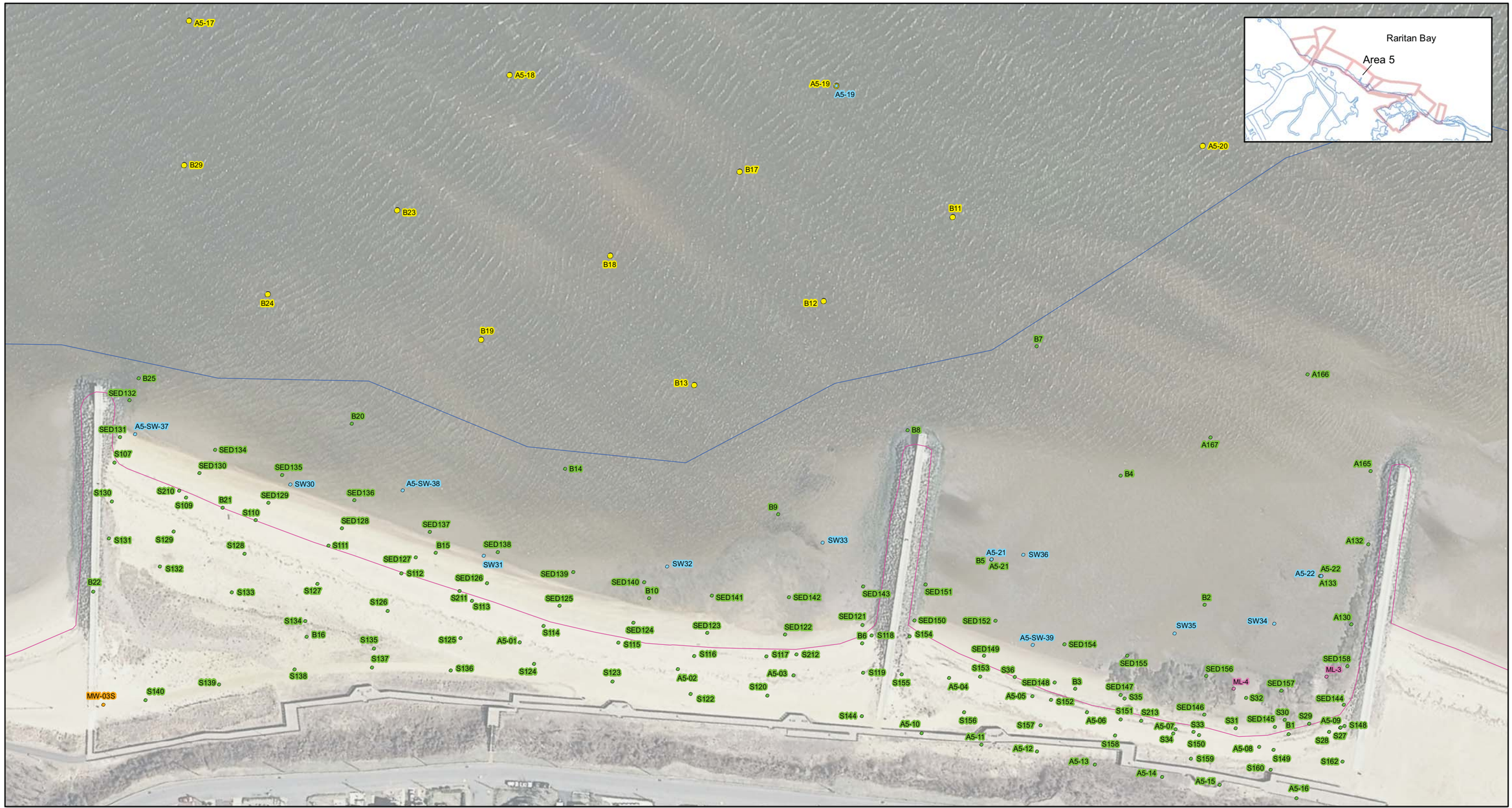
Legend

- Soil Location
- Groundwater Location

EPA

0 70 140 280 Feet

Figure 2-5
Areas 3 and 4 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Legend

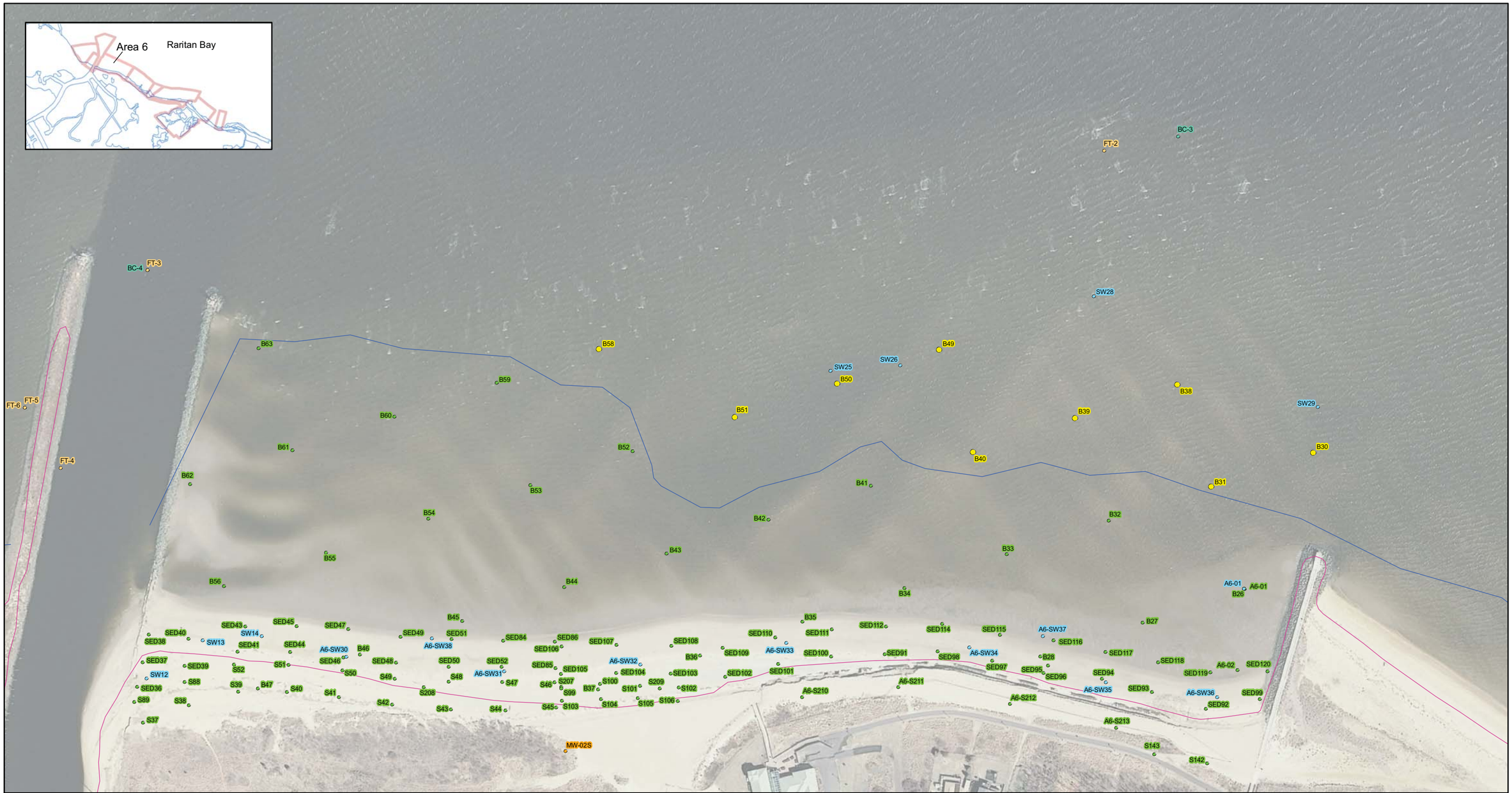
- Soil Location
- Groundwater Location
- Surface Water Location
- Sediment Location
- Ribbed Mussel
- Mean High Tide Line
- Spring Low Tide Line

N

0 50 100 200 Feet

EPA

Figure 2-6
Area 5 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Legend

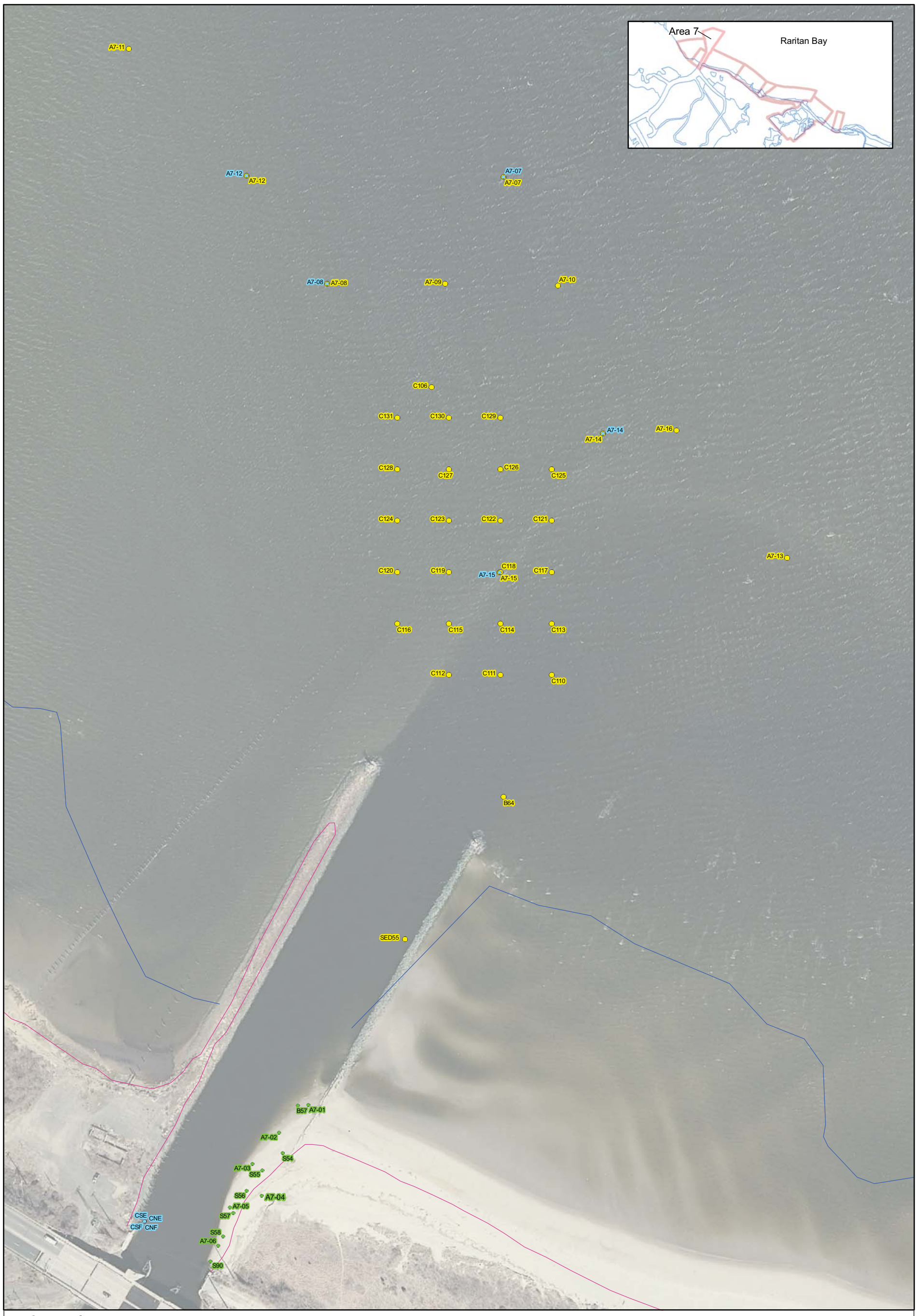
- Soil Location
- Groundwater Location
- Surface Water Location
- Sediment Location
- Fish
- Blue Crab
- Mean High Tide Line
- Spring Low Tide Line

N

0 90 180 360 Feet

EPA

Figure 2-7
Area 6 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Legend

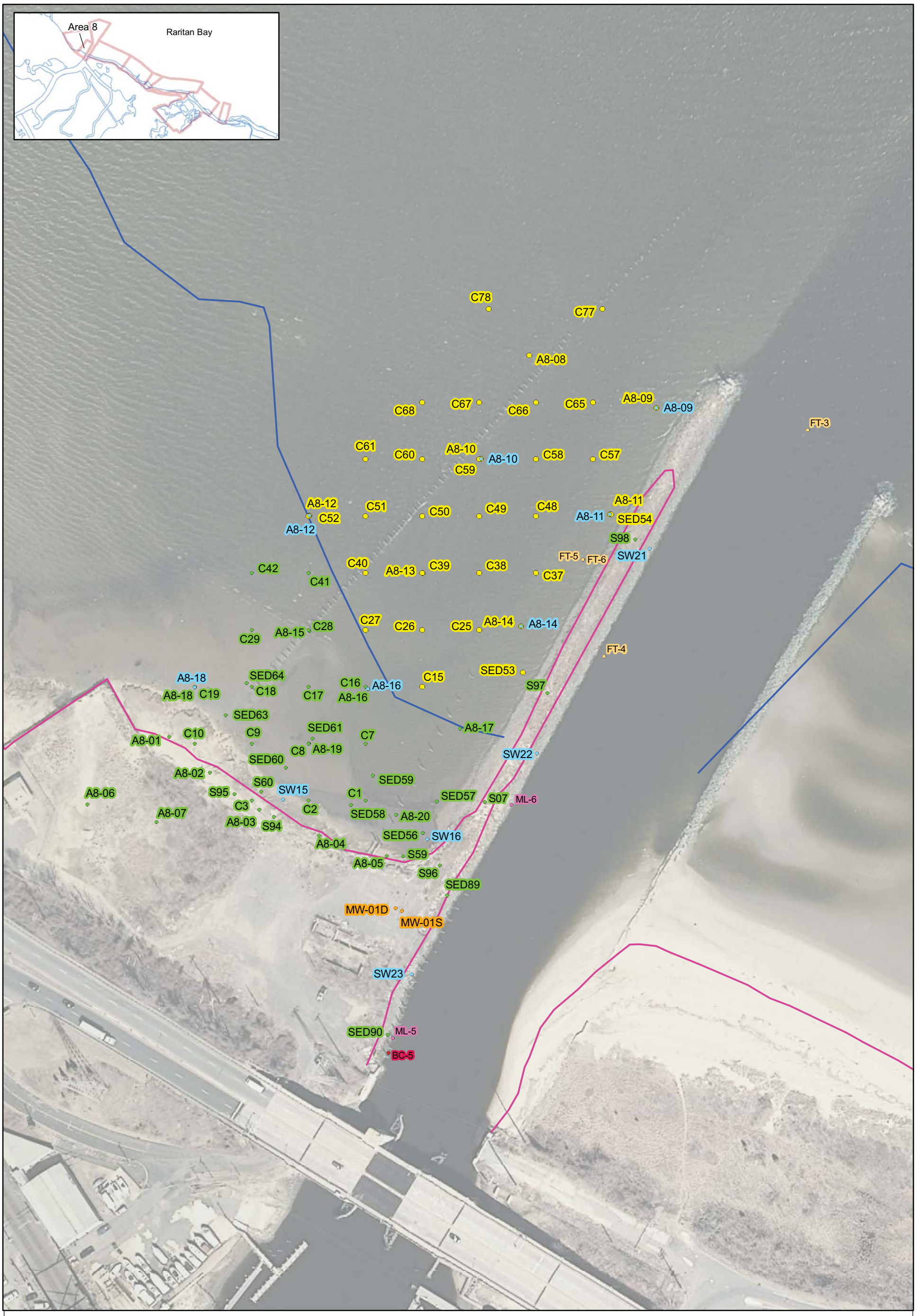
- Soil Location
- Surface Water Location
- Sediment Location
- Mean High Tide Line
- Spring Low Tide Line

N

0 90 180 360 Feet

EPA

Figure 2-8
Area 7 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Legend

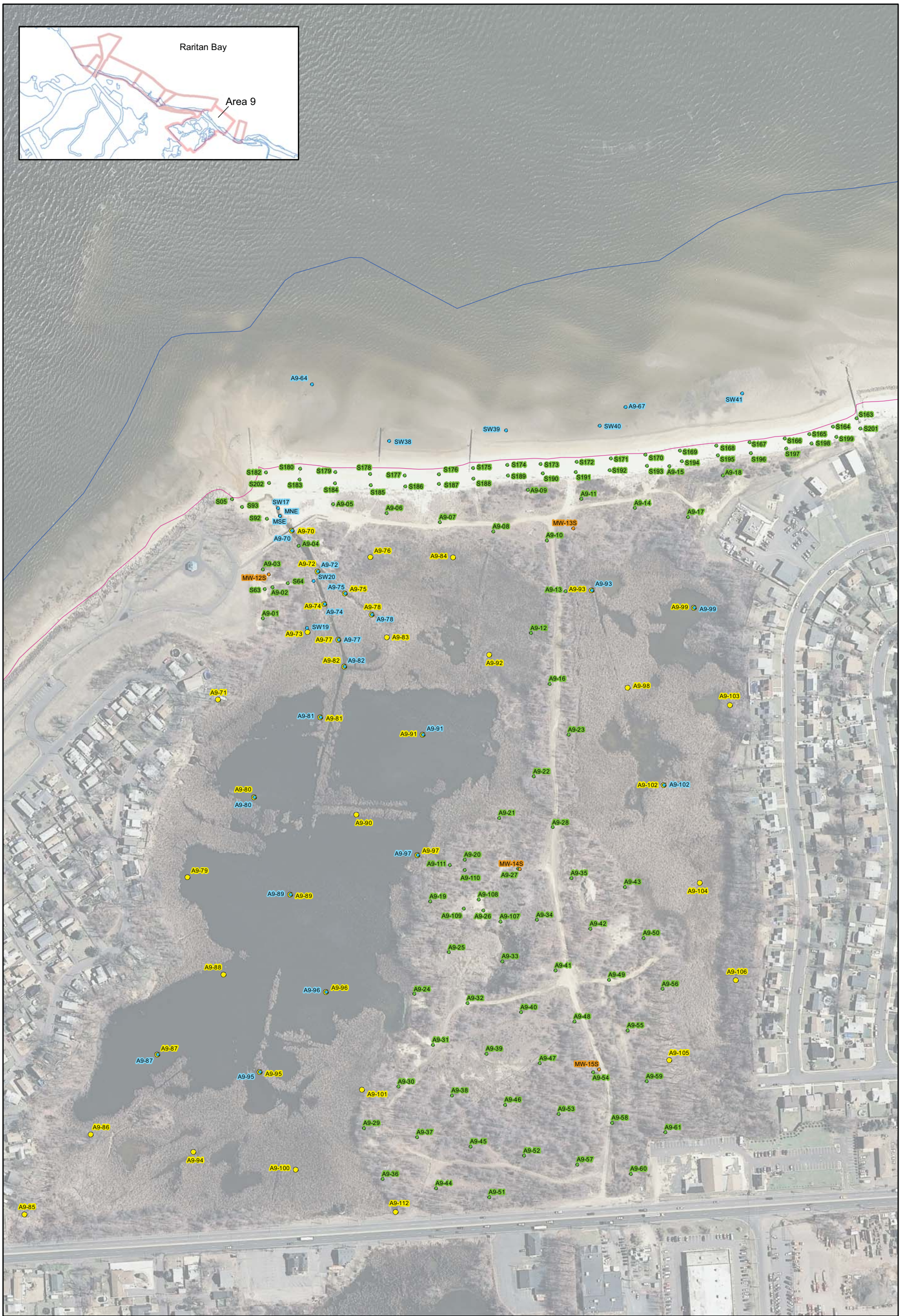
- Soil Location
- Groundwater Locations
- Surface Water Location
- Sediment Location
- Fish
- Ribbed Mussel
- Blue Crab
- Mean High Tide Line
- Spring Low Tide Line

N

0 60 120 Feet

EPA

Figure 2-9
Area 8 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

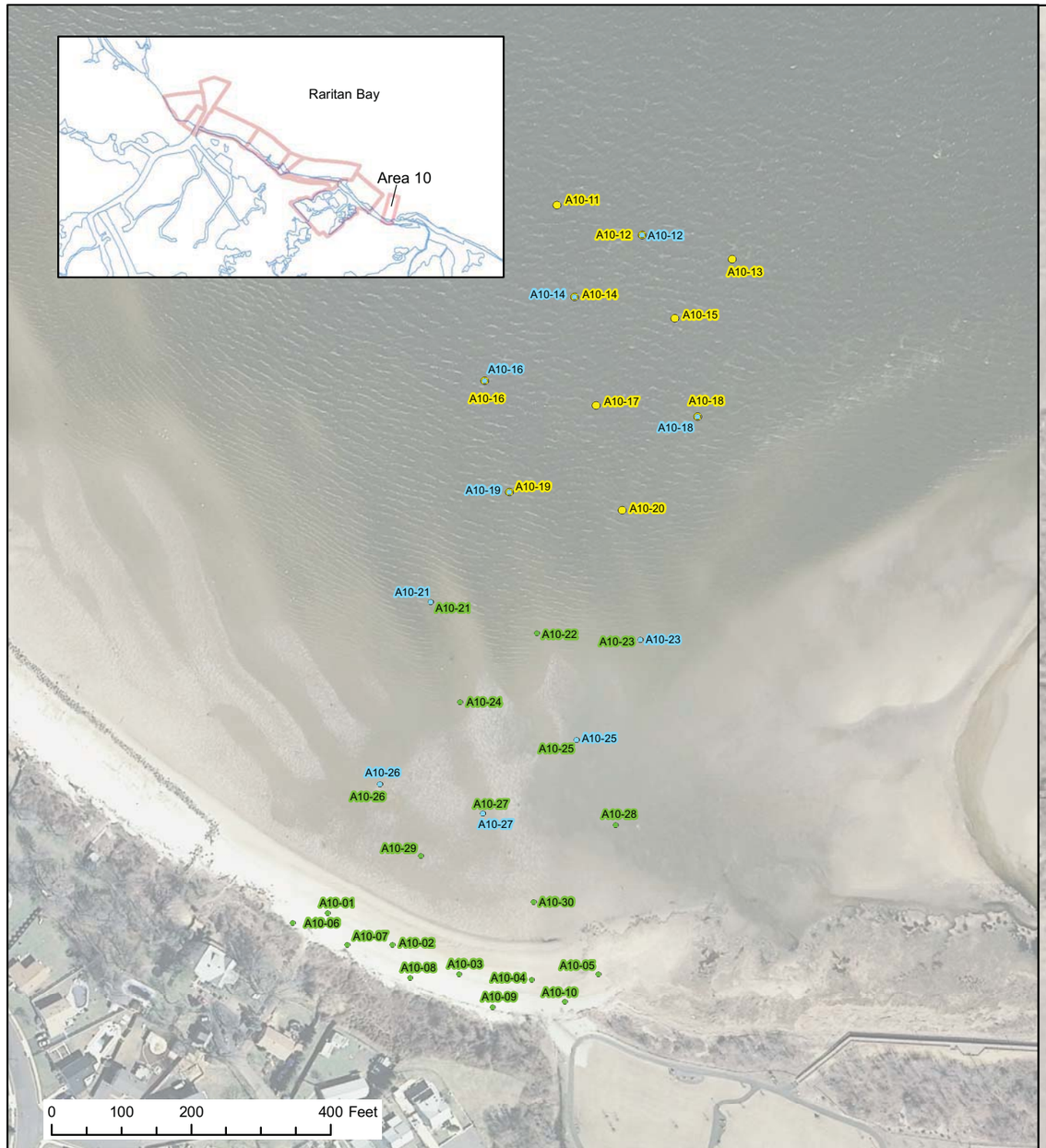


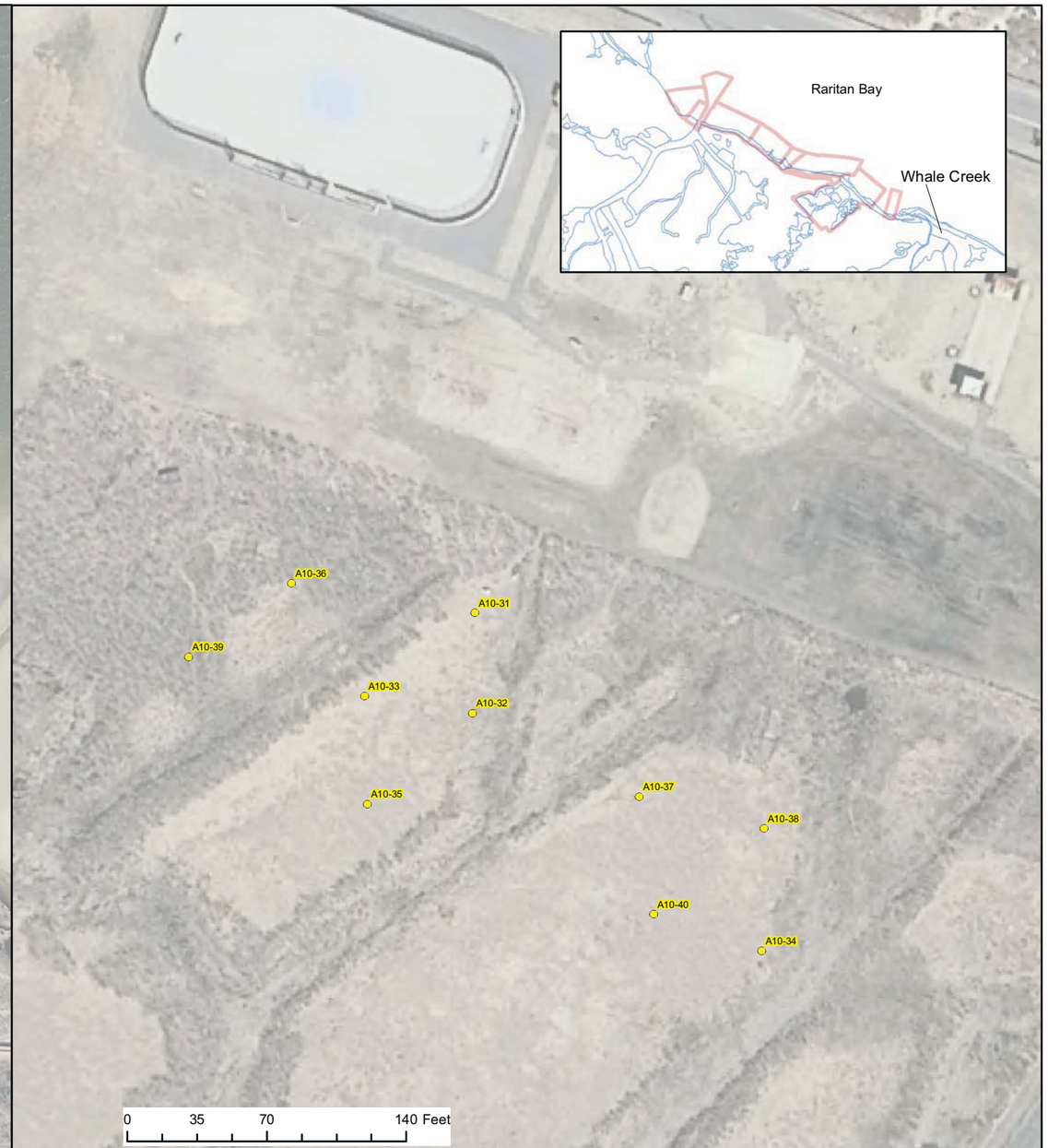
Legend

- Soil Location
- Groundwater Location
- Surface Water Location
- Sediment Location
- Mean High Tide Line
- Spring Low Tide Line

0 135 270 540 Feet

Figure 2-10
Area 9 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey





LEGEND

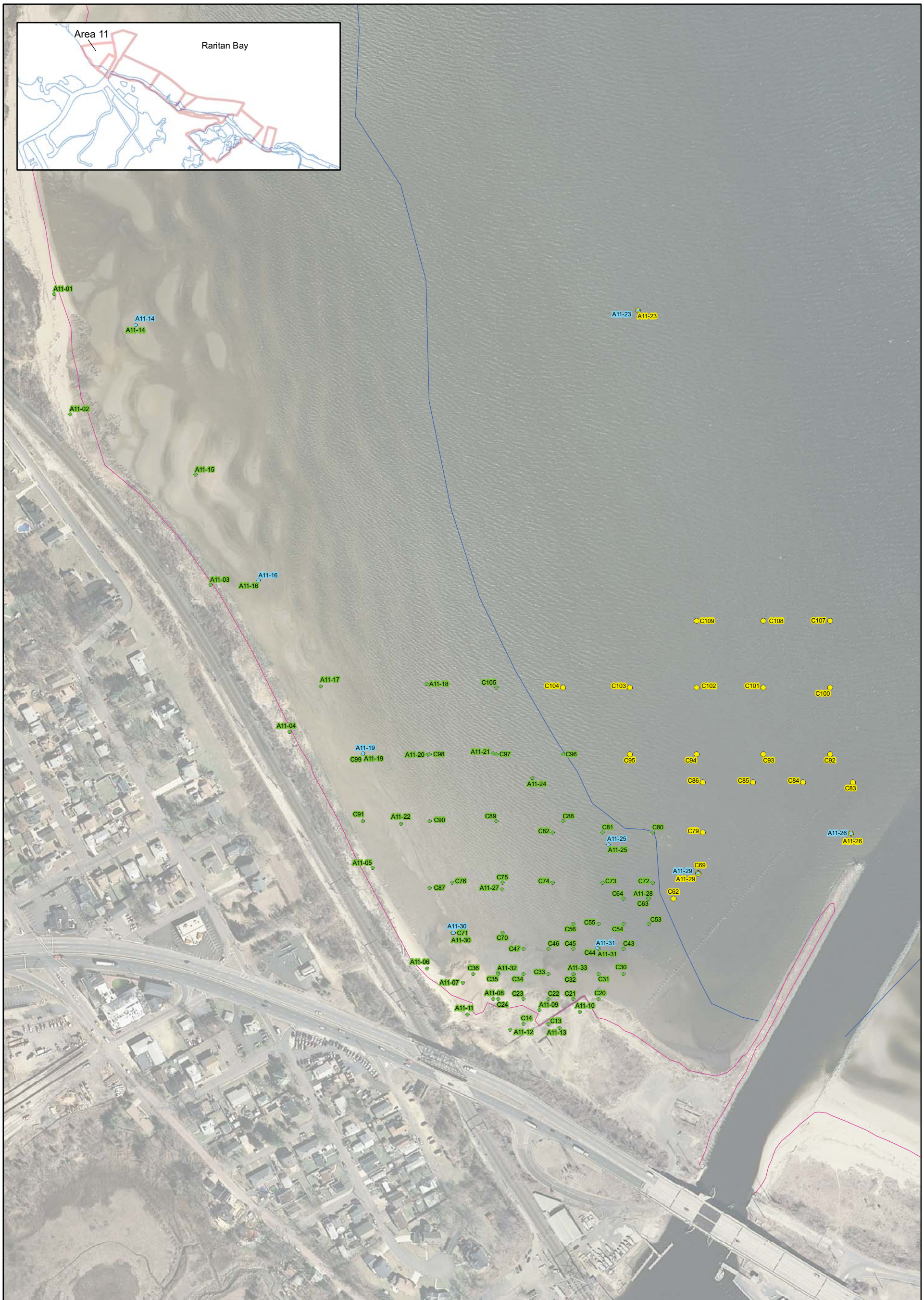
- Soil Location
- Surface Water location
- Sediment Location

Note: since many surface water and sediment samples are co-located, symbols for both matrices may not be visible at some locations.

N

EPA

Figure 2-11
Background Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Legend

- Soil Locations
- Surface Water Location
- Sediment Location
- Mean High Tide Line
- Spring Low Tide Line

EPA

Figure 2-12
Area 11 Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Legend

- TRW Sample Location
- Spring Low Tide Line
- Mean High Tide Line

N

0 237.5 475 950 Feet

EPA

Figure 2-13
Areas 2, 3, 5, and 6 TRW Lead Composite Sampling Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Legend

- Soil Location
- Mean High Tide Line
- Spring Low Tide Line

N

0 125 250 500 Feet

EPA

Figure 2-14
Areas 2, 3, 5, and 6 Bioavailability Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Legend

- Soil Location

N

0 125 250 500 Feet

Figure 2-15
Margaret's Creek Bioavailability Sample Location Map
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

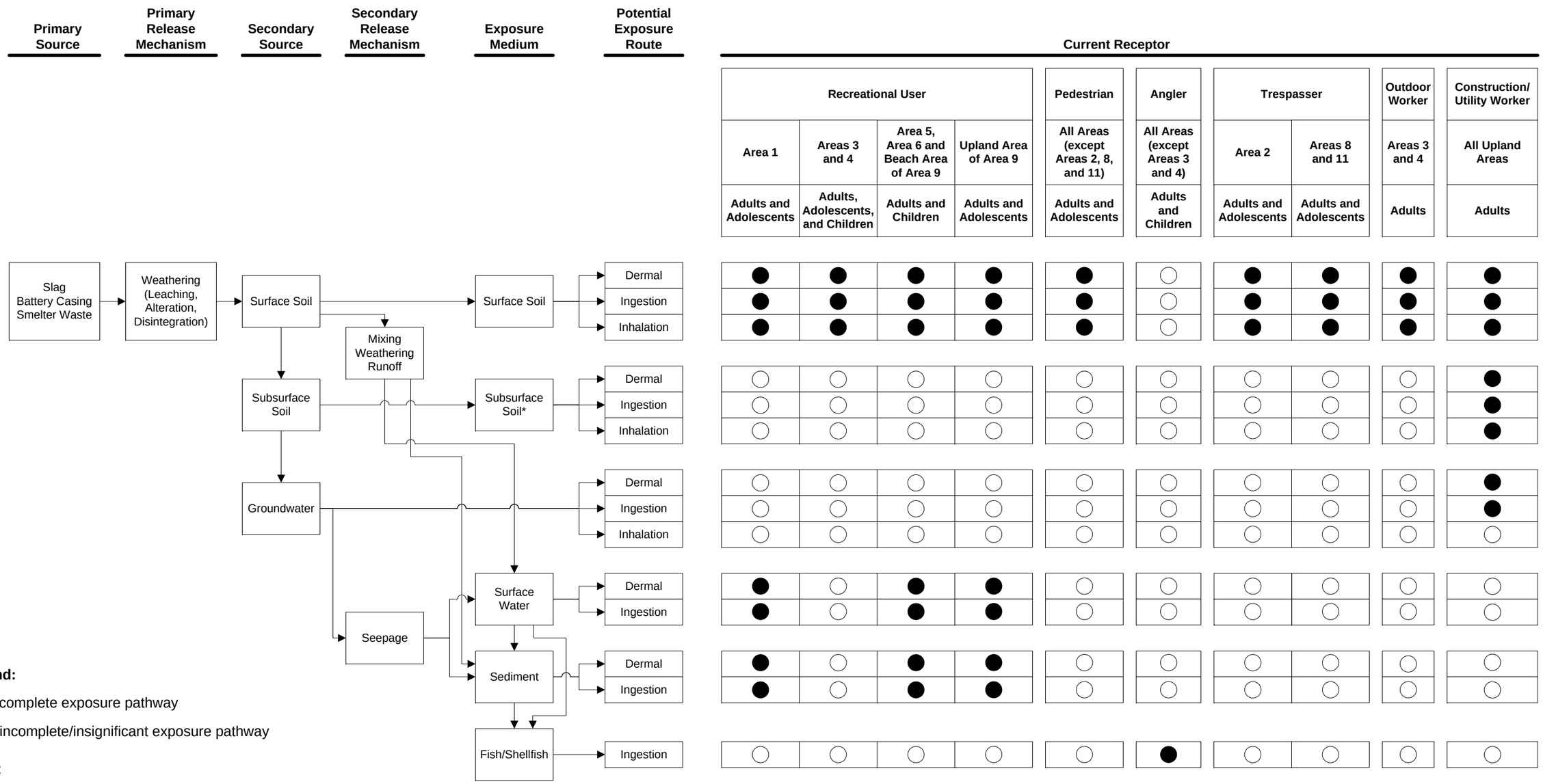


Figure 4-1
Conceptual Site Model - Current Land Use Scenario
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

EPA

R2-0005616

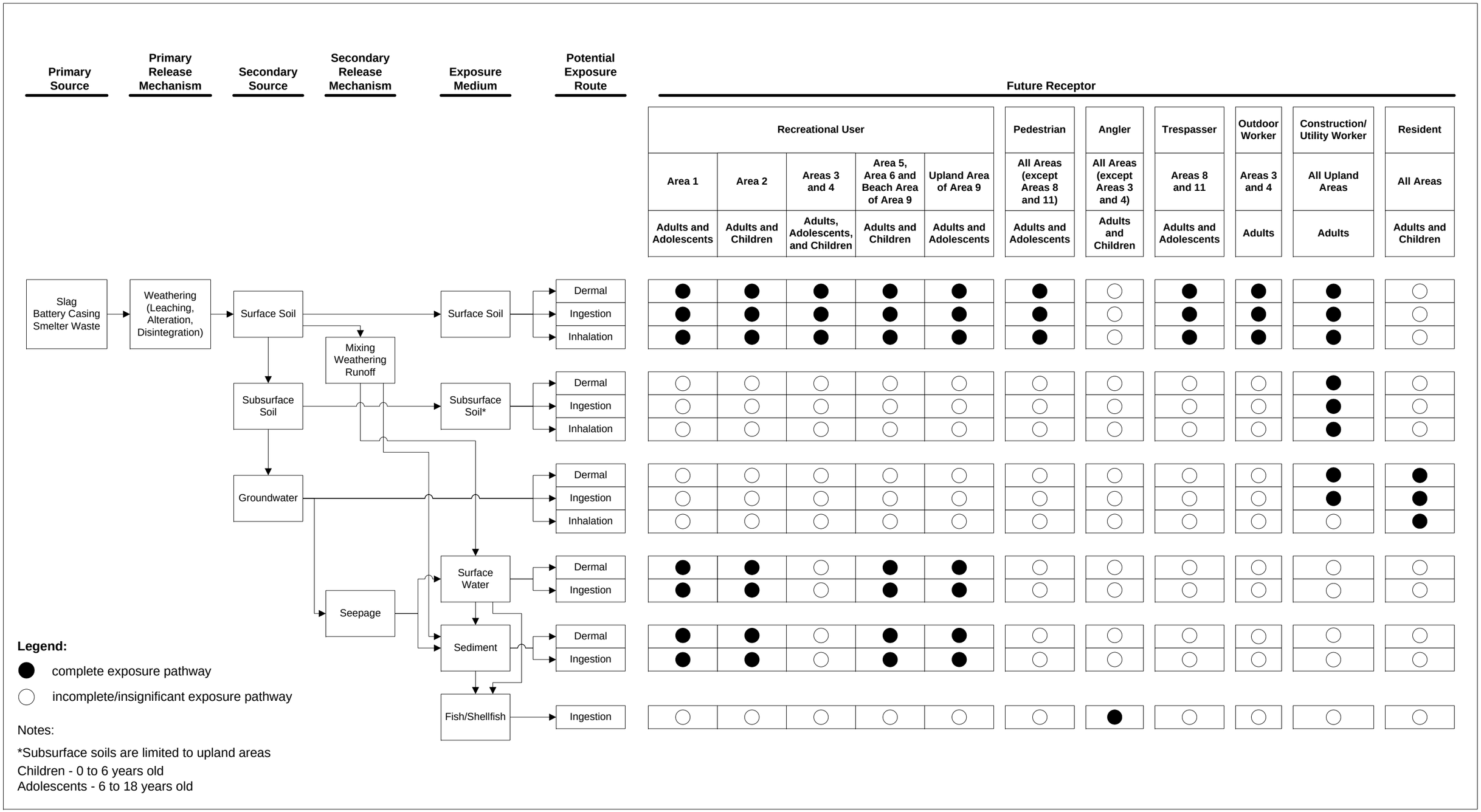


Figure 4-2
Conceptual Site Model - Future Land Use Scenario
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

EPA

R2-0005617

Appendix A
List of Samples Used in the Risk Assessment

Appendix A Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

A-1 Soil Sample List
A-2 Surface Water Sample List
A-3 Sediment Sample List
A-4 Groundwater Sample List
A-5 Biota Sample List

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Surface Soil Samples (2)					
Area 1 - Upland Area					
S04	RBS-S04A	0 - 2	9/11/2008		Y
A5	Z5 0-12	0 - 12	7/1/2009	Duplicate sample (3)	N
A5	A5 0-6	0 - 6	7/1/2009		Y
A5	A5 0-12	0 - 12	7/1/2009		Y
A6	A6 0-6	0 - 6	7/1/2009		Y
A6	A6 0-12	0 - 12	7/1/2009		Y
A7	A7 0-6	0 - 6	7/1/2009		Y
A7	A7 0-12	0 - 12	7/1/2009		Y
A1-S05	A1-SS05-06	0 - 6	5/17/2010		Y
A1-S06	A1-SS06-06	0 - 6	5/17/2010		Y
A1-S07	A1-SS07-06	0 - 6	5/17/2010		Y
A1-S08	A1-SS08-06	0 - 6	5/17/2010		Y
A1-S09	A1-SS09-06	0 - 6	5/17/2010		Y
A1-S10	A1-SS10-06	0 - 6	5/17/2010		Y
A1-S11	A1-SS11-06	0 - 6	5/17/2010		Y
A1-S12	A1-SS12-06	0 - 6	5/17/2010		Y
A1-S13	A1-SS13-06	0 - 6	5/17/2010		Y
A1-S13	Z1-SS13-06	0 - 6	5/17/2010	Duplicate sample (3)	N
A1-S14	A1-SS14-06	0 - 6	5/18/2010		Y
A1-S15	A1-SS15-06	0 - 6	5/18/2010		Y
A1-S16	A1-SS16-06	0 - 6	5/18/2010		Y
A1-S17	A1-SS17-06	0 - 6	5/18/2010		Y
A1-S18	A1-SS18-06	0 - 6	5/18/2010		Y
A1-S18	Z1-SS18-06	0 - 6	5/18/2010	Duplicate sample (3)	N
A1-02	A1-02-B	0 - 12	10/27/2010		Y
A1-02	A1-02-C	0 - 24	10/27/2010		Y
A1-03	A1-03-B	0 - 12	10/27/2010		Y
A1-03	A1-03-C	0 - 24	10/27/2010		Y
A1-04	A1-04-B	0 - 12	10/27/2010		Y
A1-04	A1-204-B	0 - 12	10/27/2010	Duplicate sample (3)	N
A1-04	A1-04-C	0 - 24	10/27/2010		Y
A1-05	A1-05-B	0 - 12	10/28/2010		Y
A1-05	A1-05-C	0 - 24	10/28/2010		Y
A1-06	A1-06-B	0 - 12	10/28/2010		Y
A1-06	A1-06-C	0 - 24	10/28/2010		Y
A1-07	A1-07-B	0 - 12	10/28/2010		Y
A1-07	A1-07-C	0 - 24	10/28/2010		Y
A1-08	A1-08-B	0 - 12	10/28/2010		Y
A1-08	A1-08-C	0 - 24	10/28/2010		Y
A1-09	A1-09-B	0 - 12	10/28/2010		Y
A1-09	A1-09-C	0 - 24	10/28/2010		Y
A1-10	A1-10-B	0 - 12	10/28/2010		Y
A1-10	A1-210-B	0 - 12	10/28/2010	Duplicate sample (3)	N
A1-10	A1-10-C	0 - 24	10/28/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone					
S01	RBS-S01A	0 - 2	9/11/2008		Y
S02	RBS-S02A	0 - 2	9/11/2008		Y
S03	RBS-S03A	0 - 2	9/11/2008		Y
SED01	RBS-SED02	0 - 3	9/10/2008	Duplicate sample (3)	N
SED01	RBS-SED01	0 - 3	9/10/2008		Y
SED03	RBS-SED03	0 - 3	9/10/2008		Y
SED04	RBS-SED04	0 - 3	9/10/2008		Y
SED05	RBS-SED05	0 - 3	9/10/2008		Y
SED06	RBS-SED06	0 - 3	9/10/2008		Y
SED07	RBS-SED07	0 - 3	9/12/2008		Y
SED08	RBS-SED08	0 - 3	9/12/2008		Y
SED09	RBS-SED09	0 - 3	9/12/2008		Y
SED10	RBS-SED10	0 - 3	9/12/2008		Y
SED11	RBS-SED11	0 - 3	9/12/2008		Y
SED12	RBS-SED12	0 - 3	9/12/2008		Y
SED13	RBS-SED13	0 - 3	9/10/2008		Y
SED14	RBS-SED14	0 - 3	9/10/2008		Y
SED15	RBS-SED15	0 - 3	9/10/2008		Y
SED16	RBS-SED16	0 - 3	9/10/2008		Y
SED17	RBS-SED17	0 - 3	9/12/2008		Y
SED18	RBS-SED18	0 - 3	9/12/2008		Y
SED19	RBS-SED19	0 - 3	9/12/2008		Y
SED20	RBS-SED20	0 - 3	9/12/2008		Y
SED21	RBS-SED22	0 - 3	9/12/2008	Duplicate sample (3)	N
SED21	RBS-SED21	0 - 3	9/12/2008		Y
SED23	RBS-SED23	0 - 3	9/12/2008		Y
SED24	RBS-SED24	0 - 3	9/12/2008		Y
SED25	RBS-SED25	0 - 3	9/12/2008		Y
SED26	RBS-SED26	0 - 3	9/12/2008		Y
SED66	RBS-SED66	0 - 3	9/10/2008		Y
SS-MM1	SS-MM1	0 - 12	9/18/2008		Y
SS-MM2	SS-MM2	0 - 12	9/18/2008		Y
SS-MM3	SS-MM3	0 - 12	9/18/2008		Y
SS-MM4	SS-MM4	0 - 12	9/18/2008		Y
SS-MM5	SS-MM5	0 - 12	9/18/2008		Y
SS-RM1	SS-RM1	0 - 12	9/18/2008		Y
SS-RM2	SS-RM2	0 - 12	9/18/2008		Y
SS-RM3	SS-RM3	0 - 12	9/18/2008		Y
SS-RM4	SS-RM4	0 - 12	9/18/2008		Y
SS-RM5	SS-RM5	0 - 12	9/18/2008		Y
SS-RM6	SS-RM6	0 - 12	9/18/2008		Y
A2	A2 0-6	0 - 6	7/1/2009		Y
A2	A2 0-12	0 - 12	7/1/2009		Y
A3	A3 0-6	0 - 6	7/1/2009		Y
A3	A3 0-12	0 - 12	7/1/2009		Y
A4	A4 0-6	0 - 6	7/1/2009		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone (continued)					
A4	A4 0-12	0 - 12	7/1/2009		Y
A8	Z8 0-12	0 - 12	7/1/2009	Duplicate sample (3)	N
A8	A8 0-6	0 - 6	7/1/2009		Y
A8	A8 0-12	0 - 12	7/1/2009		Y
A9	A9 0-6	0 - 6	7/1/2009		Y
A9	A9 0-12	0 - 12	7/1/2009		Y
A10	A10 0-6	0 - 6	7/1/2009		Y
A10	A10 0-12	0 - 12	7/1/2009		Y
A11	A11 0-6	0 - 6	7/1/2009		Y
A11	A11 0-12	0 - 12	7/1/2009		Y
A12	A12 0-6	0 - 6	7/1/2009		Y
A12	A12 0-12	0 - 12	7/1/2009		Y
A13	A13 0-6	0 - 6	7/14/2009		Y
A13	A13 0-12	0 - 12	7/14/2009		Y
A14	A14 0-6	0 - 6	7/1/2009		Y
A14	A14 0-12	0 - 12	7/1/2009		Y
A15	A15 0-6	0 - 6	7/1/2009		Y
A15	A15 0-12	0 - 12	7/1/2009		Y
A16	A16 0-6	0 - 6	7/1/2009		Y
A16	A16 0-12	0 - 12	7/1/2009		Y
A17	A17 0-6	0 - 6	7/1/2009		Y
A17	A17 0-12	0 - 12	7/1/2009		Y
A18	A18 0-6	0 - 6	7/1/2009		Y
A18	A18 0-12	0 - 12	7/1/2009		Y
A19	A19 0-6	0 - 6	7/1/2009		Y
A19	A19 0-12	0 - 12	7/1/2009		Y
A20	A20 0-6	0 - 6	7/1/2009		Y
A20	A20 0-12	0 - 12	7/1/2009		Y
A21	A21 0-6	0 - 6	7/15/2009		Y
A21	A21 0-12	0 - 12	7/15/2009		Y
A22	A22 0-6	0 - 6	7/1/2009		Y
A22	A22 0-12	0 - 12	7/1/2009		Y
A23	A23 0-6	0 - 6	7/20/2009		Y
A23	A23 0-12	0 - 12	7/20/2009		Y
A24	A24 0-6	0 - 6	7/20/2009		Y
A24	A24 0-12	0 - 12	7/20/2009		Y
A25	Z25 0-12	0 - 12	7/17/2009	Duplicate sample (3)	N
A25	A25 0-6	0 - 6	7/17/2009		Y
A25	A25 0-12	0 - 12	7/17/2009		Y
A26	A26 0-6	0 - 6	7/15/2009		Y
A26	A26 0-12	0 - 12	7/15/2009		Y
A27	A27 0-6	0 - 6	7/15/2009		Y
A27	A27 0-12	0 - 12	7/15/2009		Y
A28	A28 0-6	0 - 6	7/15/2009		Y
A28	A28 0-12	0 - 12	7/15/2009		Y
A29	A29 0-6	0 - 6	7/15/2009		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone (continued)					
A29	A29 0-12	0 - 12	7/15/2009		Y
A30	A30 0-6	0 - 6	7/15/2009		Y
A30	A30 0-12	0 - 12	7/15/2009		Y
A31	A31 0-6	0 - 6	7/15/2009		Y
A31	A31 0-12	0 - 12	7/15/2009		Y
A32	A32 0-6	0 - 6	7/1/2009		Y
A32	A32 0-12	0 - 12	7/1/2009		Y
A33	A33 0-6	0 - 6	7/1/2009		Y
A33	A33 0-12	0 - 12	7/1/2009		Y
A34	A34 0-6	0 - 6	7/1/2009		Y
A34	A34 0-12	0 - 12	7/1/2009		Y
A35	A35 0-6	0 - 6	7/1/2009		Y
A35	A35 0-12	0 - 12	7/1/2009		Y
A36	Z36 0-12	0 - 12	7/15/2009	Duplicate sample (3)	N
A36	A36 0-6	0 - 6	7/15/2009		Y
A36	A36 0-12	0 - 12	7/15/2009		Y
A37	A37 0-6	0 - 6	7/15/2009		Y
A37	A37 0-12	0 - 12	7/15/2009		Y
A38	A38 0-6	0 - 6	7/15/2009		Y
A38	A38 0-12	0 - 12	7/15/2009		Y
A39	A39 0-6	0 - 6	7/15/2009		Y
A39	A39 0-12	0 - 12	7/15/2009		Y
A40	A40 0-6	0 - 6	7/14/2009		Y
A40	A40 0-12	0 - 12	7/14/2009		Y
A41	A41 0-6	0 - 6	7/22/2009		Y
A41	A41 0-12	0 - 12	7/22/2009		Y
A42	A42 0-6	0 - 6	7/17/2009		Y
A42	A42 0-12	0 - 12	7/17/2009		Y
A43	A43 0-6	0 - 6	7/17/2009		Y
A43	A43 0-12	0 - 12	7/17/2009		Y
A44	A44 0-6	0 - 6	7/17/2009		Y
A44	A44 0-12	0 - 12	7/17/2009		Y
A45	Z45 0-12	0 - 12	7/17/2009	Duplicate sample (3)	N
A45	A45 0-6	0 - 6	7/17/2009		Y
A45	A45 0-12	0 - 12	7/17/2009		Y
A46	A46 0-6	0 - 6	7/17/2009		Y
A46	A46 0-12	0 - 12	7/17/2009		Y
A47	A47 0-6	0 - 6	7/17/2009		Y
A47	A47 0-12	0 - 12	7/17/2009		Y
A48	A48 0-6	0 - 6	7/16/2009		Y
A48	A48 0-12	0 - 12	7/16/2009		Y
A49	A49 0-6	0 - 6	7/16/2009		Y
A49	A49 0-12	0 - 12	7/16/2009		Y
A50	A50 0-6	0 - 6	7/16/2009		Y
A50	A50 0-12	0 - 12	7/16/2009		Y
A51	A51 0-6	0 - 6	7/16/2009		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone (continued)					
A51	A51 0-12	0 - 12	7/16/2009		Y
A52	A52 0-6	0 - 6	7/16/2009		Y
A52	A52 0-12	0 - 12	7/16/2009		Y
A53	A53 0-6	0 - 6	7/16/2009		Y
A53	A53 0-12	0 - 12	7/16/2009		Y
A54	A54 0-6	0 - 6	7/16/2009		Y
A54	A54 0-12	0 - 12	7/16/2009		Y
A55	Z55 0-12	0 - 12	7/16/2009	Duplicate sample (3)	N
A55	A55 0-6	0 - 6	7/16/2009		Y
A55	A55 0-12	0 - 12	7/16/2009		Y
A56	A56 0-6	0 - 6	7/16/2009		Y
A56	A56 0-12	0 - 12	7/16/2009		Y
A57	A57 0-6	0 - 6	7/16/2009		Y
A57	A57 0-12	0 - 12	7/16/2009		Y
A58	A58 0-6	0 - 6	7/16/2009		Y
A58	A58 0-12	0 - 12	7/16/2009		Y
A59	A59 0-6	0 - 6	7/16/2009		Y
A59	A59 0-12	0 - 12	7/16/2009		Y
A73	A73 0-6	0 - 6	7/17/2009		Y
A73	A73 0-12	0 - 12	7/17/2009		Y
A73	Z73 0-12	0 - 12	7/17/2009	Duplicate sample (3)	N
A74	A74 0-6	0 - 6	7/17/2009		Y
A74	A74 0-12	0 - 12	7/17/2009		Y
A74	Z74 0-12	0 - 12	7/17/2009	Duplicate sample (3)	N
A75	A75 0-6	0 - 6	7/17/2009		Y
A75	A75 0-12	0 - 12	7/17/2009		Y
A76	A76 0-6	0 - 6	7/17/2009		Y
A76	A76 0-12	0 - 12	7/17/2009		Y
A77	A77 0-6	0 - 6	7/17/2009		Y
A77	A77 0-12	0 - 12	7/17/2009		Y
A78	A78 0-6	0 - 6	7/17/2009		Y
A78	A78 0-12	0 - 12	7/17/2009		Y
A79	A79 0-6	0 - 6	7/17/2009		Y
A79	A79 0-12	0 - 12	7/17/2009		Y
A80	A80 0-6	0 - 6	7/17/2009		Y
A80	A80 0-12	0 - 12	7/17/2009		Y
A91	A91 0-6	0 - 6	7/20/2009		Y
A91	A91 0-12	0 - 12	7/20/2009		Y
A92	A92 0-6	0 - 6	7/17/2009		Y
A92	A92 0-12	0 - 12	7/17/2009		Y
A93	A93 0-6	0 - 6	7/20/2009		Y
A93	A93 0-12	0 - 12	7/20/2009		Y
A94	A94 0-6	0 - 6	7/20/2009		Y
A94	A94 0-12	0 - 12	7/20/2009		Y
A95	A95 0-6	0 - 6	7/20/2009		Y
A95	A95 0-12	0 - 12	7/20/2009		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone (continued)					
A96	A96 0-6	0 - 6	7/20/2009		Y
A96	A96 0-12	0 - 12	7/20/2009		Y
A97	A97 0-6	0 - 6	7/20/2009		Y
A97	A97 0-12	0 - 12	7/20/2009		Y
A98	A98 0-6	0 - 6	6/30/2009		Y
A98	A98 0-12	0 - 12	6/30/2009		Y
A99	A99 0-6	0 - 6	6/30/2009		Y
A99	A99 0-12	0 - 12	6/30/2009		Y
A103	A103 0-6	0 - 6	7/20/2009		Y
A103	A103 0-12	0 - 12	7/20/2009		Y
A104	A104 0-6	0 - 6	7/20/2009		Y
A104	A104 0-12	0 - 12	7/20/2009		Y
A106	A106 0-6	0 - 6	7/20/2009		Y
A106	A106 0-12	0 - 12	7/20/2009		Y
A107	A107 0-6	0 - 6	7/20/2009		Y
A107	A107 0-12	0 - 12	7/20/2009		Y
A108	A108 0-6	0 - 6	7/20/2009		Y
A108	A108 0-12	0 - 12	7/20/2009		Y
A115	A115 0-6	0 - 6	7/20/2009		Y
A115	A115 0-12	0 - 12	7/20/2009		Y
A116	A116 0-6	0 - 6	7/20/2009		Y
A116	A116 0-12	0 - 12	7/20/2009		Y
A117	A117 0-6	0 - 6	7/20/2009		Y
A117	A117 0-12	0 - 12	7/20/2009		Y
A135	A135 0-6	0 - 6	7/15/2009		Y
A135	A135 0-12	0 - 12	7/15/2009		Y
A136	A136 0-6	0 - 6	7/14/2009		Y
A136	A136 0-12	0 - 12	7/14/2009		Y
A159	Z159 0-6	0 - 6	7/21/2009	Duplicate sample (3)	N
A159	A159 0-6	0 - 6	7/21/2009		Y
A159	A159 0-12	0 - 12	7/21/2009		Y
Area 2 - Upland Area					
S10	RBS-S10A	0 - 2	9/11/2008		Y
S11	RBS-S11	0 - 2	9/11/2008		Y
S11	RBS-S12	0 - 2	9/11/2008	Duplicate sample (3)	N
S13	RBS-S13	0 - 2	9/11/2008		Y
S14	RBS-S14	0 - 2	9/11/2008		Y
S15	RBS-S15	0 - 2	9/11/2008		Y
S16	RBS-S16	0 - 2	9/11/2008		Y
S17	RBS-S17	0 - 2	9/11/2008		Y
S18	RBS-S18	0 - 2	9/11/2008		Y
S18	S18-B	0 - 12	8/4/2010		Y
S18	S18-C	0 - 24	8/4/2010		Y
S19	RBS-S19	0 - 2	9/11/2008		Y
S20	RBS-S20	0 - 2	9/11/2008		Y
S21	RBS-S21	0 - 2	9/11/2008		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 2 - Upland Area (continued)					
S22	RBS-S22	0 - 2	9/11/2008		Y
S23	RBS-S23	0 - 2	9/11/2008		Y
S24	RBS-S24	0 - 2	9/11/2008		Y
S24	RBS-S25	0 - 2	9/11/2008	Duplicate sample (3)	N
A114	A114 0-6	0 - 6	6/30/2009		Y
A114	A114 0-12	0 - 12	6/30/2009		Y
A123	A123 0-6	0 - 6	6/30/2009		Y
A124	A124 0-6	0 - 6	6/30/2009		Y
A124	A124 0-12	0 - 12	6/30/2009		Y
A2-01	A2-01-B	0 - 12	8/4/2010		Y
A2-02	A2-02-B	0 - 12	8/2/2010		Y
A2-02	A2-02-C	0 - 24	8/2/2010		Y
A2-03	A2-03-B	0 - 12	8/4/2010		Y
A2-03	A2-03-C	0 - 24	8/4/2010		Y
A2-04	A2-04-B	0 - 12	8/2/2010		Y
A2-04	A2-04-C	0 - 24	8/2/2010		Y
A2-05	A2-05-B	0 - 12	8/4/2010		Y
A2-06	A2-06-B	0 - 12	8/5/2010		Y
A2-06	A2-06-C	0 - 24	8/5/2010		Y
A2-07	A2-07-B	0 - 12	8/4/2010		Y
A2-08	A2-08-B	0 - 12	8/2/2010		Y
A2-08	A2-08-C	0 - 24	8/2/2010		Y
A2-09	A2-09-B	0 - 12	8/4/2010		Y
A2-09	A2-09-B-1	0 - 12	8/5/2010		Y
A2-09	A2-09-B-D	0 - 12	8/5/2010	Duplicate sample (3)	N
A2-09	A2-09-C	0 - 24	8/4/2010		Y
A2-10	A2-10-B	0 - 12	8/4/2010		Y
A2-10	A2-10-B-D	0 - 12	8/4/2010	Duplicate sample (3)	N
A2-10	A2-10-C	0 - 24	8/4/2010		Y
A2-11	A2-11-B	0 - 12	8/2/2010		Y
A2-11	A2-11-C	0 - 24	8/2/2010		Y
Area 2 - Intertidal Zone					
S09	RBS-S09A	0 - 2	9/11/2008		Y
SED27	RBS-SED27	0 - 3	9/11/2008		Y
SED28	RBS-SED28	0 - 3	9/11/2008		Y
SED29	RBS-SED29	0 - 3	9/11/2008		Y
SED30	RBS-SED30	0 - 3	9/11/2008		Y
SED31	RBS-SED31	0 - 3	9/11/2008		Y
SED32	RBS-SED32	0 - 3	9/11/2008		Y
SED33	RBS-SED33	0 - 3	9/11/2008		Y
SED34	RBS-SED34	0 - 3	9/11/2008		Y
SED35	RBS-SED35	0 - 3	9/11/2008		Y
SED81	RBS-SED81	0 - 3	9/11/2008		Y
SED82	RBS-SED82	0 - 3	9/11/2008		Y
SED83	RBS-SED83	0 - 3	9/11/2008		Y
SED87	RBS-SED87	0 - 3	9/12/2008		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 2 - Intertidal Zone (continued)					
SED88	RBS-SED88	0 - 3	9/12/2008		Y
A100	A100 0-6	0 - 6	6/30/2009		Y
A100	A100 0-12	0 - 12	6/30/2009		Y
A110	A110 0-6	0 - 6	6/30/2009		Y
A110	A110 0-12	0 - 12	6/30/2009		Y
A111	A111 0-6	0 - 6	6/30/2009		Y
A111	A111 0-12	0 - 12	6/30/2009		Y
A112	A112 0-6	0 - 6	6/30/2009		Y
A112	A112 0-12	0 - 12	6/30/2009		Y
A113	A113 0-6	0 - 6	6/30/2009		Y
A113	A113 0-12	0 - 12	6/30/2009		Y
A113	Z113 0-12	0 - 12	6/30/2009	Duplicate sample (3)	N
A118	A118 0-6	0 - 6	7/20/2009		Y
A118	A118 0-12	0 - 12	7/20/2009		Y
A119	A119 0-6	0 - 6	7/20/2009		Y
A119	A119 0-12	0 - 12	7/20/2009		Y
A120	A120 0-6	0 - 6	7/20/2009		Y
A120	A120 0-12	0 - 12	7/20/2009		Y
A121	A121 0-6	0 - 6	6/30/2009		Y
A121	A121 0-12	0 - 12	6/30/2009		Y
A122	A122 0-6	0 - 6	6/30/2009		Y
A122	A122 0-12	0 - 12	6/30/2009		Y
A125	A125 0-6	0 - 6	7/21/2009		Y
A125	A125 0-12	0 - 12	7/21/2009		Y
A126	A126 0-6	0 - 6	7/21/2009		Y
A126	A126 0-12	0 - 12	7/21/2009		Y
A126	Z126 0-12	0 - 12	7/21/2009	Duplicate sample (3)	N
A127	A127 0-6	0 - 6	6/30/2009		Y
A127	A127 0-12	0 - 12	6/30/2009		Y
A128	A128 0-6	0 - 6	6/30/2009		Y
A128	A128 0-12	0 - 12	6/30/2009		Y
A129	A129 0-6	0 - 6	6/30/2009		Y
A131	A131 0-6	0 - 6	6/30/2009		Y
A131	A131 0-12	0 - 12	6/30/2009		Y
A160	A160 0-6	0 - 6	7/21/2009		Y
A160	A160 0-12	0 - 12	7/21/2009		Y
A162	A162 0-6	0 - 6	7/22/2009		Y
A162	A162 0-12	0 - 12	7/22/2009		Y
A163	A163 0-6	0 - 6	7/22/2009		Y
A163	A163 0-12	0 - 12	7/22/2009		Y
A164	A164 0-6	0 - 6	7/22/2009		Y
A164	A164 0-12	0 - 12	7/22/2009		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 3 - Upland					
S70	RBS-S70	0 - 2	9/11/2008		Y
S70	A3-SS70-02	0 - 2	5/10/2010		Y
S70	A3-SS70-06	0 - 6	5/10/2010		Y
S71	RBS-S71	0 - 2	9/11/2008		Y
S71	RBS-S72	0 - 2	9/11/2008	Duplicate sample (3)	N
S71	A3-SS71-02	0 - 2	5/10/2010		Y
S71	A3-SS71-06	0 - 6	5/10/2010		Y
S73	RBS-S73	0 - 2	9/11/2008		Y
S73	A3-SS73-02	0 - 2	5/10/2010		Y
S73	A3-SS73-06	0 - 6	5/10/2010		Y
S74	RBS-S74	0 - 2	9/11/2008		Y
S74	A3-SS74-02	0 - 2	5/10/2010		Y
S74	A3-SS74-06	0 - 6	5/10/2010		Y
S75	RBS-S75	0 - 2	9/11/2008		Y
S75	A3-SS75-02	0 - 2	5/10/2010		Y
S75	A3-SS75-06	0 - 6	5/10/2010		Y
S75	Z3-SS75-02	0 - 2	5/10/2010	Duplicate sample (3)	N
S76	RBS-S76	0 - 2	9/11/2008		Y
S76	A3-SS76-02	0 - 2	5/10/2010		Y
S76	A3-SS76-06	0 - 6	5/10/2010		Y
S77	RBS-S77	0 - 2	9/11/2008		Y
S77	RBS-S78	0 - 2	9/11/2008	Duplicate sample (3)	N
S77	A3-SS77-02	0 - 2	5/10/2010		Y
S77	A3-SS77-06	0 - 6	5/10/2010		Y
S79	RBS-S79	0 - 2	9/11/2008		Y
S79	A3-SS79-02	0 - 2	5/10/2010		Y
S79	A3-SS79-06	0 - 6	5/10/2010		Y
S80	RBS-S80	0 - 2	9/11/2008		Y
S80	A3-SS80-02	0 - 2	5/10/2010		Y
S80	A3-SS80-06	0 - 6	5/10/2010		Y
S81	RBS-S81	0 - 2	9/11/2008		Y
S81	A3-SS81-02	0 - 2	5/10/2010		Y
S81	A3-SS81-06	0 - 6	5/10/2010		Y
S82	RBS-S82	0 - 2	9/11/2008		Y
S82	A3-SS82-02	0 - 2	5/10/2010		Y
S82	A3-SS82-06	0 - 6	5/10/2010		Y
S83	RBS-S83	0 - 2	9/11/2008		Y
S83	A3-SS83-02	0 - 2	5/10/2010		Y
S83	A3-SS83-06	0 - 6	5/10/2010		Y
S84	RBS-S84	0 - 2	9/11/2008		Y
S84	A3-SS84-02	0 - 2	5/10/2010		Y
S84	A3-SS84-06	0 - 6	5/10/2010		Y
S85	RBS-S85	0 - 2	9/11/2008		Y
S85	A3-SS85-02	0 - 2	5/10/2010		Y
S85	A3-SS85-06	0 - 6	5/10/2010		Y
S86	RBS-S86	0 - 2	9/11/2008		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 3 - Upland (continued)					
S86	A3-SS86-02	0 - 2	5/10/2010		Y
S86	A3-SS86-06	0 - 6	5/10/2010		Y
S87	RBS-S87	0 - 2	9/11/2008		Y
S87	A3-SS87-02	0 - 2	5/10/2010		Y
S87	A3-SS87-06	0 - 6	5/10/2010		Y
A3-S88	A3-SS88-02	0 - 2	5/10/2010		Y
A3-S88	A3-SS88-06	0 - 6	5/10/2010		Y
A3-S89	A3-SS89-02	0 - 2	5/10/2010		Y
A3-S89	A3-SS89-06	0 - 6	5/10/2010		Y
A3-S89	Z3-SS89-02	0 - 2	5/10/2010	Duplicate sample (3)	N
A3-S90	A3-SS90-02	0 - 2	5/10/2010		Y
A3-S90	A3-SS90-06	0 - 6	5/10/2010		Y
A3-S90	Z3-SS90-06	0 - 6	5/10/2010	Duplicate sample (3)	N
Area 4 - Upland					
S61	RBS-S61	0 - 2	9/10/2008		Y
S62	RBS-S62	0 - 2	9/10/2008		Y
S65	RBS-S65	0 - 2	9/10/2008		Y
S66	RBS-S66	0 - 2	9/10/2008		Y
S67	RBS-S67	0 - 2	9/10/2008		Y
S68	RBS-S68	0 - 2	9/10/2008		Y
S69	RBS-S69	0 - 2	9/10/2008		Y
A4-01	A4-01-B	0 - 12	10/29/2010		Y
A4-01	A4-01-C	0 - 24	10/29/2010		Y
A4-02	A4-02-B	0 - 12	10/29/2010		Y
A4-02	A4-202-B	0 - 12	10/29/2010	Duplicate sample (3)	N
A4-02	A4-02-C	0 - 24	10/29/2010		Y
A4-03	A4-03-B	0 - 12	11/2/2010		Y
A4-03	A4-03-C	0 - 24	11/2/2010		Y
A4-04	A4-04-B	0 - 12	11/2/2010		Y
A4-04	A4-04-C	0 - 24	11/2/2010		Y
A4-05	A4-05-B	0 - 12	11/2/2010		Y
A4-05	A4-205-B	0 - 12	11/2/2010	Duplicate sample (3)	N
A4-05	A4-05-C	0 - 24	11/2/2010		Y
A4-06	A4-06-B	0 - 12	11/2/2010		Y
A4-06	A4-06-C	0 - 24	11/2/2010		Y
A4-07	A4-07-B	0 - 12	11/2/2010		Y
A4-07	A4-07-C	0 - 24	11/2/2010		Y
A4-08	A4-08-B	0 - 12	11/1/2010		Y
A4-08	A4-08-C	0 - 24	11/1/2010		Y
A4-09	A4-09-B	0 - 12	11/1/2010		Y
A4-09	A4-09-C	0 - 24	11/1/2010		Y
A4-10	A4-10-B	0 - 12	11/1/2010		Y
A4-10	A4-10-C	0 - 24	11/1/2010		Y
A4-10	A4-210-C	0 - 24	11/1/2010	Duplicate sample (3)	N
A4-11	A4-11-B	0 - 12	11/1/2010		Y
A4-11	A4-11-C	0 - 24	11/1/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 4 - Upland (continued)					
A4-12	A4-12-B	0 - 12	11/1/2010		Y
A4-12	A4-12-C	0 - 24	11/1/2010		Y
A4-13	A4-13-B	0 - 12	11/1/2010		Y
A4-13	A4-13-C	0 - 24	11/1/2010		Y
A4-14	A4-14-B	0 - 12	10/29/2010		Y
A4-14	A4-14-C	0 - 24	10/29/2010		Y
A4-15	A4-15-B	0 - 12	10/29/2010		Y
A4-15	A4-15-C	0 - 24	10/29/2010		Y
Area 5 - Upland					
B1	B1 0-6	0 - 6	7/7/2009		Y
B1	B1 0-12	0 - 12	7/7/2009		Y
B6	B6 0-6	0 - 6	7/7/2009		Y
B6	B6 0-12	0 - 12	7/7/2009		Y
B6	A5-SDB6-02	0 - 2	5/13/2010		Y
B6	A5-SDB6-06	0 - 6	5/13/2010		Y
B16	B16 0-6	0 - 6	7/7/2009		Y
B16	B16 0-12	0 - 12	7/7/2009		Y
B22	B22 0-6	0 - 6	7/8/2009		Y
B22	B22 0-12	0 - 12	7/8/2009		Y
B22	A5-SDB22-06	0 - 6	5/12/2010		Y
S27	RBS-S27	0 - 2	9/11/2008		Y
S28	RBS-S28	0 - 2	9/11/2008		Y
S33	RBS-S33	0 - 2	9/11/2008		Y
S33	A5-SS33-06	0 - 6	5/12/2010		Y
S34	RBS-S34	0 - 2	9/11/2008		Y
S107	RBS-S107	0 - 2	4/20/2009		Y
S107	RBS-S108	0 - 2	4/20/2009	Duplicate sample (3)	N
S107	A5-SS107-02	0 - 2	5/12/2010		Y
S107	A5-SS107-06	0 - 6	5/12/2010		Y
S109	RBS-S109	0 - 2	4/20/2009		Y
S109	A5-SS109-02	0 - 2	5/12/2010		Y
S109	A5-SS109-06	0 - 6	5/12/2010		Y
S112	RBS-S112	0 - 2	4/20/2009		Y
S112	A5-SS112-02	0 - 2	5/12/2010		Y
S112	A5-SS112-06	0 - 6	5/12/2010		Y
S113	RBS-S113	0 - 2	4/20/2009		Y
S113	A5-SS113-06	0 - 6	5/12/2010		Y
S113	Z5-SS113-06	0 - 6	5/12/2010	Duplicate sample (3)	N
S114	RBS-S114	0 - 2	4/20/2009		Y
S115	RBS-S115	0 - 2	4/20/2009		Y
S115	A5-SS115-06	0 - 6	5/12/2010		Y
S116	RBS-S116	0 - 2	4/20/2009		Y
S117	RBS-S117	0 - 2	4/20/2009		Y
S117	A5-SS117-06	0 - 6	5/12/2010		Y
S118	RBS-S118	0 - 2	4/20/2009		Y
S118	A5-SS118-02	0 - 2	5/12/2010		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Upland (continued)					
S118	A5-SS118-06	0 - 6	5/12/2010		Y
S119	RBS-S119	0 - 2	4/20/2009		Y
S119	A5-SS119-06	0 - 6	5/12/2010		Y
S120	RBS-S120	0 - 2	4/20/2009		Y
S120	RBS-S121	0 - 2	4/20/2009	Duplicate sample (3)	N
S122	RBS-S122	0 - 2	4/20/2009		Y
S123	RBS-S123	0 - 2	4/20/2009		Y
S123	A5-SS123-06	0 - 6	5/12/2010		Y
S124	RBS-S124	0 - 2	4/20/2009		Y
S125	RBS-S125	0 - 2	4/20/2009		Y
S125	A5-SS125-02	0 - 2	5/12/2010		Y
S125	A5-SS125-06	0 - 6	5/12/2010		Y
S126	RBS-S126	0 - 2	4/20/2009		Y
S127	RBS-S127	0 - 2	4/20/2009		Y
S128	RBS-S128	0 - 2	4/20/2009		Y
S129	RBS-S129	0 - 2	4/20/2009		Y
S130	RBS-S130	0 - 2	4/20/2009		Y
S131	RBS-S131	0 - 2	4/20/2009		Y
S132	RBS-S132	0 - 2	4/20/2009		Y
S132	A5-SS132-06	0 - 6	5/12/2010		Y
S133	RBS-S133	0 - 2	4/20/2009		Y
S134	RBS-S134	0 - 2	4/20/2009		Y
S135	RBS-S135	0 - 2	4/20/2009		Y
S136	RBS-S136	0 - 2	4/20/2009		Y
S137	RBS-S137	0 - 2	4/20/2009		Y
S138	RBS-S138	0 - 2	4/20/2009		Y
S139	RBS-S139	0 - 2	4/20/2009		Y
S139	A5-SS139-06	0 - 6	5/12/2010		Y
S140	RBS-S140	0 - 2	4/20/2009		Y
S140	RBS-S141	0 - 2	4/20/2009	Duplicate sample (3)	N
S140	A5-SS140-06	0 - 6	5/12/2010		Y
S144	RBS-S144	0 - 2	4/20/2009		Y
S144	RBS-S145	0 - 2	4/20/2009	Duplicate sample (3)	N
S148	RBS-S148	0 - 2	4/21/2009		Y
S149	RBS-S149	0 - 2	4/21/2009		Y
S150	RBS-S150	0 - 2	4/21/2009		Y
S151	RBS-S151	0 - 2	4/21/2009		Y
S152	RBS-S152	0 - 2	4/21/2009		Y
S153	RBS-S153	0 - 2	4/21/2009		Y
S153	A5-SS153-02	0 - 2	5/13/2010		Y
S153	A5-SS153-06	0 - 6	5/13/2010		Y
S154	RBS-S154	0 - 2	4/21/2009		Y
S155	RBS-S155	0 - 2	4/21/2009		Y
S155	A5-SS155-02	0 - 2	5/13/2010		Y
S155	A5-SS155-06	0 - 6	5/13/2010		Y
S156	RBS-S156	0 - 2	4/21/2009		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Upland (continued)					
S157	RBS-S157	0 - 2	4/21/2009		Y
S158	RBS-S158	0 - 2	4/21/2009		Y
S159	RBS-S159	0 - 2	4/21/2009		Y
S159	A5-SS159-06	0 - 6	5/12/2010		Y
S160	RBS-S160	0 - 2	4/21/2009		Y
S160	RBS-S161	0 - 2	4/21/2009	Duplicate sample (3)	N
S160	A5-SS160-06	0 - 6	5/12/2010		Y
S162	RBS-S162	0 - 2	4/21/2009		Y
S162	A5-SS162-02	0 - 2	5/13/2010		Y
S162	A5-SS162-06	0 - 6	5/13/2010		Y
S210	RBS-S210A	0 - 2	4/23/2009		Y
S212	RBS-S212A	0 - 2	4/23/2009		Y
S213	RBS-S213A	0 - 2	4/23/2009		Y
S213	A5-SS213-06	0 - 6	5/12/2010		Y
A5-10	A5-10-B	0 - 12	12/6/2010		Y
A5-10	A5-10-C	0 - 24	12/6/2010		Y
A5-11	A5-11-B	0 - 12	12/6/2010		Y
A5-11	A5-11-C	0 - 24	12/6/2010		Y
A5-12	A5-12-B	0 - 12	12/6/2010		Y
A5-12	A5-12-C	0 - 24	12/6/2010		Y
A5-13	A5-13-B	0 - 12	12/6/2010		Y
A5-13	A5-13-C	0 - 24	12/6/2010		Y
A5-14	A5-14-B	0 - 12	12/6/2010		Y
A5-14	A5-14-C	0 - 24	12/6/2010		Y
A5-15	A5-15-B	0 - 12	11/3/2010		Y
A5-15	A5-15-C	0 - 24	11/3/2010		Y
A5-16	A5-16-B	0 - 12	11/3/2010		Y
A5-16	A5-16-C	0 - 24	11/3/2010		Y
Area 5 - Intertidal Zone					
A130	A130 0-6	0 - 6	6/30/2009		Y
A130	A130 0-12	0 - 12	6/30/2009		Y
A130	A5-SDA130-02	0 - 2	5/13/2010		Y
A130	A5-SDA130-06	0 - 6	5/13/2010		Y
A132	A132 0-6	0 - 6	6/30/2009		Y
A132	A132 0-12	0 - 12	6/30/2009		Y
A133	A133 0-6	0 - 6	6/30/2009		Y
A133	A133 0-12	0 - 12	6/30/2009		Y
A133	A5-SDA133-06	0 - 6	5/13/2010		Y
A165	A165 0-6	0 - 6	6/30/2009		Y
A165	A165 0-12	0 - 12	6/30/2009		Y
A165	A5-SDA165-06	0 - 6	5/13/2010		Y
A166	A166 0-6	0 - 6	7/22/2009		Y
A166	A166 0-12	0 - 12	7/22/2009		Y
A166	Z166 0-12	0 - 12	7/22/2009	Duplicate sample (3)	N
A167	A167 0-6	0 - 6	7/22/2009		Y
A167	A167 0-12	0 - 12	7/22/2009		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Intertidal Zone (continued)					
B2	B2 0-6	0 - 6	7/23/2009		Y
B2	B2 0-12	0 - 12	7/23/2009		Y
B3	B3 0-6	0 - 6	7/7/2009		Y
B3	B3 0-12	0 - 12	7/7/2009		Y
B3	A5-SDB3-02	0 - 2	5/13/2010		Y
B3	A5-SDB3-06	0 - 6	5/13/2010		Y
B4	B4 0-6	0 - 6	7/23/2009		Y
B4	B4 0-12	0 - 12	7/23/2009		Y
B5	B5 0-6	0 - 6	7/23/2009		Y
B5	B5 0-12	0 - 12	7/23/2009		Y
B7	B7 0-6	0 - 6	7/23/2009		Y
B7	B7 0-12	0 - 12	7/23/2009		Y
B7	Z7 0-12	0 - 12	7/23/2009	Duplicate sample (3)	N
B8	B8 0-6	0 - 6	7/27/2009		Y
B8	B8 0-12	0 - 12	7/27/2009		Y
B9	B9 0-6	0 - 6	7/23/2009		Y
B9	B9 0-12	0 - 12	7/23/2009		Y
B9	A5-SDB9-06	0 - 6	5/14/2010		Y
B10	B10 0-6	0 - 6	7/7/2009		Y
B10	B10 0-12	0 - 12	7/7/2009		Y
B10	Z10 0-12	0 - 12	7/7/2009	Duplicate sample (3)	N
B10	A5-SDB10-02	0 - 2	5/12/2010		Y
B10	A5-SDB10-06	0 - 6	5/12/2010		Y
B14	B14 0-6	0 - 6	7/23/2009		Y
B14	B14 0-12	0 - 12	7/23/2009		Y
B15	B15 0-6	0 - 6	7/8/2009		Y
B15	B15 0-12	0 - 12	7/8/2009		Y
B20	B20 0-6	0 - 6	7/23/2009		Y
B20	B20 0-12	0 - 12	7/23/2009		Y
B20	A5-SDB20-02	0 - 2	5/12/2010		Y
B20	A5-SDB20-06	0 - 6	5/12/2010		Y
B21	B21 0-6	0 - 6	7/7/2009		Y
B21	B21 0-12	0 - 12	7/7/2009		Y
B25	B25 0-6	0 - 6	7/23/2009		Y
B25	B25 0-12	0 - 12	7/23/2009		Y
S29	RBS-S29	0 - 2	9/11/2008		Y
S29	A5-SS29-06	0 - 6	5/12/2010		Y
S30	RBS-S30	0 - 2	9/11/2008		Y
S31	RBS-S31	0 - 2	9/11/2008		Y
S32	RBS-S32	0 - 2	9/11/2008		Y
S35	RBS-S35	0 - 2	9/11/2008		Y
S35	A5-SS35-02	0 - 2	5/13/2010		Y
S35	A5-SS35-06	0 - 6	5/13/2010		Y
S36	RBS-S36	0 - 2	9/11/2008		Y
S110	RBS-S110	0 - 2	4/20/2009		Y
S111	RBS-S111	0 - 2	4/20/2009		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Intertidal Zone (continued)					
S111	A5-SS111-02	0 - 2	5/12/2010		Y
S111	A5-SS111-06	0 - 6	5/12/2010		Y
S211	RBS-S211A	0 - 2	4/23/2009		Y
S211	A5-SS211-06	0 - 6	5/12/2010		Y
SED121	RBS-SED121	0 - 3	4/21/2009		Y
SED121	A5-SD121-06	0 - 6	5/13/2010		Y
SED121	Z5-SD121-06	0 - 6	5/13/2010	Duplicate sample (3)	N
SED122	RBS-SED122	0 - 3	4/21/2009		Y
SED123	RBS-SED123	0 - 3	4/21/2009		Y
SED123	A5-SD123-06	0 - 6	5/12/2010		Y
SED124	RBS-SED124	0 - 3	4/21/2009		Y
SED124	A5-SD124-02	0 - 2	5/12/2010		Y
SED124	A5-SD124-06	0 - 6	5/12/2010		Y
SED125	RBS-SED125	0 - 3	4/21/2009		Y
SED126	RBS-SED126	0 - 3	4/21/2009		Y
SED127	RBS-SED127	0 - 3	4/21/2009		Y
SED127	A5-SD127-06	0 - 6	5/12/2010		Y
SED128	RBS-SED128	0 - 3	4/21/2009		Y
SED129	RBS-SED129	0 - 3	4/21/2009		Y
SED129	A5-SD129-06	0 - 6	5/12/2010		Y
SED130	RBS-SED130	0 - 3	4/21/2009		Y
SED131	RBS-SED131	0 - 3	4/21/2009		Y
SED132	RBS-SED132	0 - 3	4/21/2009		Y
SED132	RBS-SED133	0 - 3	4/21/2009	Duplicate sample (3)	N
SED134	RBS-SED134	0 - 3	4/21/2009		Y
SED135	RBS-SED135	0 - 3	4/21/2009		Y
SED136	RBS-SED136	0 - 3	4/21/2009		Y
SED136	A5-SD136-06	0 - 6	5/13/2010		Y
SED137	RBS-SED137	0 - 3	4/21/2009		Y
SED138	RBS-SED138	0 - 3	4/21/2009		Y
SED139	RBS-SED139	0 - 3	4/21/2009		Y
SED139	A5-SD139-02	0 - 2	5/12/2010		Y
SED139	A5-SD139-06	0 - 6	5/12/2010		Y
SED140	RBS-SED140	0 - 3	4/21/2009		Y
SED141	RBS-SED141	0 - 3	4/21/2009		Y
SED141	A5-SD141-02	0 - 2	5/12/2010		Y
SED141	A5-SD141-06	0 - 6	5/12/2010		Y
SED142	RBS-SED142	0 - 3	4/21/2009		Y
SED142	A5-SD142-06	0 - 6	5/13/2010		Y
SED143	RBS-SED143	0 - 3	4/21/2009		Y
SED144	RBS-SED144	0 - 3	4/21/2009		Y
SED145	RBS-SED145	0 - 3	4/21/2009		Y
SED146	RBS-SED146	0 - 3	4/21/2009		Y
SED147	RBS-SED147	0 - 3	4/21/2009		Y
SED147	A5-SD147-06	0 - 6	5/12/2010		Y
SED148	RBS-SED148	0 - 3	4/21/2009		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Intertidal Zone (continued)					
SED149	RBS-SED149	0 - 3	4/21/2009		Y
SED150	RBS-SED150	0 - 3	4/21/2009		Y
SED151	RBS-SED151	0 - 3	4/21/2009		Y
SED152	RBS-SED152	0 - 3	4/21/2009		Y
SED152	RBS-SED153	0 - 3	4/21/2009	Duplicate sample (3)	N
SED152	A5-SD152-06	0 - 6	5/13/2010		Y
SED154	RBS-SED154	0 - 3	4/21/2009		Y
SED155	RBS-SED155	0 - 3	4/21/2009		Y
SED156	RBS-SED156	0 - 3	4/21/2009		Y
SED157	RBS-SED157	0 - 3	4/21/2009		Y
SED157	A5-SD157-02	0 - 2	5/13/2010		Y
SED158	RBS-SED158	0 - 3	4/21/2009		Y
Area 6 - Upland					
B47	B47 0-6	0 - 6	7/8/2009		Y
B47	B47 0-12	0 - 12	7/8/2009		Y
B47	A6-SDB47-02	0 - 2	5/11/2010		Y
B47	A6-SDB47-06	0 - 6	5/11/2010		Y
S37	RBS-S37	0 - 2	9/12/2008		Y
S37	A6-SS37-02	0 - 2	5/11/2010		Y
S37	A6-SS37-06	0 - 6	5/11/2010		Y
S38	RBS-S38	0 - 2	9/12/2008		Y
S39	RBS-S39	0 - 2	9/12/2008		Y
S40	RBS-S40	0 - 2	9/12/2008		Y
S41	RBS-S41	0 - 2	9/12/2008		Y
S41	A6-SS41-06	0 - 6	5/11/2010		Y
S42	RBS-S42	0 - 2	9/12/2008		Y
S43	RBS-S43	0 - 2	9/12/2008		Y
S44	RBS-S44	0 - 2	9/12/2008		Y
S44	A6-SS44-02	0 - 2	5/11/2010		Y
S44	A6-SS44-06	0 - 6	5/11/2010		Y
S45	RBS-S45	0 - 2	9/12/2008		Y
S52	RBS-S52	0 - 2	9/12/2008		Y
S52	RBS-S53	0 - 2	9/12/2008	Duplicate sample (3)	N
S88	RBS-S88	0 - 2	9/12/2008		Y
S88	A6-SS88-02	0 - 2	5/11/2010		Y
S88	A6-SS88-06	0 - 6	5/11/2010		Y
S89	RBS-S89	0 - 2	9/12/2008		Y
S106	RBS-S106	0 - 2	4/20/2009		Y
S142	RBS-S142	0 - 2	4/20/2009		Y
S142	A6-SS142-06	0 - 6	5/11/2010		Y
S143	RBS-S143	0 - 2	4/20/2009		Y
SED36	RBS-SED36	0 - 3	9/12/2008		Y
SED37	RBS-SED37	0 - 3	9/12/2008		Y
SED39	RBS-SED39	0 - 3	9/12/2008		Y
A6-S210	A6-SS210-02	0 - 2	5/11/2010		Y
A6-S210	A6-SS210-06	0 - 6	5/11/2010		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 - Upland (continued)					
A6-S211	A6-SS211-02	0 - 2	5/11/2010		Y
A6-S211	A6-SS211-06	0 - 6	5/11/2010		Y
A6-S212	A6-SS212-02	0 - 2	5/11/2010		Y
A6-S212	A6-SS212-06	0 - 6	5/11/2010		Y
A6-S212	Z6-SS212-02	0 - 2	5/11/2010	Duplicate sample (3)	N
A6-S213	A6-SS213-06	0 - 6	5/11/2010		Y
Area 6 - Intertidal Zone					
B26	B26 0-12	0 - 12	7/9/2009		Y
B26	B26 0-6	0 - 6	7/9/2009		Y
B26	A6-SDB26-02	0 - 2	5/11/2010		Y
B26	A6-SDB26-06	0 - 6	5/11/2010		Y
B27	B27 0-12	0 - 12	7/9/2009		Y
B27	B27 0-6	0 - 6	7/9/2009		Y
B27	A6-SDB27-06	0 - 6	5/11/2010		Y
B28	B28 0-12	0 - 12	7/8/2009		Y
B28	B28 0-6	0 - 6	7/8/2009		Y
B32	B32 0-12	0 - 12	7/9/2009		Y
B32	B32 0-6	0 - 6	7/9/2009		Y
B33	B33 0-12	0 - 12	7/27/2009		Y
B33	B33 0-6	0 - 6	7/27/2009		Y
B34	B34 0-12	0 - 12	7/8/2009		Y
B34	B34 0-6	0 - 6	7/8/2009		Y
B35	B35 0-12	0 - 12	7/8/2009		Y
B35	B35 0-6	0 - 6	7/8/2009		Y
B35	A6-SDB35-02	0 - 2	5/11/2010		Y
B35	A6-SDB35-06	0 - 6	5/11/2010		Y
B36	B36 0-12	0 - 12	7/8/2009		Y
B36	B36 0-6	0 - 6	7/8/2009		Y
B37	B37 0-12	0 - 12	7/8/2009		Y
B37	B37 0-6	0 - 6	7/8/2009		Y
B37	Z37 0-12	0 - 12	7/8/2009	Duplicate sample (3)	N
B41	B41 0-12	0 - 12	7/8/2009		Y
B41	B41 0-6	0 - 6	7/8/2009		Y
B42	B42 0-12	0 - 12	7/27/2009		Y
B42	B42 0-6	0 - 6	7/27/2009		Y
B43	B43 0-12	0 - 12	7/27/2009		Y
B43	B43 0-6	0 - 6	7/27/2009		Y
B43	A6-SDB43-02	0 - 2	5/11/2010		Y
B43	A6-SDB43-06	0 - 6	5/11/2010		Y
B44	B44 0-12	0 - 12	7/9/2009		Y
B44	B44 0-6	0 - 6	7/9/2009		Y
B45	B45 0-12	0 - 12	7/8/2009		Y
B45	B45 0-6	0 - 6	7/8/2009		Y
B46	B46 0-12	0 - 12	7/10/2009		Y
B46	B46 0-6	0 - 6	7/10/2009		Y
B52	B52 0-12	0 - 12	7/27/2009		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 - Intertidal Zone (continued)					
B52	B52 0-6	0 - 6	7/27/2009		Y
B53	B53 0-12	0 - 12	7/27/2009		Y
B53	B53 0-6	0 - 6	7/27/2009		Y
B54	B54 0-12	0 - 12	7/27/2009		Y
B54	B54 0-6	0 - 6	7/27/2009		Y
B55	B55 0-12	0 - 12	7/8/2009		Y
B55	B55 0-6	0 - 6	7/8/2009		Y
B55	A6-SDB55-06	0 - 6	5/13/2010		Y
B56	B56 0-12	0 - 12	7/8/2009		Y
B56	B56 0-6	0 - 6	7/8/2009		Y
B59	B59 0-12	0 - 12	7/27/2009		Y
B59	B59 0-6	0 - 6	7/27/2009		Y
B60	B60 0-12	0 - 12	7/27/2009		Y
B60	B60 0-6	0 - 6	7/27/2009		Y
B61	B61 0-12	0 - 12	7/27/2009		Y
B61	B61 0-6	0 - 6	7/27/2009		Y
B62	B62 0-12	0 - 12	7/27/2009		Y
B62	B62 0-6	0 - 6	7/27/2009		Y
B63	B63 0-12	0 - 12	7/27/2009		Y
B63	B63 0-6	0 - 6	7/27/2009		Y
S46	RBS-S46	0 - 2	9/12/2008		Y
S46	A6-SS46-02	0 - 2	5/11/2010		Y
S46	A6-SS46-06	0 - 6	5/11/2010		Y
S47	RBS-S47	0 - 2	9/12/2008		Y
S48	RBS-S48	0 - 2	9/12/2008		Y
S49	RBS-S49	0 - 2	9/12/2008		Y
S50	RBS-S50	0 - 2	9/12/2008		Y
S51	RBS-S51	0 - 2	9/12/2008		Y
S99	RBS-S99	0 - 2	4/20/2009		Y
S100	RBS-S100	0 - 2	4/20/2009		Y
S101	RBS-S101	0 - 2	4/20/2009		Y
S101	A6-SS101-06	0 - 6	5/11/2010		Y
S102	RBS-S102	0 - 2	4/20/2009		Y
S103	RBS-S103	0 - 2	4/20/2009		Y
S104	RBS-S104	0 - 2	4/20/2009		Y
S105	RBS-S105	0 - 2	4/20/2009		Y
S207	RBS-S207A	0 - 2	4/23/2009		Y
S208	RBS-S208A	0 - 2	4/23/2009		Y
S209	RBS-S209A	0 - 2	4/23/2009		Y
SED38	A6-SD38-02	0 - 2	5/11/2010		Y
SED38	A6-SD38-06	0 - 6	5/11/2010		Y
SED40	RBS-SED40	0 - 3	9/12/2008		Y
SED41	RBS-SED41	0 - 3	9/12/2008		Y
SED41	RBS-SED42	0 - 3	9/12/2008	Duplicate sample (3)	N
SED41	A6-SD41-06	0 - 6	5/11/2010		Y
SED41	Z6-SD41-06	0 - 6	5/11/2010	Duplicate sample (3)	N

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 - Intertidal Zone (continued)					
SED43	RBS-SED43	0 - 3	9/12/2008		Y
SED44	RBS-SED44	0 - 3	9/12/2008		Y
SED45	RBS-SED45	0 - 3	9/12/2008		Y
SED46	RBS-SED46	0 - 3	9/12/2008		Y
SED47	RBS-SED47	0 - 3	9/12/2008		Y
SED48	RBS-SED48	0 - 3	9/12/2008		Y
SED48	A6-SD48-02	0 - 2	5/11/2010		Y
SED48	A6-SD48-06	0 - 6	5/11/2010		Y
SED49	RBS-SED49	0 - 3	9/12/2008		Y
SED50	RBS-SED50	0 - 3	9/12/2008		Y
SED51	RBS-SED51	0 - 3	9/12/2008		Y
SED52	RBS-SED52	0 - 3	9/12/2008		Y
SED84	RBS-SED84	0 - 3	9/12/2008		Y
SED85	RBS-SED85	0 - 3	9/12/2008		Y
SED86	RBS-SED86	0 - 3	9/12/2008		Y
SED91	RBS-SED91	0 - 3	4/23/2009		Y
SED92	RBS-SED92	0 - 3	4/21/2009		Y
SED93	RBS-SED93	0 - 3	4/21/2009		Y
SED94	RBS-SED94	0 - 3	4/21/2009		Y
SED95	RBS-SED95	0 - 3	4/21/2009		Y
SED95	A6-SD95-02	0 - 2	5/11/2010		Y
SED95	A6-SD95-06	0 - 6	5/11/2010		Y
SED96	RBS-SED96	0 - 3	4/23/2009		Y
SED97	RBS-SED97	0 - 3	4/23/2009		Y
SED98	RBS-SED98	0 - 3	4/23/2009		Y
SED98	A6-SD98-06	0 - 6	5/11/2010		Y
SED99	RBS-SED99	0 - 3	4/21/2009		Y
SED99	A6-SD99-02	0 - 2	5/13/2010		Y
SED99	A6-SD99-06	0 - 6	5/13/2010		Y
SED100	RBS-SED100	0 - 3	4/23/2009		Y
SED100	A6-SD100-06	0 - 6	5/11/2010		Y
SED101	RBS-SED101	0 - 3	4/23/2009		Y
SED102	RBS-SED102	0 - 3	4/23/2009		Y
SED103	RBS-SED103	0 - 3	4/23/2009		Y
SED104	RBS-SED104	0 - 3	4/23/2009		Y
SED105	RBS-SED105	0 - 3	4/23/2009		Y
SED106	RBS-SED106	0 - 3	4/23/2009		Y
SED106	A6-SD106-02	0 - 2	5/11/2010		Y
SED106	A6-SD106-06	0 - 6	5/11/2010		Y
SED107	RBS-SED107	0 - 3	4/23/2009		Y
SED108	RBS-SED108	0 - 3	4/23/2009		Y
SED109	RBS-SED109	0 - 3	4/23/2009		Y
SED110	RBS-SED110	0 - 3	4/23/2009		Y
SED111	RBS-SED111	0 - 3	4/23/2009		Y
SED112	RBS-SED112	0 - 3	4/23/2009		Y
SED112	RBS-SED113	0 - 3	4/23/2009	Duplicate sample (3)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 - Intertidal Zone (continued)					
SED112	A6-SD112-02	0 - 2	5/11/2010		Y
SED112	A6-SD112-06	0 - 6	5/11/2010		Y
SED114	RBS-SED114	0 - 3	4/23/2009		Y
SED115	RBS-SED115	0 - 3	4/23/2009		Y
SED116	RBS-SED116	0 - 3	4/23/2009		Y
SED117	RBS-SED117	0 - 3	4/23/2009		Y
SED118	RBS-SED118	0 - 3	4/23/2009		Y
SED119	RBS-SED119	0 - 3	4/23/2009		Y
SED120	RBS-SED120	0 - 3	4/21/2009		Y
A6-02	A6-02-A	0 - 6	12/6/2010		Y
A6-02	A6-02-C	0 - 24	12/6/2010		Y
Area 7 - Upland					
A7-04	A7-04-B	0 - 12	12/7/2010		Y
A7-04	A7-04-C	0 - 24	12/7/2010		Y
Area 7 - Intertidal Zone					
B57	B57 0-6	0 - 6	7/8/2009		Y
B57	B57 0-12	0 - 12	7/8/2009		Y
S54	RBS-S54	0 - 2	9/12/2008		Y
S55	RBS-S55	0 - 2	9/12/2008		Y
S56	RBS-S56	0 - 2	9/12/2008		Y
S57	RBS-S57	0 - 2	9/12/2008		Y
S58	RBS-S58	0 - 2	9/12/2008		Y
S90	RBS-S90	0 - 2	9/12/2008		Y
A7-01	A7-01-A	0 - 6	12/6/2010		Y
A7-01	A7-01-C	0 - 24	12/6/2010		Y
A7-02	A7-02-A	0 - 6	12/7/2010		Y
A7-02	A7-02-C	0 - 24	12/7/2010		Y
A7-03	A7-03-A	0 - 6	12/7/2010		Y
A7-03	A7-03-C	0 - 24	12/7/2010		Y
A7-05	A7-05-A	0 - 6	12/7/2010		Y
A7-05	A7-05-C	0 - 24	12/7/2010		Y
A7-06	A7-06-A	0 - 6	12/7/2010		Y
A7-06	A7-06-C	0 - 24	12/7/2010		Y
Area 8 - Upland					
S07	RBS-S07A	0 - 2	9/15/2008	Jetty area (7)	Y
S94	RBS-S94	0 - 2	9/15/2008		Y
S95	RBS-S95	0 - 2	9/15/2008		Y
S96	RBS-S96	0 - 2	9/15/2008	Jetty area (7)	Y
S97	RBS-S97	0 - 2	9/15/2008	Jetty area (7)	Y
S98	RBS-S98	0 - 2	9/15/2008	Jetty area (7)	Y
SED89	RBS-SED89	0 - 3	9/16/2008		Y
C3	C3 0-6	0 - 6	7/9/2009		Y
C3	C3 0-12	0 - 12	7/9/2009		Y
A8-02	A8-02-B	0 - 12	12/7/2010		Y
A8-02	A8-02-C	0 - 24	12/7/2010		Y
A8-03	A8-03-B	0 - 12	12/7/2010		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 8 - Upland (continued)					
A8-03	A8-03-C	0 - 24	12/7/2010		Y
A8-04	A8-04-B	0 - 12	12/7/2010		Y
A8-04	A8-04-C	0 - 24	12/7/2010		Y
A8-06	A8-06-B	0 - 12	11/3/2010		Y
A8-06	A8-206-B	0 - 12	11/3/2010	Duplicate sample (3)	N
A8-06	A8-06-C	0 - 24	11/3/2010		Y
A8-07	A8-07-B	0 - 12	11/3/2010		Y
A8-07	A8-207-B	0 - 12	11/3/2010	Duplicate sample (3)	N
A8-07	A8-07-C	0 - 24	11/3/2010		Y
Area 8 - Intertidal Zone					
S59	RBS-S59A	0 - 2	9/15/2008		Y
S60	RBS-S60A	0 - 2	9/15/2008		Y
SED56	RBS-SED56	0 - 3	9/15/2008		Y
SED57	RBS-SED57	0 - 3	9/15/2008		Y
SED58	RBS-SED58	0 - 3	9/15/2008		Y
SED59	RBS-SED59	0 - 3	9/15/2008		Y
SED60	RBS-SED60	0 - 3	9/15/2008		Y
SED61	RBS-SED61	0 - 3	9/15/2008		Y
SED61	RBS-SED62	0 - 3	9/15/2008	Duplicate sample (3)	N
SED63	RBS-SED63	0 - 3	9/15/2008		Y
SED64	RBS-SED64	0 - 3	9/15/2008		Y
SED90	RBS-SED90	0 - 3	9/16/2008		Y
C1	C1 0-6	0 - 6	7/9/2009		Y
C1	C1 0-12	0 - 12	7/9/2009		Y
C2	C2 0-6	0 - 6	7/9/2009		Y
C2	C2 0-12	0 - 12	7/9/2009		Y
C7	C07 0-6	0 - 6	7/23/2009		Y
C7	C07 0-12	0 - 12	7/23/2009		Y
C8	C8 0-6	0 - 6	7/10/2009		Y
C8	C8 0-12	0 - 12	7/10/2009		Y
C9	C9 0-6	0 - 6	7/9/2009		Y
C9	C9 0-12	0 - 12	7/9/2009		Y
C10	C10 0-6	0 - 6	7/9/2009		Y
C10	C10 0-12	0 - 12	7/9/2009		Y
C16	C16 0-6	0 - 6	7/9/2009		Y
C16	C16 0-12	0 - 12	7/9/2009		Y
C17	C17 0-6	0 - 6	7/10/2009		Y
C17	C17 0-12	0 - 12	7/10/2009		Y
C18	C18 0-6	0 - 6	7/10/2009		Y
C18	C18 0-12	0 - 12	7/10/2009		Y
C19	C19 0-6	0 - 6	7/9/2009		Y
C19	C19 0-12	0 - 12	7/9/2009		Y
C28	C28 0-6	0 - 6	7/9/2009		Y
C28	C28 0-12	0 - 12	7/9/2009		Y
C29	C29 0-6	0 - 6	7/27/2009		Y
C29	C29 0-12	0 - 12	7/27/2009		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 8 - Intertidal Zone (continued)					
C41	C41 0-6	0 - 6	7/23/2009		Y
C41	C41 0-12	0 - 12	7/23/2009		Y
C42	C42 0-6	0 - 6	7/13/2009		Y
C42	C42 0-12	0 - 12	7/13/2009		Y
A8-01	A8-01-A	0 - 6	12/7/2010		Y
A8-01	A8-01-C	0 - 24	12/7/2010		Y
A8-05	A8-05-A	0 - 6	12/7/2010		Y
A8-05	A8-05-C	0 - 24	12/7/2010		Y
A8-17	A8-17-A	0 - 6	11/30/2010		Y
A8-17	A8-217-A	0 - 6	11/30/2010	Duplicate sample (3)	N
A8-17	A8-17-C	0 - 24	11/30/2010		Y
A8-20	A8-20-A	0 - 6	12/7/2010		Y
A8-20	A8-20-C	0 - 24	12/7/2010		Y
Area 9 - Upland					
S63	RBS-S63	0 - 2	9/10/2008		Y
S64	RBS-S64	0 - 2	9/10/2008		Y
S05	RBS-S05A	0 - 2	9/11/2008		Y
S05	RBS-S06A	0 - 2	9/11/2008	Duplicate sample (3)	N
S92	RBS-S92	0 - 2	9/12/2008		Y
S93	RBS-S93	0 - 2	9/12/2008		Y
S163	RBS-S163	0 - 2	4/22/2009	(8)	Y
S164	RBS-S164	0 - 2	4/22/2009	(8)	Y
S165	RBS-S165	0 - 2	4/22/2009	(8)	Y
S166	RBS-S166	0 - 2	4/22/2009	(8)	Y
S167	RBS-S167	0 - 2	4/22/2009	(8)	Y
S168	RBS-S168	0 - 2	4/22/2009	(8)	Y
S169	RBS-S169	0 - 2	4/22/2009	(8)	Y
S170	RBS-S170	0 - 2	4/22/2009	(8)	Y
S171	RBS-S171	0 - 2	4/22/2009	(8)	Y
S172	RBS-S172	0 - 2	4/22/2009	(8)	Y
S173	RBS-S173	0 - 2	4/22/2009	(8)	Y
S174	RBS-S174	0 - 2	4/22/2009	(8)	Y
S175	RBS-S175	0 - 2	4/22/2009	(8)	Y
S176	RBS-S176	0 - 2	4/22/2009	(8)	Y
S177	RBS-S177	0 - 2	4/22/2009	(8)	Y
S178	RBS-S178	0 - 2	4/22/2009	(8)	Y
S179	RBS-S179	0 - 2	4/22/2009	(8)	Y
S180	RBS-S180	0 - 2	4/22/2009	(8)	Y
S180	RBS-S181	0 - 2	4/22/2009	Duplicate sample (3) / (8)	N
S182	RBS-S182	0 - 2	4/22/2009	(8)	Y
S183	RBS-S183	0 - 2	4/22/2009	(8)	Y
S184	RBS-S184	0 - 2	4/22/2009	(8)	Y
S185	RBS-S185	0 - 2	4/22/2009	(8)	Y
S186	RBS-S186	0 - 2	4/22/2009	(8)	Y
S187	RBS-S187	0 - 2	4/22/2009	(8)	Y
S188	RBS-S188	0 - 2	4/22/2009	(8)	Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
S189	RBS-S189	0 - 2	4/22/2009	(8)	Y
S190	RBS-S190	0 - 2	4/22/2009	(8)	Y
S191	RBS-S191	0 - 2	4/22/2009	(8)	Y
S192	RBS-S192	0 - 2	4/22/2009	(8)	Y
S193	RBS-S193	0 - 2	4/22/2009	(8)	Y
S194	RBS-S194	0 - 2	4/22/2009	(8)	Y
S195	RBS-S195	0 - 2	4/22/2009	(8)	Y
S196	RBS-S196	0 - 2	4/22/2009	(8)	Y
S197	RBS-S197	0 - 2	4/22/2009	(8)	Y
S198	RBS-S198	0 - 2	4/22/2009	(8)	Y
S199	RBS-S199	0 - 2	4/22/2009	(8)	Y
S199	RBS-S200	0 - 2	4/22/2009	Duplicate sample (3) / (8)	N
S201	RBS-S201	0 - 2	4/22/2009	(8)	Y
S202	RBS-S202	0 - 2	4/22/2009	(8)	Y
A9-01	A9-01-B	0 - 12	11/29/2010		Y
A9-01	A9-01-C	0 - 24	11/29/2010		Y
A9-02	A9-02-B	0 - 12	11/29/2010		Y
A9-02	A9-02-C	0 - 24	11/29/2010		Y
A9-03	A9-03-B	0 - 12	11/23/2010		Y
A9-03	A9-03-C	0 - 24	11/23/2010		Y
A9-03	A9-203-C	0 - 24	11/23/2010	Duplicate sample (3)	N
A9-04	A9-04-B	0 - 12	11/23/2010		Y
A9-04	A9-04-C	0 - 24	11/23/2010		Y
A9-05	A9-05-B	0 - 12	11/23/2010		Y
A9-05	A9-05-C	0 - 24	11/23/2010		Y
A9-06	A9-06-B	0 - 12	11/23/2010		Y
A9-06	A9-06-C	0 - 24	11/23/2010		Y
A9-07	A9-07-B	0 - 12	11/23/2010		Y
A9-07	A9-07-C	0 - 24	11/23/2010		Y
A9-08	A9-08-B	0 - 12	11/22/2010		Y
A9-08	A9-08-C	0 - 24	11/22/2010		Y
A9-09	A9-09-B	0 - 12	11/22/2010		Y
A9-09	A9-09-C	0 - 24	11/22/2010		Y
A9-10	A9-10-B	0 - 12	11/22/2010		Y
A9-10	A9-10-C	0 - 24	11/22/2010		Y
A9-11	A9-11-B	0 - 12	11/22/2010		Y
A9-11	A9-11-C	0 - 24	11/22/2010		Y
A9-12	A9-12-B	0 - 12	11/18/2010		Y
A9-12	A9-12-C	0 - 24	11/18/2010		Y
A9-13	A9-13-B	0 - 12	11/22/2010		Y
A9-13	A9-13-C	0 - 24	11/22/2010		Y
A9-14	A9-14-B	0 - 12	11/19/2010		Y
A9-14	A9-14-C	0 - 24	11/19/2010		Y
A9-15	A9-15-B	0 - 12	11/19/2010	(8)	Y
A9-15	A9-15-C	0 - 24	11/19/2010	(8)	Y
A9-16	A9-16-B	0 - 12	11/18/2010		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
A9-16	A9-16-C	0 - 24	11/18/2010		Y
A9-17	A9-17-B	0 - 12	11/19/2010		Y
A9-17	A9-17-C	0 - 24	11/19/2010		Y
A9-18	A9-18-B	0 - 12	11/19/2010		Y
A9-18	A9-18-C	0 - 24	11/19/2010		Y
A9-19	A9-19-B	0 - 12	11/5/2010		Y
A9-19	A9-19-C	0 - 24	11/5/2010		Y
A9-20	A9-20-B	0 - 12	11/5/2010		Y
A9-20	A9-20-C	0 - 24	11/5/2010		Y
A9-21	A9-21-B	0 - 12	11/5/2010		Y
A9-21	A9-21-C	0 - 24	11/5/2010		Y
A9-22	A9-22-B	0 - 12	11/5/2010		Y
A9-22	A9-22-C	0 - 24	11/5/2010		Y
A9-23	A9-23-B	0 - 12	11/5/2010		Y
A9-23	A9-23-C	0 - 24	11/5/2010		Y
A9-24	A9-24-B	0 - 12	11/8/2010		Y
A9-24	A9-24-C	0 - 24	11/8/2010		Y
A9-25	A9-25-B	0 - 12	11/8/2010		Y
A9-25	A9-25-C	0 - 24	11/8/2010		Y
A9-26	A9-26-B	0 - 12	11/8/2010		Y
A9-26	A9-26-C	0 - 24	11/8/2010		Y
A9-27	A9-27-B	0 - 12	11/8/2010		Y
A9-27	A9-27-C	0 - 24	11/8/2010		Y
A9-28	A9-28-B	0 - 12	11/8/2010		Y
A9-28	A9-28-C	0 - 24	11/8/2010		Y
A9-29	A9-29-B	0 - 12	11/9/2010		Y
A9-29	A9-29-C	0 - 24	11/9/2010		Y
A9-30	A9-30-B	0 - 12	11/9/2010		Y
A9-30	A9-30-C	0 - 24	11/9/2010		Y
A9-31	A9-31-B	0 - 12	11/9/2010		Y
A9-31	A9-31-C	0 - 24	11/9/2010		Y
A9-32	A9-32-B	0 - 12	11/10/2010		Y
A9-32	A9-32-C	0 - 24	11/10/2010		Y
A9-32	A9-232-C	0 - 24	11/10/2010	Duplicate sample (3)	N
A9-33	A9-33-B	0 - 12	11/10/2010		Y
A9-33	A9-33-C	0 - 24	11/10/2010		Y
A9-34	A9-34-B	0 - 12	11/10/2010		Y
A9-34	A9-34-C	0 - 24	11/10/2010		Y
A9-35	A9-35-B	0 - 12	11/10/2010		Y
A9-35	A9-35-C	0 - 24	11/10/2010		Y
A9-36	A9-36-B	0 - 12	11/10/2010		Y
A9-36	A9-36-C	0 - 24	11/10/2010		Y
A9-37	A9-37-B	0 - 12	11/11/2010		Y
A9-37	A9-37-C	0 - 24	11/11/2010		Y
A9-38	A9-38-B	0 - 12	11/11/2010		Y
A9-38	A9-38-C	0 - 24	11/11/2010		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
A9-39	A9-39-B	0 - 12	11/11/2010		Y
A9-39	A9-39-C	0 - 24	11/11/2010		Y
A9-40	A9-40-B	0 - 12	11/11/2010		Y
A9-40	A9-40-C	0 - 24	11/11/2010		Y
A9-41	A9-41-B	0 - 12	11/11/2010		Y
A9-41	A9-41-C	0 - 24	11/11/2010		Y
A9-42	A9-42-B	0 - 12	11/15/2010		Y
A9-42	A9-42-C	0 - 24	11/15/2010		Y
A9-43	A9-43-B	0 - 12	11/16/2010		Y
A9-43	A9-43-C	0 - 24	11/16/2010		Y
A9-44	A9-44-B	0 - 12	11/15/2010		Y
A9-44	A9-44-C	0 - 24	11/15/2010		Y
A9-45	A9-45-B	0 - 12	11/15/2010		Y
A9-45	A9-45-C	0 - 24	11/15/2010		Y
A9-46	A9-46-B	0 - 12	11/15/2010		Y
A9-46	A9-46-C	0 - 24	11/15/2010		Y
A9-47	A9-47-B	0 - 12	11/15/2010		Y
A9-47	A9-47-C	0 - 24	11/15/2010		Y
A9-48	A9-48-B	0 - 12	11/16/2010		Y
A9-48	A9-48-C	0 - 24	11/16/2010		Y
A9-49	A9-49-B	0 - 12	11/16/2010		Y
A9-49	A9-49-C	0 - 24	11/16/2010		Y
A9-50	A9-50-B	0 - 12	11/16/2010		Y
A9-50	A9-250-B	0 - 12	11/16/2010	Duplicate sample (3)	N
A9-50	A9-50-C	0 - 24	11/16/2010		Y
A9-51	A9-51-B	0 - 12	11/16/2010		Y
A9-51	A9-51-C	0 - 24	11/16/2010		Y
A9-52	A9-52-B	0 - 12	11/17/2010		Y
A9-52	A9-52-C	0 - 24	11/17/2010		Y
A9-53	A9-53-B	0 - 12	11/17/2010		Y
A9-53	A9-53-C	0 - 24	11/17/2010		Y
A9-54	A9-54-B	0 - 12	11/17/2010		Y
A9-54	A9-54-C	0 - 24	11/17/2010		Y
A9-55	A9-55-B	0 - 12	11/17/2010		Y
A9-55	A9-55-C	0 - 24	11/17/2010		Y
A9-56	A9-56-B	0 - 12	11/17/2010		Y
A9-56	A9-56-C	0 - 24	11/17/2010		Y
A9-57	A9-57-B	0 - 12	11/17/2010		Y
A9-57	A9-57-C	0 - 24	11/17/2010		Y
A9-58	A9-58-B	0 - 12	11/18/2010		Y
A9-58	A9-58-C	0 - 24	11/18/2010		Y
A9-59	A9-59-B	0 - 12	11/18/2010		Y
A9-59	A9-59-C	0 - 24	11/18/2010		Y
A9-60	A9-60-B	0 - 12	11/18/2010		Y
A9-60	A9-60-C	0 - 24	11/18/2010		Y
A9-60	A9-260-C	0 - 24	11/18/2010	Duplicate sample (3)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
A9-61	A9-61-B	0 - 12	11/18/2010		Y
A9-61	A9-261-B	0 - 12	11/18/2010	Duplicate sample (3)	N
A9-61	A9-61-C	0 - 24	11/18/2010		Y
A9-107	A9-107-B	0 - 12	11/29/2010		Y
A9-107	A9-107-C	0 - 24	11/29/2010		Y
A9-108	A9-108-B	0 - 12	11/29/2010		Y
A9-108	A9-108-C	0 - 24	11/29/2010		Y
A9-109	A9-109-B	0 - 12	12/3/2010		Y
A9-109	A9-109-C	0 - 24	12/3/2010		Y
A9-110	A9-110-B	0 - 12	12/3/2010		Y
A9-110	A9-110-C	0 - 24	12/3/2010		Y
A9-111	A9-111-B	0 - 12	12/3/2010		Y
A9-111	A9-111-C	0 - 24	12/3/2010		Y
Upland 9 - Intertidal Zone					
SED159	RBS-SED159	0 - 3	4/22/2009	(8)	Y
SED160	RBS-SED160	0 - 3	4/22/2009	(8)	Y
SED161	RBS-SED161	0 - 3	4/22/2009	(8)	Y
SED162	RBS-SED162	0 - 3	4/22/2009	(8)	Y
SED163	RBS-SED163	0 - 3	4/22/2009	(8)	Y
SED164	RBS-SED164	0 - 3	4/22/2009	(8)	Y
SED165	RBS-SED165	0 - 3	4/22/2009	(8)	Y
SED166	RBS-SED166	0 - 3	4/22/2009	(8)	Y
SED167	RBS-SED167	0 - 3	4/22/2009	(8)	Y
SED168	RBS-SED168	0 - 3	4/22/2009	(8)	Y
SED169	RBS-SED169	0 - 3	4/22/2009	(8)	Y
SED170	RBS-SED170	0 - 3	4/22/2009	(8)	Y
SED171	RBS-SED171	0 - 3	4/22/2009	(8)	Y
SED172	RBS-SED172	0 - 3	4/22/2009	(8)	Y
SED172	RBS-SED173	0 - 3	4/22/2009	Duplicate sample (3) / (8)	N
SED174	RBS-SED174	0 - 3	4/22/2009	(8)	Y
SED175	RBS-SED175	0 - 3	4/22/2009	(8)	Y
SED176	RBS-SED176	0 - 3	4/22/2009	(8)	Y
SED195	RBS-SED195	0 - 3	4/23/2009	(8)	Y
SED198	RBS-SED198	0 - 3	4/22/2009	(8)	Y
SED199	RBS-SED199	0 - 3	4/22/2009	(8)	Y
A9-64	A9-64-A	0 - 6	12/8/2010	(8)	Y
A9-64	A9-64-C	0 - 24	12/8/2010	(8)	Y
A9-65	A9-65-A	0 - 6	10/26/2010	(8)	Y
A9-65	A9-65-C	0 - 24	10/26/2010	(8)	Y
A9-66	A9-66-A	0 - 6	10/27/2010	(8)	Y
A9-66	A9-66-C	0 - 24	10/27/2010	(8)	Y
A9-67	A9-67-A	0 - 6	12/8/2010	(8)	Y
A9-67	A9-67-C	0 - 24	12/8/2010	(8)	Y
A9-68	A9-68-A	0 - 6	10/27/2010	(8)	Y
A9-68	A9-68-C	0 - 24	10/27/2010	(8)	Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 10					
A10-01	A10-01-B	0 - 12	11/4/2010	Background (4)	N
A10-01	A10-01-C	0 - 24	11/4/2010	Background (4)	N
A10-02	A10-02-B	0 - 12	11/4/2010	Background (4)	N
A10-02	A10-02-C	0 - 24	11/4/2010	Background (4)	N
A10-03	A10-03-B	0 - 12	11/4/2010	Background (4)	N
A10-03	A10-03-C	0 - 24	11/4/2010	Background (4)	N
A10-04	A10-04-B	0 - 12	11/4/2010	Background (4)	N
A10-04	A10-04-C	0 - 24	11/4/2010	Background (4)	N
A10-05	A10-05-B	0 - 12	11/4/2010	Background (4)	N
A10-05	A10-05-C	0 - 24	11/4/2010	Background (4)	N
A10-06	A10-06-B	0 - 12	11/4/2010	Background (4)	N
A10-06	A10-06-C	0 - 24	11/4/2010	Background (4)	N
A10-07	A10-07-B	0 - 12	11/4/2010	Background (4)	N
A10-07	A10-07-C	0 - 24	11/4/2010	Background (4)	N
A10-08	A10-08-B	0 - 12	11/4/2010	Background (4)	N
A10-08	A10-08-C	0 - 24	11/4/2010	Background (4)	N
A10-09	A10-09-B	0 - 12	11/4/2010	Background (4)	N
A10-09	A10-09-C	0 - 24	11/4/2010	Background (4)	N
A10-10	A10-10-B	0 - 12	11/4/2010	Background (4)	N
A10-10	A10-10-C	0 - 24	11/4/2010	Background (4)	N
A10-21	A10-21-A	0 - 6	11/19/2010	Background (4)	N
A10-21	A10-21-C	0 - 24	11/19/2010	Background (4)	N
A10-22	A10-22-A	0 - 6	11/22/2010	Background (4)	N
A10-22	A10-22-C	0 - 24	11/22/2010	Background (4)	N
A10-23	A10-23-A	0 - 6	11/22/2010	Background (4)	N
A10-23	A10-23-C	0 - 24	11/22/2010	Background (4)	N
A10-24	A10-24-A	0 - 6	11/22/2010	Background (4)	N
A10-24	A10-24-C	0 - 24	11/22/2010	Background (4)	N
A10-25	A10-25-A	0 - 6	11/22/2010	Background (4)	N
A10-25	A10-25-C	0 - 24	11/22/2010	Background (4)	N
A10-26	A10-26-A	0 - 6	11/22/2010	Background (4)	N
A10-26	A10-26-C	0 - 24	11/22/2010	Background (4)	N
A10-27	A10-27-A	0 - 6	11/22/2010	Background (4)	N
A10-27	A10-27-C	0 - 24	11/22/2010	Background (4)	N
A10-28	A10-28-A	0 - 6	11/22/2010	Background (4)	N
A10-28	A10-28-C	0 - 24	11/22/2010	Background (4)	N
A10-29	A10-29-A	0 - 6	11/22/2010	Background (4)	N
A10-29	A10-29-C	0 - 24	11/22/2010	Background (4)	N
A10-30	A10-30-A	0 - 6	11/22/2010	Background (4)	N
A10-30	A10-30-C	0 - 24	11/22/2010	Background (4)	N
SED69	RBS-SED69	0 - 3	9/16/2008	Background (4)	N
SED70	RBS-SED70	0 - 3	9/16/2008	Background (4)	N
SED71	RBS-SED71	0 - 3	9/16/2008	Background (4)	N
SED72	RBS-SED72	0 - 3	9/16/2008	Background (4)	N
SED73	RBS-SED73	0 - 3	9/16/2008	Background (4)	N
SED74	RBS-SED74	0 - 3	9/16/2008	Background (4)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 10 (continued)					
SED200	RBS-SED200	0 - 3	4/23/2009	Background (4)	N
SED201	RBS-SED201	0 - 3	4/23/2009	Background (4)	N
SED202	RBS-SED202	0 - 3	4/23/2009	Background (4)	N
SED203	RBS-SED203	0 - 3	4/23/2009	Background (4)	N
SED204	RBS-SED204	0 - 3	4/23/2009	Background (4)	N
SED205	RBS-SED205	0 - 3	4/23/2009	Background (4)	N
Area 11 - Upland					
C13	C13 0-6	0 - 6	7/10/2009		Y
C13	C13 0-12	0 - 12	7/10/2009		Y
C14	C14 0-6	0 - 6	7/10/2009		Y
C14	C14 0-12	0 - 12	7/10/2009		Y
C14	Z14 0-12	0 - 12	7/10/2009	Duplicate sample (3)	N
A11-01	A11-01-A	0 - 6	12/14/2010		Y
A11-01	A11-01-C	0 - 24	12/14/2010		Y
A11-02	A11-02-B	0 - 12	12/14/2010		Y
A11-02	A11-02-C	0 - 24	12/14/2010		Y
A11-03	A11-03-B	0 - 12	12/15/2010		Y
A11-03	A11-03-C	0 - 24	12/15/2010		Y
A11-04	A11-04-A	0 - 6	12/8/2010		Y
A11-04	A11-04-C	0 - 24	12/8/2010		Y
A11-10	A11-10-B	0 - 12	12/8/2010		Y
A11-10	A11-10-C	0 - 24	12/8/2010		Y
A11-11	A11-11-B	0 - 12	12/6/2010		Y
A11-11	A11-11-C	0 - 24	12/6/2010		Y
A11-12	A11-12-B	0 - 12	12/6/2010		Y
A11-12	A11-12-C	0 - 24	12/6/2010		Y
A11-13	A11-13-B	0 - 12	11/4/2010		Y
A11-13	A11-13-C	0 - 24	11/4/2010		Y
Area 11 - Intertidal Zone					
C20	C20 0-6	0 - 6	7/9/2009		Y
C20	C20 0-12	0 - 12	7/9/2009		Y
C21	C21 0-6	0 - 6	7/10/2009		Y
C21	C21 0-12	0 - 12	7/10/2009		Y
C22	C22 0-6	0 - 6	7/9/2009		Y
C23	C23 0-6	0 - 6	7/9/2009		Y
C23	C23 0-12	0 - 12	7/9/2009		Y
C24	C24 0-6	0 - 6	7/9/2009		Y
C24	C24 0-12	0 - 12	7/9/2009		Y
C24	Z24 0-12	0 - 12	7/9/2009	Duplicate sample (3)	N
C30	C30 0-6	0 - 6	7/10/2009		Y
C30	C30 0-12	0 - 12	7/10/2009		Y
C31	C31 0-6	0 - 6	7/10/2009		Y
C31	C31 0-12	0 - 12	7/10/2009		Y
C32	C32 0-6	0 - 6	7/10/2009		Y
C32	C32 0-12	0 - 12	7/10/2009		Y
C32	Z32 0-12	0 - 12	7/10/2009	Duplicate sample (3)	N

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 11 - Intertidal Zone (continued)					
C33	C33 0-6	0 - 6	7/10/2009		Y
C33	C33 0-12	0 - 12	7/10/2009		Y
C34	C34 0-6	0 - 6	7/10/2009		Y
C34	C34 0-12	0 - 12	7/10/2009		Y
C35	C35 0-6	0 - 6	7/10/2009		Y
C35	C35 0-12	0 - 12	7/10/2009		Y
C36	C36 0-6	0 - 6	7/10/2009		Y
C36	C36 0-12	0 - 12	7/10/2009		Y
C43	C43 0-6	0 - 6	7/13/2009		Y
C43	C43 0-12	0 - 12	7/13/2009		Y
C44	C44 0-6	0 - 6	7/13/2009		Y
C44	C44 0-12	0 - 12	7/13/2009		Y
C45	C45 0-6	0 - 6	7/13/2009		Y
C45	C45 0-12	0 - 12	7/13/2009		Y
C46	C46 0-6	0 - 6	7/13/2009		Y
C46	C46 0-12	0 - 12	7/13/2009		Y
C47	C47 0-6	0 - 6	7/10/2009		Y
C47	C47 0-12	0 - 12	7/10/2009		Y
C53	C53 0-6	0 - 6	7/13/2009		Y
C53	C53 0-12	0 - 12	7/13/2009		Y
C53	Z53 0-12	0 - 12	7/13/2009	Duplicate sample (3)	N
C54	C54 0-6	0 - 6	7/13/2009		Y
C54	C54 0-12	0 - 12	7/13/2009		Y
C55	C55 0-6	0 - 6	7/13/2009		Y
C55	C55 0-12	0 - 12	7/13/2009		Y
C56	C56 0-6	0 - 6	7/13/2009		Y
C56	C56 0-12	0 - 12	7/13/2009		Y
C63	C63 0-6	0 - 6	7/23/2009		Y
C63	C63 0-12	0 - 12	7/23/2009		Y
C63	Z63 0-12	0 - 12	7/23/2009	Duplicate sample (3)	N
C64	C64 0-6	0 - 6	7/23/2009		Y
C64	C64 0-12	0 - 12	7/23/2009		Y
C70	C70 0-6	0 - 6	7/10/2009		Y
C70	C70 0-12	0 - 12	7/10/2009		Y
C71	C71 0-6	0 - 6	7/10/2009		Y
C71	C71 0-12	0 - 12	7/10/2009		Y
C72	C72 0-6	0 - 6	7/10/2009		Y
C72	C72 0-12	0 - 12	7/10/2009		Y
C73	C73 0-6	0 - 6	7/23/2009		Y
C73	C73 0-12	0 - 12	7/23/2009		Y
C74	C74 0-6	0 - 6	7/23/2009		Y
C74	C74 0-12	0 - 12	7/23/2009		Y
C75	C75 0-6	0 - 6	7/23/2009		Y
C75	C75 0-12	0 - 12	7/23/2009		Y
C76	C76 0-6	0 - 6	7/10/2009		Y
C76	C76 0-12	0 - 12	7/10/2009		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 11 - Intertidal Zone (continued)					
C80	C80 0-6	0 - 6	7/13/2009		Y
C80	C80 0-12	0 - 12	7/13/2009		Y
C81	C81 0-6	0 - 6	7/23/2009		Y
C81	C81 0-12	0 - 12	7/23/2009		Y
C82	C82 0-6	0 - 6	7/23/2009		Y
C82	C82 0-12	0 - 12	7/23/2009		Y
C87	C87 0-6	0 - 6	7/10/2009		Y
C87	C87 0-12	0 - 12	7/10/2009		Y
C88	C88 0-6	0 - 6	7/23/2009		Y
C88	C88 0-12	0 - 12	7/23/2009		Y
C89	C89 0-6	0 - 6	7/23/2009		Y
C89	C89 0-12	0 - 12	7/23/2009		Y
C89	Z89 0-12	0 - 12	7/23/2009	Duplicate sample (3)	N
C90	C90 0-6	0 - 6	7/10/2009		Y
C90	C90 0-12	0 - 12	7/10/2009		Y
C90	Z90 0-12	0 - 12	7/10/2009	Duplicate sample (3)	N
C91	C91 0-6	0 - 6	7/10/2009		Y
C91	C91 0-12	0 - 12	7/10/2009		Y
C96	C96 0-6	0 - 6	7/23/2009		Y
C96	C96 0-12	0 - 12	7/23/2009		Y
C97	C97 0-6	0 - 6	7/23/2009		Y
C97	C97 0-12	0 - 12	7/23/2009		Y
C98	C98 0-6	0 - 6	7/23/2009		Y
C98	C98 0-12	0 - 12	7/23/2009		Y
C99	C99 0-6	0 - 6	7/10/2009		Y
C99	C99 0-12	0 - 12	7/10/2009		Y
C105	C105 0-6	0 - 6	7/22/2009		Y
C105	C105 0-12	0 - 12	7/22/2009		Y
A11-05	A11-05-A	0 - 6	12/8/2010		Y
A11-05	A11-05-C	0 - 24	12/8/2010		Y
A11-06	A11-06-A	0 - 6	12/2/2010		Y
A11-06	A11-06-C	0 - 24	12/2/2010		Y
A11-07	A11-07-A	0 - 6	12/2/2010		Y
A11-07	A11-07-C	0 - 24	12/2/2010		Y
A11-08	A11-08-A	0 - 6	12/6/2010		Y
A11-08	A11-08-C	0 - 24	12/6/2010		Y
A11-09	A11-09-A	0 - 6	12/6/2010		Y
A11-09	A11-09-C	0 - 24	12/6/2010		Y
A11-14	A11-14-A	0 - 6	11/23/2010		Y
A11-14	A11-14-C	0 - 24	11/23/2010		Y
A11-15	A11-15-A	0 - 6	11/3/2010		Y
A11-15	A11-15-C	0 - 24	11/3/2010		Y
A11-16	A11-16-A	0 - 6	11/3/2010		Y
A11-16	A11-16-C	0 - 24	11/3/2010		Y
A11-17	A11-17-A	0 - 6	11/3/2010		Y
A11-17	A11-17-C	0 - 24	11/3/2010		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 11 - Intertidal Zone (continued)					
A11-18	A11-18-A	0 - 6	11/23/2010		Y
A11-18	A11-18-C	0 - 24	11/23/2010		Y
A11-25	A11-25-A	0 - 6	11/3/2010		Y
A11-27	A11-27-A	0 - 6	12/3/2010		Y
A11-27	A11-27-C	0 - 24	12/3/2010		Y
Subsurface Soil Samples					
Area 1 - Upland					
S04	RBS-S04B	6 - 12	9/11/2008		Y
A5	A5 12-24	12 - 24	7/1/2009		Y
A1-01	A1-01-F	24 - 48	10/27/2010		Y
A1-02	A1-02-E	12 - 24	10/27/2010		Y
A1-02	A1-02-F	24 - 48	10/27/2010		Y
A1-03	A1-03-E	12 - 24	10/27/2010		Y
A1-03	A1-03-F	24 - 48	10/27/2010		Y
A1-04	A1-04-E	12 - 24	10/27/2010		Y
A1-04	A1-04-F	24 - 48	10/27/2010		Y
A1-05	A1-05-E	12 - 24	10/28/2010		Y
A1-05	A1-05-F	24 - 48	10/28/2010		Y
A1-06	A1-06-E	12 - 24	10/28/2010		Y
A1-06	A1-06-F	24 - 48	10/28/2010		Y
A1-07	A1-07-E	12 - 24	10/28/2010		Y
A1-07	A1-07-F	24 - 48	10/28/2010		Y
A1-08	A1-08-E	12 - 24	10/28/2010		Y
A1-08	A1-08-F	24 - 48	10/28/2010		Y
A1-09	A1-09-E	12 - 24	10/28/2010		Y
A1-09	A1-09-F	24 - 48	10/28/2010		Y
A1-10	A1-10-E	12 - 24	10/28/2010		Y
A1-10	A1-10-F	24 - 48	10/28/2010		Y
A1-S05	A1-SS05-12	6 - 12	5/17/2010		Y
A1-S06	A1-SS06-12	6 - 12	5/17/2010		Y
A1-S07	A1-SS07-12	6 - 12	5/17/2010		Y
A1-S08	A1-SS08-12	6 - 12	5/17/2010		Y
A1-S09	A1-SS09-12	6 - 12	5/17/2010		Y
A1-S10	A1-SS10-12	6 - 12	5/17/2010		Y
A1-S11	A1-SS11-12	6 - 12	5/17/2010		Y
A1-S12	A1-SS12-12	6 - 12	5/17/2010		Y
A1-S13	A1-SS13-12	6 - 12	5/17/2010		Y
A1-S14	A1-SS14-12	6 - 12	5/18/2010		Y
A1-S15	A1-SS15-12	6 - 12	5/18/2010		Y
A1-S16	A1-SS16-12	6 - 12	5/18/2010		Y
A1-S17	A1-SS17-12	6 - 12	5/18/2010		Y
A1-S17	Z1-SS17-12	6 - 12	5/14/2010	Duplicate sample (3)	N
A1-S18	A1-SS18-12	6 - 12	5/18/2010		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone					
S01	RBS-S01B	6 - 12	9/11/2008	(6)	N
S02	RBS-S02B	6 - 12	9/11/2008	(6)	N
A2	A2 12-24	12 - 24	7/1/2009	(6)	N
A3	A3 12-24	12 - 24	7/1/2009	(6)	N
A8	A8 12-24	12 - 24	7/1/2009	(6)	N
A11	A11 12-24	12 - 24	7/1/2009	(6)	N
A13	A13 12-24	12 - 24	7/14/2009	(6)	N
A14	A14 12-24	12 - 24	7/1/2009	(6)	N
A17	A17 12-24	12 - 24	7/1/2009	(6)	N
A18	A18 12-24	12 - 24	7/1/2009	(6)	N
A19	A19 12-24	12 - 24	7/1/2009	(6)	N
A21	A21 12-24	12 - 24	7/15/2009	(6)	N
A22	A22 12-24	12 - 24	7/1/2009	(6)	N
A23	A23 12-24	12 - 24	7/20/2009	(6)	N
A23	Z23 12-24	12 - 24	7/20/2009	Duplicate sample (3)	N
A24	A24 12-24	12 - 24	7/20/2009	(6)	N
A26	A26 12-24	12 - 24	7/15/2009	(6)	N
A27	A27 12-24	12 - 24	7/15/2009	(6)	N
A28	A28 12-24	12 - 24	7/15/2009	(6)	N
A35	A35 12-24	12 - 24	7/1/2009	(6)	N
A36	A36 12-24	12 - 24	7/15/2009	(6)	N
A39	A39 12-24	12 - 24	7/15/2009	(6)	N
A40	A40 12-24	12 - 24	7/14/2009	(6)	N
A41	A41 12-24	12 - 24	7/22/2009	(6)	N
A42	A42 12-24	12 - 24	7/17/2009	(6)	N
A44	A44 12-24	12 - 24	7/17/2009	(6)	N
A45	A45 12-24	12 - 24	7/17/2009	(6)	N
A46	A46 12-24	12 - 24	7/17/2009	(6)	N
A47	A47 12-24	12 - 24	7/17/2009	(6)	N
A48	A48 12-24	12 - 24	7/16/2009	(6)	N
A49	A49 12-24	12 - 24	7/16/2009	(6)	N
A50	A50 12-24	12 - 24	7/16/2009	(6)	N
A51	A51 12-24	12 - 24	7/16/2009	(6)	N
A52	A52 12-24	12 - 24	7/16/2009	(6)	N
A53	A53 12-24	12 - 24	7/16/2009	(6)	N
A54	A54 12-24	12 - 24	7/16/2009	(6)	N
A55	A55 12-24	12 - 24	7/16/2009	(6)	N
A56	A56 12-24	12 - 24	7/16/2009	(6)	N
A57	A57 12-24	12 - 24	7/16/2009	(6)	N
A58	A58 12-24	12 - 24	7/16/2009	(6)	N
A59	A59 12-24	12 - 24	7/16/2009	(6)	N
A73	A73 12-24	12 - 24	7/17/2009	(6)	N
A74	A74 12-24	12 - 24	7/17/2009	(6)	N
A75	A75 12-24	12 - 24	7/17/2009	(6)	N
A77	A77 12-24	12 - 24	7/17/2009	(6)	N
A78	A78 12-24	12 - 24	7/17/2009	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 1 - Intertidal Zone (continued)					
A79	A79 12-24	12 - 24	7/17/2009	(6)	N
A80	A80 12-24	12 - 24	7/17/2009	(6)	N
A91	A91 12-24	12 - 24	7/20/2009	(6)	N
A92	A92 12-24	12 - 24	7/17/2009	(6)	N
A93	A93 12-24	12 - 24	7/20/2009	(6)	N
A94	A94 12-24	12 - 24	7/20/2009	(6)	N
A95	A95 12-24	12 - 24	7/20/2009	(6)	N
A96	A96 12-24	12 - 24	7/20/2009	(6)	N
A97	A97 12-24	12 - 24	7/20/2009	(6)	N
A98	A98 12-24	12 - 24	6/30/2009	(6)	N
A99	A99 12-24	12 - 24	6/30/2009	(6)	N
A103	A103 12-24	12 - 24	7/20/2009	(6)	N
A104	A104 12-24	12 - 24	7/20/2009	(6)	N
A106	A106 12-24	12 - 24	7/20/2009	(6)	N
A107	A107 12-24	12 - 24	7/20/2009	(6)	N
A108	A108 12-24	12 - 24	7/20/2009	(6)	N
A115	A115 12-24	12 - 24	7/20/2009	(6)	N
A116	A116 12-24	12 - 24	7/20/2009	(6)	N
A117	A117 12-24	12 - 24	7/20/2009	(6)	N
A135	A135 12-24	12 - 24	7/15/2009	(6)	N
A136	A136 12-24	12 - 24	7/14/2009	(6)	N
A159	A159 12-24	12 - 24	7/21/2009	(6)	N
A1-31	A1-31-F	24 - 48	10/28/2010	(6)	N
A1-31	A1-31-G	48 - 72	10/28/2010	(6)	N
A1-32	A1-32-F	24 - 48	10/27/2010	(6)	N
A1-33	A1-33-F	24 - 48	10/27/2010	(6)	N
A1-34	A1-34-D	6 - 24	10/26/2010	(6)	N
A1-34	A1-34-F	24 - 48	10/26/2010	(6)	N
A1-35	A1-35-F	24 - 48	10/27/2010	(6)	N
A1-36	A1-36-D	6 - 24	12/3/2010	(6)	N
A1-36	A1-36-F	24 - 48	12/3/2010	(6)	N
Area 2 - Upland					
S10	RBS-S10B	6 - 12	9/11/2008		Y
S10	RBS-S10C	12 - 18	9/11/2008		Y
S10	S10-F	24 - 48	8/4/2010		Y
S11	S11-F	24 - 48	8/4/2010		Y
S13	S13-F	24 - 48	8/3/2010		Y
S14	S14-F	24 - 48	8/4/2010		Y
S15	S15-F	24 - 48	8/3/2010		Y
S16	S16-F	24 - 48	8/3/2010		Y
S17	S17-F	24 - 48	8/3/2010		Y
S18	S18-E	12 - 24	8/4/2010		Y
S18	S18-F	24 - 48	8/4/2010		Y
S19	S19-F	24 - 48	8/4/2010		Y
S20	S20-F	24 - 48	8/3/2010		Y
S21	S21-F	24 - 48	8/3/2010		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 2 - Upland (continued)					
S22	S22-F	24 - 48	8/3/2010		Y
S23	S23-F	24 - 48	8/3/2010		Y
S24	S24-F	24 - 48	8/3/2010		Y
S24	S24-F-D	24 - 48	8/3/2010	Duplicate sample (3)	N
A114	A114 12-24	12 - 24	6/30/2009		Y
A124	A124 12-24	12 - 24	6/30/2009		Y
A2-02	A2-02-E	12 - 24	8/3/2010		Y
A2-03	A2-03-B-1	12 - 24	8/5/2010		Y
A2-03	A2-03-B-D	12 - 24	8/5/2010	Duplicate sample (3)	N
A2-03	A2-03-E	12 - 24	8/4/2010		Y
A2-04	A2-04-E	12 - 24	8/2/2010		Y
A2-06	A2-06-E	12 - 24	8/5/2010		Y
A2-08	A2-08-E	12 - 24	8/3/2010		Y
A2-09	A2-09-E	12 - 24	8/4/2010		Y
A2-10	A2-10-E	12 - 24	8/4/2010		Y
A2-10	A2-10-E-D	12 - 24	8/4/2010	Duplicate sample (3)	N
A2-11	A2-11-E	12 - 24	8/2/2010		Y
Area 2 - Intertidal Zone					
S09	RBS-S09B	6 - 12	9/11/2008	(6)	N
S09	RBS-S09C	12 - 18	9/11/2008	(6)	N
S09	S09-F	24 - 48	8/3/2010	(6)	N
A100	A100 12-24	12 - 24	6/30/2009	(6)	N
A110	A110 12-24	12 - 24	6/30/2009	(6)	N
A111	A111 12-24	12 - 24	6/30/2009	(6)	N
A111	Z111 12-24	12 - 24	6/30/2009	Duplicate sample (3)	N
A112	A112 12-24	12 - 24	6/30/2009	(6)	N
A113	A113 12-24	12 - 24	6/30/2009	(6)	N
A118	A118 12-24	12 - 24	7/20/2009	(6)	N
A120	A120 12-24	12 - 24	7/20/2009	(6)	N
A121	A121 12-24	12 - 24	6/30/2009	(6)	N
A122	A122 12-24	12 - 24	6/30/2009	(6)	N
A125	A125 12-24	12 - 24	7/21/2009	(6)	N
A126	A126 12-24	12 - 24	7/21/2009	(6)	N
A127	A127 12-24	12 - 24	6/30/2009	(6)	N
A128	A128 12-24	12 - 24	6/30/2009	(6)	N
A131	A131 12-24	12 - 24	6/30/2009	(6)	N
A160	A160 12-24	12 - 24	7/21/2009	(6)	N
A162	A162 12-24	12 - 24	7/22/2009	(6)	N
A163	A163 12-24	12 - 24	7/22/2009	(6)	N
A164	A164 12-24	12 - 24	7/22/2009	(6)	N
Area 3					
A3-S88	A3-SS88-12	6 - 12	5/10/2010		Y
A3-S89	A3-SS89-12	6 - 12	5/10/2010		Y
A3-S90	A3-SS90-12	6 - 12	5/10/2010		Y
S70	A3-SS70-12	6 - 12	5/10/2010		Y
S71	A3-SS71-12	6 - 12	5/10/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 3 (continued)					
S73	A3-SS73-12	6 - 12	5/10/2010		Y
S74	A3-SS74-12	6 - 12	5/10/2010		Y
S75	A3-SS75-12	6 - 12	5/10/2010		Y
S76	A3-SS76-12	6 - 12	5/10/2010		Y
S77	A3-SS77-12	6 - 12	5/10/2010		Y
S79	A3-SS79-12	6 - 12	5/10/2010		Y
S80	A3-SS80-12	6 - 12	5/10/2010		Y
S81	A3-SS81-12	6 - 12	5/10/2010		Y
S82	A3-SS82-12	6 - 12	5/10/2010		Y
S83	A3-SS83-12	6 - 12	5/10/2010		Y
S84	A3-SS84-12	6 - 12	5/10/2010		Y
S85	A3-SS85-12	6 - 12	5/10/2010		Y
S86	A3-SS86-12	6 - 12	5/10/2010		Y
S87	A3-SS87-12	6 - 12	5/10/2010		Y
Area 4					
A4-01	A4-01-E	12 - 24	10/29/2010		Y
A4-01	A4-01-F	24 - 48	10/29/2010		Y
A4-02	A4-02-E	12 - 24	10/29/2010		Y
A4-02	A4-02-F	24 - 48	10/29/2010		Y
A4-03	A4-03-E	12 - 24	11/2/2010		Y
A4-03	A4-03-F	24 - 48	11/2/2010		Y
A4-04	A4-04-E	12 - 24	11/2/2010		Y
A4-04	A4-04-F	24 - 48	11/2/2010		Y
A4-05	A4-05-E	12 - 24	11/2/2010		Y
A4-05	A4-05-F	24 - 48	11/2/2010		Y
A4-06	A4-06-E	12 - 24	11/2/2010		Y
A4-06	A4-06-F	24 - 48	11/2/2010		Y
A4-07	A4-07-E	12 - 24	11/2/2010		Y
A4-07	A4-07-F	24 - 48	11/2/2010		Y
A4-08	A4-08-E	12 - 24	11/1/2010		Y
A4-08	A4-08-F	24 - 48	11/1/2010		Y
A4-09	A4-09-E	12 - 24	11/1/2010		Y
A4-09	A4-09-F	24 - 48	11/1/2010		Y
A4-10	A4-10-E	12 - 24	11/1/2010		Y
A4-10	A4-10-F	24 - 48	11/1/2010		Y
A4-11	A4-11-E	12 - 24	11/1/2010		Y
A4-11	A4-11-F	24 - 48	11/1/2010		Y
A4-12	A4-12-E	12 - 24	11/1/2010		Y
A4-12	A4-12-F	24 - 48	11/1/2010		Y
A4-13	A4-13-E	12 - 24	11/1/2010		Y
A4-13	A4-13-F	24 - 48	11/1/2010		Y
A4-14	A4-14-E	12 - 24	10/29/2010		Y
A4-14	A4-14-F	24 - 48	10/29/2010		Y
A4-15	A4-15-E	12 - 24	10/29/2010		Y
A4-15	A4-15-F	24 - 48	10/29/2010		Y

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SOIL SAMPLE LIST
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Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Upland					
B6	B6 12-24	12 - 24	7/7/2009		Y
B6	A5-SDB6-12	6 - 12	5/13/2010		Y
B6	A5-SDB6-24	12 - 24	5/13/2010		Y
B16	B16 12-24	12 - 24	7/7/2009		Y
S107	A5-SS107-12	6 - 12	5/12/2010		Y
S107	A5-SS107-24	12 - 24	5/12/2010		Y
S109	A5-SS109-12	6 - 12	5/12/2010		Y
S109	A5-SS109-24	12 - 24	5/12/2010		Y
S112	A5-SS112-12	6 - 12	5/12/2010		Y
S112	A5-SS112-24	12 - 24	5/12/2010		Y
S118	A5-SS118-12	6 - 12	5/12/2010		Y
S118	A5-SS118-24	12 - 24	5/12/2010		Y
S125	A5-SS125-12	6 - 12	5/12/2010		Y
S125	A5-SS125-24	12 - 24	5/12/2010		Y
S153	A5-SS153-12	6 - 12	5/13/2010		Y
S153	A5-SS153-24	12 - 24	5/13/2010		Y
S155	A5-SS155-12	6 - 12	5/13/2010		Y
S155	A5-SS155-24	12 - 24	5/13/2010		Y
S210	RBS-S210B	6 - 12	4/23/2009		Y
S210	RBS-S210C	12 - 18	4/23/2009		Y
S210	RBS-S210D	18 - 24	4/23/2009		Y
S212	RBS-S212B	6 - 12	4/23/2009		Y
S212	RBS-S212C	12 - 18	4/23/2009		Y
S212	RBS-S212D	18 - 24	4/23/2009		Y
S213	RBS-S213B	6 - 12	4/23/2009		Y
S213	RBS-S213C	12 - 18	4/23/2009		Y
S213	RBS-S213D	18 - 24	4/23/2009		Y
A5-01	A5-01-F	24 - 48	12/7/2010		Y
A5-02	A5-02-F	24 - 48	12/7/2010		Y
A5-03	A5-03-F	24 - 48	12/7/2010		Y
A5-04	A5-04-F	24 - 48	12/7/2010		Y
A5-04	A5-204-F	24 - 48	12/7/2010	Duplicate sample (3)	N
A5-05	A5-05-F	24 - 48	12/6/2010		Y
A5-06	A5-06-F	24 - 48	12/6/2010		Y
A5-07	A5-07-F	24 - 48	12/6/2010		Y
A5-08	A5-08-F	24 - 48	12/6/2010		Y
A5-09	A5-09-F	24 - 48	12/6/2010		Y
A5-10	A5-10-E	12 - 24	12/6/2010		Y
A5-10	A5-10-F	24 - 48	12/6/2010		Y
A5-11	A5-11-E	12 - 24	12/6/2010		Y
A5-11	A5-11-F	24 - 48	12/6/2010		Y
A5-12	A5-12-E	12 - 24	12/6/2010		Y
A5-12	A5-12-F	24 - 48	12/6/2010		Y
A5-13	A5-13-E	12 - 24	12/6/2010		Y
A5-13	A5-13-F	24 - 48	12/6/2010		Y
A5-14	A5-14-E	12 - 24	12/6/2010		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Upland (continued)					
A5-14	A5-14-F	24 - 48	12/6/2010		Y
A5-15	A5-15-E	12 - 24	11/3/2010		Y
A5-15	A5-15-F	24 - 48	11/3/2010		Y
A5-16	A5-16-E	12 - 24	11/3/2010		Y
A5-16	A5-16-F	24 - 48	11/3/2010		Y
Area 5 - Intertidal Zone					
A130	A130 12-24	12 - 24	6/30/2009	(6)	N
A130	A5-SDA130-12	6 - 12	5/13/2010	(6)	N
A130	A5-SDA130-24	12 - 24	5/13/2010	(6)	N
A132	A132 12-24	12 - 24	6/30/2009	(6)	N
A132	Z132 12-24	12 - 24	6/30/2009	Duplicate sample (3)	N
A133	A133 12-24	12 - 24	6/30/2009	(6)	N
A165	A165 12-24	12 - 24	6/30/2009	(6)	N
A166	A166 12-24	12 - 24	7/22/2009	(6)	N
A167	A167 12-24	12 - 24	7/22/2009	(6)	N
B2	B2 12-24	12 - 24	7/23/2009	(6)	N
B3	A5-SDB3-12	6 - 12	5/13/2010	(6)	N
B3	A5-SDB3-24	12 - 24	5/13/2010	(6)	N
B4	B4 12-24	12 - 24	7/23/2009	(6)	N
B5	B5 12-24	12 - 24	7/23/2009	(6)	N
B7	B7 12-24	12 - 24	7/23/2009	(6)	N
B9	B9 12-24	12 - 24	7/23/2009	(6)	N
B10	B10 12-24	12 - 24	7/7/2009	(6)	N
B10	A5-SDB10-12	6 - 12	5/12/2010	(6)	N
B10	A5-SDB10-24	12 - 24	5/12/2010	(6)	N
B10	Z5-SDB10-24	12 - 24	5/12/2010	Duplicate sample (3)	N
B14	B14 12-24	12 - 24	7/23/2009	(6)	N
B15	B15 12-24	12 - 24	7/8/2009	(6)	N
B20	B20 12-24	12 - 24	7/23/2009	(6)	N
B20	A5-SDB20-12	6 - 12	5/12/2010	(6)	N
B20	A5-SDB20-24	12 - 24	5/12/2010	(6)	N
B20	Z5-SDB20-24	12 - 24	5/12/2010	Duplicate sample (3)	N
B21	B21 12-24	12 - 24	7/7/2009	(6)	N
B25	B25 12-24	12 - 24	7/23/2009	(6)	N
S35	A5-SS35-12	6 - 12	5/13/2010	(6)	N
S35	A5-SS35-24	12 - 24	5/13/2010	(6)	N
S35	Z5-SS35-24	12 - 24	5/13/2010	Duplicate sample (3)	N
S111	A5-SS111-12	6 - 12	5/12/2010	(6)	N
S111	A5-SS111-24	12 - 24	5/12/2010	(6)	N
S211	RBS-S211C	12 - 18	4/23/2009	(6)	N
S211	RBS-S211D	18 - 24	4/23/2009	(6)	N
S211	RBS-S211E	18 - 24	4/23/2009	(6)	N
SED124	A5-SD124-12	6 - 12	5/12/2010	(6)	N
SED124	A5-SD124-24	12 - 24	5/12/2010	(6)	N
SED139	A5-SD139-12	6 - 12	5/12/2010	(6)	N
SED139	A5-SD139-24	12 - 24	5/12/2010	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 - Intertidal Zone (continued)					
SED141	A5-SD141-12	6 - 12	5/12/2010	(6)	N
SED141	A5-SD141-24	12 - 24	5/12/2010	(6)	N
SED157	A5-SD157-12	6 - 12	5/13/2010	(6)	N
SED157	A5-SD157-24	12 - 24	5/13/2010	(6)	N
A5-21	A5-21-F	24 - 48	11/1/2010	(6)	N
A5-22	A5-22-F	24 - 48	11/3/2010	(6)	N
Area 6 - Upland					
B47	A6-SDB47-12	6 - 12	5/11/2010		Y
B47	A6-SDB47-24	12 - 24	5/11/2010		Y
B47	B47 12-24	12 - 24	7/8/2009		Y
S37	A6-SS37-12	6 - 12	5/11/2010		Y
S37	A6-SS37-24	12 - 24	5/11/2010		Y
S44	A6-SS44-12	6 - 12	5/11/2010		Y
S44	A6-SS44-24	12 - 24	5/11/2010		Y
S88	A6-SS88-12	6 - 12	5/11/2010		Y
S88	A6-SS88-24	12 - 24	5/11/2010		Y
A6-S210	A6-SS210-12	6 - 12	5/11/2010		Y
A6-S210	A6-SS210-24	12 - 24	5/11/2010		Y
A6-S211	A6-SS211-12	6 - 12	5/11/2010		Y
A6-S211	A6-SS211-24	12 - 24	5/11/2010		Y
A6-S212	A6-SS212-12	6 - 12	5/11/2010		Y
A6-S212	A6-SS212-24	12 - 24	5/11/2010		Y
A6-S212	Z6-SS212-24	12 - 24	5/11/2010	Duplicate sample (3)	N
Area 6 - Intertidal Zone					
B26	B26 12-24	12 - 24	7/9/2009	(6)	N
B26	A6-SDB26-12	6 - 12	5/11/2010	(6)	N
B26	A6-SDB26-24	12 - 24	5/11/2010	(6)	N
B27	B27 12-24	12 - 24	7/9/2009	(6)	N
B28	B28 12-24	12 - 24	7/8/2009	(6)	N
B32	B32 12-24	12 - 24	7/9/2009	(6)	N
B33	B33 12-24	12 - 24	7/27/2009	(6)	N
B33	Z33 12-24	12 - 24	7/27/2009	Duplicate sample (3)	N
B34	B34 12-24	12 - 24	7/8/2009	(6)	N
B35	B35 12-24	12 - 24	7/8/2009	(6)	N
B35	A6-SDB35-12	6 - 12	5/11/2010	(6)	N
B35	A6-SDB35-24	12 - 24	5/11/2010	(6)	N
B36	B36 12-24	12 - 24	7/8/2009	(6)	N
B37	B37 12-24	12 - 24	7/8/2009	(6)	N
B41	B41 12-24	12 - 24	7/8/2009	(6)	N
B42	B42 12-24	12 - 24	7/27/2009	(6)	N
B43	A6-SDB43-12	6 - 12	5/11/2010	(6)	N
B43	A6-SDB43-24	12 - 24	5/11/2010	(6)	N
B43	B43 12-24	12 - 24	7/27/2009	(6)	N
B44	B44 12-24	12 - 24	7/9/2009	(6)	N
B45	B45 12-24	12 - 24	7/8/2009	(6)	N
B46	B46 12-24	12 - 24	7/10/2009	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 - Intertidal Zone (continued)					
B52	B52 12-24	12 - 24	7/27/2009	(6)	N
B53	B53 12-24	12 - 24	7/27/2009	(6)	N
B54	B54 12-24	12 - 24	7/27/2009	(6)	N
B55	B55 12-24	12 - 24	7/8/2009	(6)	N
B56	B56 12-24	12 - 24	7/8/2009	(6)	N
B59	B59 12-24	12 - 24	7/27/2009	(6)	N
B60	B60 12-24	12 - 24	7/27/2009	(6)	N
B61	B61 12-24	12 - 24	7/27/2009	(6)	N
B62	B62 12-24	12 - 24	7/27/2009	(6)	N
B63	B63 12-24	12 - 24	7/27/2009	(6)	N
S207	RBS-S207B	6 - 12	4/23/2009	(6)	N
S207	RBS-S207C	12 - 18	4/23/2009	(6)	N
S207	RBS-S207D	18 - 24	4/23/2009	(6)	N
S207	RBS-S207E	18 - 24	4/23/2009	(6)	N
S208	RBS-S208B	6 - 12	4/23/2009	(6)	N
S208	RBS-S208C	12 - 18	4/23/2009	(6)	N
S208	RBS-S208D	18 - 24	4/23/2009	(6)	N
S209	RBS-S209B	6 - 12	4/23/2009	(6)	N
S209	RBS-S209C	12 - 18	4/23/2009	(6)	N
S209	RBS-S209D	18 - 24	4/23/2009	(6)	N
S46	A6-SS46-12	6 - 12	5/11/2010	(6)	N
S46	A6-SS46-24	12 - 24	5/11/2010	(6)	N
SED106	A6-SD106-12	6 - 12	5/11/2010	(6)	N
SED106	A6-SD106-24	12 - 24	5/11/2010	(6)	N
SED112	A6-SD112-12	6 - 12	5/11/2010	(6)	N
SED112	A6-SD112-24	12 - 24	5/11/2010	(6)	N
SED38	A6-SD38-12	6 - 12	5/11/2010	(6)	N
SED38	A6-SD38-24	12 - 24	5/11/2010	(6)	N
SED48	A6-SD48-12	6 - 12	5/11/2010	(6)	N
SED48	A6-SD48-24	12 - 24	5/11/2010	(6)	N
SED95	A6-SD95-12	6 - 12	5/11/2010	(6)	N
SED95	A6-SD95-24	12 - 24	5/11/2010	(6)	N
SED99	A6-SD99-12	6 - 12	5/13/2010	(6)	N
SED99	A6-SD99-24	12 - 24	5/13/2010	(6)	N
A6-01	A6-01-F	24 - 48	11/1/2010	(6)	N
A6-02	A6-02-D	6 - 24	12/6/2010	(6)	N
A6-02	A6-02-F	24 - 48	12/6/2010	(6)	N
Area 7 - Upland					
A7-04	A7-04-E	12 - 24	12/7/2010		Y
A7-04	A7-04-F	24 - 48	12/7/2010		Y
Area 7 - Intertidal Zone					
B57	B57 12-24	12 - 24	7/8/2009	(6)	N
A7-01	A7-01-D	6 - 24	12/6/2010	(6)	N
A7-01	A7-01-F	24 - 48	12/6/2010	(6)	N
A7-02	A7-02-D	6 - 24	12/7/2010	(6)	N
A7-02	A7-02-F	24 - 48	12/7/2010	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 7 - Intertidal Zone (continued)					
A7-03	A7-03-D	6 - 24	12/7/2010	(6)	N
A7-03	A7-03-F	24 - 48	12/7/2010	(6)	N
A7-05	A7-05-D	6 - 24	12/7/2010	(6)	N
A7-05	A7-05-F	24 - 48	12/7/2010	(6)	N
A7-06	A7-06-D	6 - 24	12/7/2010	(6)	N
A7-06	A7-06-F	24 - 48	12/7/2010	(6)	N
Area 8 - Upland					
S07	RBS-S07B	6 - 12	9/15/2008	Jetty area (7)	N
S07	RBS-S07C	12 - 18	9/15/2008	Jetty area (7)	N
C3	C3 12-24	12 - 24	7/9/2009		Y
A8-02	A8-02-E	12 - 24	12/7/2010		Y
A8-02	A8-02-F	24 - 48	12/7/2010		Y
A8-03	A8-03-E	12 - 24	12/7/2010		Y
A8-03	A8-03-F	24 - 48	12/7/2010		Y
A8-04	A8-04-E	12 - 24	12/7/2010		Y
A8-04	A8-04-F	24 - 48	12/7/2010		Y
A8-06	A8-06-E	12 - 24	11/3/2010		Y
A8-06	A8-06-F	24 - 48	11/3/2010		Y
A8-07	A8-07-E	12 - 24	11/3/2010		Y
A8-07	A8-07-F	24 - 48	11/3/2010		Y
Area 8 - Intertidal Zone					
C1	C1 12-24	12 - 24	7/9/2009	(6)	N
C1	C1 24-36	24 - 36	7/10/2009	(6)	N
C2	C2 12-24	12 - 24	7/9/2009	(6)	N
C7	C07 12-24	12 - 24	7/23/2009	(6)	N
C8	C8 12-24	12 - 24	7/10/2009	(6)	N
C8	C8 24-36	24 - 36	7/10/2009	(6)	N
C9	C9 12-24	12 - 24	7/9/2009	(6)	N
C16	C16 12-24	12 - 24	7/9/2009	(6)	N
C17	C17 12-24	12 - 24	7/10/2009	(6)	N
C17	C17 24-36	24 - 36	7/10/2009	(6)	N
C18	C18 12-24	12 - 24	7/10/2009	(6)	N
C18	C18 24-36	24 - 36	7/10/2009	(6)	N
C19	C19 12-24	12 - 24	7/9/2009	(6)	N
C28	C28 12-24	12 - 24	7/10/2009	(6)	N
C29	C29 12-24	12 - 24	7/27/2009	(6)	N
C41	C41 12-24	12 - 24	7/23/2009	(6)	N
S59	RBS-S59B	6 - 12	9/15/2008	(6)	N
A8-01	A8-01-D	6 - 24	12/7/2010	(6)	N
A8-01	A8-01-F	24 - 48	12/7/2010	(6)	N
A8-05	A8-05-D	6 - 24	12/7/2010	(6)	N
A8-05	A8-05-F	24 - 48	12/7/2010	(6)	N
A8-15	A8-15-F	24 - 48	11/30/2010	(6)	N
A8-16	A8-16-F	24 - 48	11/5/2010	(6)	N
A8-17	A8-17-D	6 - 24	11/30/2010	(6)	N
A8-17	A8-17-F	24 - 48	11/30/2010	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 8 - Intertidal Zone (continued)					
A8-17	A8-17-G	48 - 72	11/30/2010	(6)	N
A8-18	A8-18-F	24 - 48	11/5/2010	(6)	N
A8-19	A8-19-F	24 - 48	11/23/2010	(6)	N
A8-19	A8-219-F	24 - 48	11/23/2010	Duplicate sample (3)	N
A8-20	A8-20-D	6 - 24	12/7/2010	(6)	N
A8-20	A8-20-F	24 - 48	12/7/2010	(6)	N
Area 9 - Upland					
A9-01	A9-01-E	12 - 24	11/29/2010		Y
A9-01	A9-01-F	24 - 48	11/29/2010		Y
A9-02	A9-02-E	12 - 24	11/29/2010		Y
A9-02	A9-02-F	24 - 48	11/29/2010		Y
A9-03	A9-03-E	12 - 24	11/23/2010		Y
A9-03	A9-03-F	24 - 48	11/23/2010		Y
A9-04	A9-04-E	12 - 24	11/23/2010		Y
A9-04	A9-04-F	24 - 48	11/23/2010		Y
A9-05	A9-05-E	12 - 24	11/23/2010		Y
A9-05	A9-205-E	12 - 24	11/23/2010	Duplicate sample (3)	N
A9-05	A9-05-F	24 - 48	11/23/2010		Y
A9-06	A9-06-E	12 - 24	11/23/2010		Y
A9-06	A9-06-F	24 - 48	11/23/2010		Y
A9-07	A9-07-E	12 - 24	11/23/2010		Y
A9-07	A9-07-F	24 - 48	11/23/2010		Y
A9-08	A9-08-E	12 - 24	11/22/2010		Y
A9-08	A9-08-F	24 - 48	11/22/2010		Y
A9-09	A9-09-E	12 - 24	11/22/2010		Y
A9-09	A9-09-F	24 - 48	11/22/2010		Y
A9-10	A9-10-E	12 - 24	11/22/2010		Y
A9-10	A9-10-F	24 - 48	11/22/2010		Y
A9-11	A9-11-E	12 - 24	11/22/2010		Y
A9-11	A9-11-F	24 - 48	11/22/2010		Y
A9-12	A9-12-E	12 - 24	11/18/2010		Y
A9-12	A9-12-F	24 - 48	11/18/2010		Y
A9-13	A9-13-E	12 - 24	11/22/2010		Y
A9-13	A9-13-F	24 - 48	11/22/2010		Y
A9-14	A9-14-E	12 - 24	11/19/2010		Y
A9-14	A9-14-F	24 - 48	11/19/2010		Y
A9-15	A9-15-E	12 - 24	11/19/2010		Y
A9-15	A9-15-F	24 - 48	11/19/2010		Y
A9-16	A9-16-E	12 - 24	11/18/2010		Y
A9-16	A9-16-F	24 - 48	11/18/2010		Y
A9-17	A9-17-E	12 - 24	11/19/2010		Y
A9-17	A9-17-F	24 - 48	11/19/2010		Y
A9-18	A9-18-E	12 - 24	11/19/2010		Y
A9-18	A9-18-F	24 - 48	11/19/2010		Y
A9-19	A9-19-E	12 - 24	11/5/2010		Y
A9-19	A9-19-F	24 - 48	11/5/2010		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
A9-20	A9-20-E	12 - 24	11/5/2010		Y
A9-20	A9-20-F	24 - 48	11/5/2010		Y
A9-21	A9-21-E	12 - 24	11/5/2010		Y
A9-21	A9-21-F	24 - 48	11/5/2010		Y
A9-22	A9-22-E	12 - 24	11/5/2010		Y
A9-22	A9-22-F	24 - 48	11/5/2010		Y
A9-23	A9-23-E	12 - 24	11/5/2010		Y
A9-23	A9-23-F	24 - 48	11/5/2010		Y
A9-24	A9-24-E	12 - 24	11/8/2010		Y
A9-24	A9-24-F	24 - 48	11/8/2010		Y
A9-25	A9-25-E	12 - 24	11/8/2010		Y
A9-25	A9-25-F	24 - 48	11/8/2010		Y
A9-26	A9-26-E	12 - 24	11/8/2010		Y
A9-26	A9-26-F	24 - 48	11/8/2010		Y
A9-27	A9-27-E	12 - 24	11/8/2010		Y
A9-27	A9-27-F	24 - 48	11/8/2010		Y
A9-28	A9-28-E	12 - 24	11/8/2010		Y
A9-28	A9-28-F	24 - 48	11/8/2010		Y
A9-29	A9-29-E	12 - 24	11/9/2010		Y
A9-29	A9-29-F	24 - 48	11/9/2010		Y
A9-30	A9-30-E	12 - 24	11/9/2010		Y
A9-30	A9-30-F	24 - 48	11/9/2010		Y
A9-31	A9-31-E	12 - 24	11/9/2010		Y
A9-31	A9-31-F	24 - 48	11/9/2010		Y
A9-32	A9-32-E	12 - 24	11/10/2010		Y
A9-32	A9-32-F	24 - 48	11/10/2010		Y
A9-33	A9-33-E	12 - 24	11/10/2010		Y
A9-33	A9-33-F	24 - 48	11/10/2010		Y
A9-34	A9-34-E	12 - 24	11/10/2010		Y
A9-34	A9-34-F	24 - 48	11/10/2010		Y
A9-35	A9-35-E	12 - 24	11/10/2010		Y
A9-35	A9-35-F	24 - 48	11/10/2010		Y
A9-36	A9-36-E	12 - 24	11/10/2010		Y
A9-36	A9-36-F	24 - 48	11/10/2010		Y
A9-37	A9-37-E	12 - 24	11/11/2010		Y
A9-37	A9-37-F	24 - 48	11/11/2010		Y
A9-38	A9-38-E	12 - 24	11/11/2010		Y
A9-38	A9-38-F	24 - 48	11/11/2010		Y
A9-39	A9-39-E	12 - 24	11/11/2010		Y
A9-39	A9-39-F	24 - 48	11/11/2010		Y
A9-40	A9-40-E	12 - 24	11/11/2010		Y
A9-40	A9-40-F	24 - 48	11/11/2010		Y
A9-41	A9-41-E	12 - 24	11/11/2010		Y
A9-41	A9-41-F	24 - 48	11/11/2010		Y
A9-42	A9-42-E	12 - 24	11/15/2010		Y
A9-42	A9-42-F	24 - 48	11/15/2010		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
A9-43	A9-43-E	12 - 24	11/16/2010		Y
A9-43	A9-243-F	24 - 48	11/16/2010	Duplicate sample (3)	N
A9-43	A9-43-F	24 - 48	11/16/2010		Y
A9-44	A9-44-E	12 - 24	11/15/2010		Y
A9-44	A9-44-F	24 - 48	11/15/2010		Y
A9-45	A9-45-E	12 - 24	11/15/2010		Y
A9-45	A9-45-F	24 - 48	11/15/2010		Y
A9-46	A9-46-E	12 - 24	11/15/2010		Y
A9-46	A9-46-F	24 - 48	11/15/2010		Y
A9-47	A9-47-E	12 - 24	11/15/2010		Y
A9-47	A9-47-F	24 - 48	11/15/2010		Y
A9-48	A9-48-E	12 - 24	11/16/2010		Y
A9-48	A9-48-F	24 - 48	11/16/2010		Y
A9-49	A9-49-E	12 - 24	11/16/2010		Y
A9-49	A9-49-F	24 - 48	11/16/2010		Y
A9-50	A9-50-E	12 - 24	11/16/2010		Y
A9-50	A9-50-F	24 - 48	11/16/2010		Y
A9-51	A9-51-E	12 - 24	11/16/2010		Y
A9-51	A9-51-F	24 - 48	11/16/2010		Y
A9-52	A9-52-E	12 - 24	11/17/2010		Y
A9-52	A9-52-F	24 - 48	11/17/2010		Y
A9-53	A9-53-E	12 - 24	11/17/2010		Y
A9-53	A9-53-F	24 - 48	11/17/2010		Y
A9-54	A9-54-E	12 - 24	11/17/2010		Y
A9-54	A9-54-F	24 - 48	11/17/2010		Y
A9-55	A9-55-E	12 - 24	11/17/2010		Y
A9-55	A9-55-F	24 - 48	11/17/2010		Y
A9-56	A9-56-E	12 - 24	11/17/2010		Y
A9-56	A9-56-F	24 - 48	11/17/2010		Y
A9-57	A9-57-E	12 - 24	11/17/2010		Y
A9-57	A9-57-F	24 - 48	11/17/2010		Y
A9-58	A9-58-E	12 - 24	11/18/2010		Y
A9-58	A9-58-F	24 - 48	11/18/2010		Y
A9-59	A9-59-E	12 - 24	11/18/2010		Y
A9-59	A9-59-F	24 - 48	11/18/2010		Y
A9-60	A9-60-E	12 - 24	11/18/2010		Y
A9-60	A9-60-F	24 - 48	11/18/2010		Y
A9-61	A9-61-E	12 - 24	11/18/2010		Y
A9-61	A9-61-F	24 - 48	11/18/2010		Y
A9-107	A9-107-E	12 - 24	11/29/2010		Y
A9-107	A9-107-F	24 - 48	11/29/2010		Y
A9-108	A9-108-E	12 - 24	11/29/2010		Y
A9-108	A9-108-F	24 - 48	11/29/2010		Y
A9-109	A9-109-E	12 - 24	12/3/2010		Y
A9-109	A9-109-F	24 - 48	12/3/2010		Y
A9-110	A9-110-E	12 - 24	12/3/2010		Y

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Raritan Bay Slag Superfund Site
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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 9 - Upland (continued)					
A9-110	A9-110-F	24 - 48	12/3/2010		Y
A9-111	A9-111-E	12 - 24	12/3/2010		Y
A9-111	A9-111-F	24 - 48	12/3/2010		Y
Area 9 - Intertidal Zone					
A9-64	A9-64-D	6 - 24	12/8/2010	(6) / (8)	N
A9-64	A9-64-F	24 - 48	12/8/2010	(6)	N
A9-65	A9-65-D	6 - 24	10/26/2010	(6) / (8)	N
A9-65	A9-65-F	24 - 48	10/26/2010	(6)	N
A9-66	A9-66-D	6 - 24	10/27/2010	(6) / (8)	N
A9-66	A9-66-F	24 - 48	10/27/2010	(6)	N
A9-67	A9-67-D	6 - 24	12/8/2010	(6) / (8)	N
A9-67	A9-67-F	24 - 48	12/8/2010	(6)	N
A9-68	A9-68-D	6 - 24	10/27/2010	(6) / (8)	N
A9-68	A9-68-F	24 - 48	10/27/2010	(6)	N
A9-69	A9-69-F	24 - 48	11/29/2010	(6)	N
Area 11 - Upland					
C14	C14 12-24	12 - 24	7/10/2009		Y
A11-01	A11-01-D	6 - 24	12/14/2010		Y
A11-01	A11-01-F	24 - 48	12/14/2010		Y
A11-02	A11-02-E	12 - 24	12/14/2010		Y
A11-02	A11-02-F	24 - 48	12/14/2010		Y
A11-03	A11-03-E	12 - 24	12/15/2010		Y
A11-03	A11-03-F	24 - 48	12/15/2010		Y
A11-03	A11-203-F	24 - 48	12/15/2010	Duplicate sample (3)	N
A11-04	A11-04-D	6 - 24	12/8/2010	(6)	N
A11-04	A11-204-D	6 - 24	12/8/2010	Duplicate sample (3)	N
A11-04	A11-04-F	24 - 48	12/8/2010	(6)	N
A11-04	A11-04-F-GS	24 - 48	12/14/2010	(6)	N
A11-10	A11-10-E	12 - 24	12/8/2010		Y
A11-10	A11-10-F	24 - 48	12/8/2010		Y
A11-11	A11-11-E	12 - 24	12/6/2010		Y
A11-11	A11-11-F	24 - 48	12/6/2010		Y
A11-12	A11-12-E	12 - 24	12/6/2010		Y
A11-12	A11-12-F	24 - 48	12/6/2010		Y
A11-13	A11-13-E	12 - 24	11/4/2010		Y
A11-13	A11-13-F	24 - 48	11/4/2010		Y
Area 11 - Intertidal Zone					
C20	C20 12-24	12 - 24	7/9/2009	(6)	N
C21	C21 12-24	12 - 24	7/10/2009	(6)	N
C23	C23 12-24	12 - 24	7/9/2009	(6)	N
C24	C24 12-24	12 - 24	7/9/2009	(6)	N
C30	C30 12-24	12 - 24	7/10/2009	(6)	N
C31	C31 12-24	12 - 24	7/10/2009	(6)	N
C32	C32 12-24	12 - 24	7/10/2009	(6)	N
C33	C33 12-24	12 - 24	7/10/2009	(6)	N
C34	C34 12-24	12 - 24	7/10/2009	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 11 - Intertidal Zone (continued)					
C35	C35 12-24	12 - 24	7/10/2009	(6)	N
C36	C36 12-24	12 - 24	7/10/2009	(6)	N
C43	C43 12-24	12 - 24	7/13/2009	(6)	N
C44	C44 12-24	12 - 24	7/13/2009	(6)	N
C45	C45 12-24	12 - 24	7/13/2009	(6)	N
C46	C46 12-24	12 - 24	7/13/2009	(6)	N
C47	C47 12-24	12 - 24	7/10/2009	(6)	N
C53	C53 12-24	12 - 24	7/13/2009	(6)	N
C54	C54 12-24	12 - 24	7/13/2009	(6)	N
C55	C55 12-24	12 - 24	7/13/2009	(6)	N
C56	C56 12-24	12 - 24	7/13/2009	(6)	N
C63	C63 12-24	12 - 24	7/23/2009	(6)	N
C64	C64 12-24	12 - 24	7/23/2009	(6)	N
C70	C70 12-24	12 - 24	7/10/2009	(6)	N
C71	C71 12-24	12 - 24	7/10/2009	(6)	N
C72	C72 12-24	12 - 24	7/10/2009	(6)	N
C73	C73 12-24	12 - 24	7/23/2009	(6)	N
C74	C74 12-24	12 - 24	7/23/2009	(6)	N
C75	C75 12-24	12 - 24	7/23/2009	(6)	N
C76	C76 12-24	12 - 24	7/10/2009	(6)	N
C81	C81 12-24	12 - 24	7/23/2009	(6)	N
C82	C82 12-24	12 - 24	7/23/2009	(6)	N
C87	C87 12-24	12 - 24	7/10/2009	(6)	N
C88	C88 12-24	12 - 24	7/23/2009	(6)	N
C89	C89 12-24	12 - 24	7/23/2009	(6)	N
C90	C90 12-24	12 - 24	7/10/2009	(6)	N
C91	C91 12-24	12 - 24	7/10/2009	(6)	N
C96	C96 12-24	12 - 24	7/23/2009	(6)	N
C97	C97 12-24	12 - 24	7/23/2009	(6)	N
C98	C98 12-24	12 - 24	7/23/2009	(6)	N
C99	C99 12-24	12 - 24	7/10/2009	(6)	N
C105	C105 12-24	12 - 24	7/22/2009	(6)	N
A11-05	A11-05-D	6 - 24	12/8/2010	(6)	N
A11-05	A11-05-F	24 - 48	12/8/2010	(6)	N
A11-06	A11-06-D	6 - 24	12/2/2010	(6)	N
A11-06	A11-06-F	24 - 48	12/2/2010	(6)	N
A11-06	A11-206-F	24 - 48	12/2/2010	Duplicate sample (3)	N
A11-07	A11-07-D	6 - 24	12/2/2010	(6)	N
A11-07	A11-07-F	24 - 48	12/2/2010	(6)	N
A11-08	A11-08-D	6 - 24	12/6/2010	(6)	N
A11-08	A11-08-F	24 - 48	12/6/2010	(6)	N
A11-08	A11-208-F	24 - 48	12/6/2010	Duplicate sample (3)	N
A11-09	A11-09-D	6 - 24	12/6/2010	(6)	N
A11-09	A11-09-F	24 - 48	12/6/2010	(6)	N
A11-14	A11-14-D	6 - 24	11/23/2010	(6)	N
A11-14	A11-14-F	24 - 48	11/23/2010	(6)	N

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 11 - Intertidal Zone (continued)					
A11-15	A11-15-D	6 - 24	11/3/2010	(6)	N
A11-15	A11-15-F	24 - 48	11/3/2010	(6)	N
A11-16	A11-16-D	6 - 24	11/3/2010	(6)	N
A11-16	A11-16-F	24 - 48	11/3/2010	(6)	N
A11-17	A11-17-D	6 - 24	11/3/2010	(6)	N
A11-17	A11-17-F	24 - 48	11/3/2010	(6)	N
A11-18	A11-18-D	6 - 24	11/23/2010	(6)	N
A11-18	A11-18-F	24 - 48	11/23/2010	(6)	N
A11-19	A11-19-F	24 - 48	11/2/2010	(6)	N
A11-20	A11-20-F	24 - 48	11/29/2010	(6)	N
A11-21	A11-21-F	24 - 48	11/2/2010	(6)	N
A11-21	A11-221-F	24 - 48	11/2/2010	Duplicate sample (3)	N
A11-22	A11-22-F	24 - 48	11/29/2010	(6)	N
A11-24	A11-24-D	6 - 24	11/3/2010	(6)	N
A11-24	A11-24-F	24 - 48	11/3/2010	(6)	N
A11-25	A11-25-D	6 - 24	11/3/2010	(6)	N
A11-25	A11-25-F	24 - 48	11/3/2010	(6)	N
A11-27	A11-27-D	6 - 24	12/3/2010	(6)	N
A11-27	A11-27-F	24 - 48	12/3/2010	(6)	N
A11-28	A11-28-F	24 - 48	12/3/2010	(6)	N
A11-30	A11-30-F	24 - 48	11/23/2010	(6)	N
A11-31	A11-231-F	24 - 48	11/23/2010	Duplicate sample (3)	N
A11-31	A11-31-F	24 - 48	11/23/2010	(6)	N
A11-32	A11-32-F	24 - 48	11/23/2010	(6)	N
A11-33	A11-33-F	24 - 48	11/23/2010	(6)	N
Technical Workgroup Lead Samples					
Area 2					
A2-T1	A2-T1	0 - 2	8/3/2010		Y
A2-T2	A2-T2	0 - 2	8/3/2010		Y
A2-T3	A2-T3	0 - 2	8/3/2010		Y
A2-T4	A2-T4	0 - 2	8/3/2010		Y
A2-T5	A2-T5	0 - 2	8/3/2010		Y
A2-T6	A2-T6	0 - 2	8/3/2010		Y
A2-T7	A2-T7	0 - 2	8/3/2010		Y
A2-T8	A2-T8	0 - 2	8/3/2010		Y
A2-T9	A2-T9	0 - 2	8/3/2010		Y
A2-T10	A2-T10	0 - 2	8/5/2010		Y
A2-T10	A2-T10-D	0 - 2	8/5/2010	Duplicate sample (3)	N
A2-T11	A2-T11	0 - 2	8/5/2010		Y
A2-T12	A2-T12	0 - 2	8/3/2010		Y
A2-T13	A2-T13	0 - 2	8/5/2010		Y
A2-T13	A2-T13-D	0 - 2	8/5/2010	Duplicate sample (3)	N
A2-T14	A2-T14	0 - 2	8/6/2010		Y
A2-T15	A2-T15	0 - 2	8/6/2010		Y
A2-T16	A2-T16	0 - 2	8/5/2010		Y
A2-T17	A2-T17	0 - 2	8/5/2010		Y

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Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 2 (continued)					
A2-T18	A2-T18	0 - 2	8/5/2010		Y
A2-T19	A2-T19	0 - 2	8/5/2010		Y
A2-T20	A2-T20	0 - 2	8/5/2010		Y
A2-T21	A2-T21	0 - 2	8/5/2010		Y
A2-T21	A2-T21-D	0 - 2	8/5/2010	Duplicate sample (3)	N
A2-T22	A2-T22	0 - 2	8/5/2010		Y
A2-T23	A2-T23	0 - 2	8/6/2010		Y
A2-T24	A2-T24	0 - 2	8/6/2010		Y
A2-T25	A2-T25	0 - 2	8/6/2010		Y
A2-T26	A2-T26	0 - 2	8/6/2010	Below spring low tide line	N
A2-T27	A2-T27	0 - 2	8/5/2010		Y
A2-T28	A2-T28	0 - 2	8/5/2010		Y
A2-T29	A2-T29	0 - 2	8/5/2010		Y
A2-T30	A2-T30	0 - 2	8/5/2010		Y
A2-T31	A2-T31	0 - 2	8/5/2010	Below spring low tide line	N
A2-T32	A2-T32	0 - 2	8/5/2010		Y
A2-T33	A2-T33	0 - 2	8/5/2010		Y
A2-T34	A2-T34	0 - 2	8/5/2010		Y
Area 3					
A3-T1	A3-T1	0 - 2	12/9/2010		Y
A3-T2	A3-T2	0 - 2	12/9/2010		Y
A3-T3	A3-T3	0 - 2	12/9/2010		Y
Area 5					
A5-T1	A5-T1	0 - 2	11/30/2010		Y
A5-T1	A5-T201	0 - 2	11/30/2010	Duplicate sample (3)	N
A5-T2	A5-T2	0 - 2	11/30/2010		Y
A5-T3	A5-T3	0 - 2	12/2/2010		Y
A5-T4	A5-T4	0 - 2	11/30/2010		Y
A5-T5	A5-T5	0 - 2	11/30/2010		Y
A5-T6	A5-T6	0 - 2	12/8/2010		Y
A5-T7	A5-T7	0 - 2	12/7/2010		Y
A5-T7	A5-T207	0 - 2	12/7/2010	Duplicate sample (3)	N
A5-T8	A5-T8	0 - 2	11/30/2010		Y
A5-T9	A5-T9	0 - 2	11/30/2010		Y
A5-T10	A5-T10	0 - 2	12/2/2010		Y
A5-T11	A5-T11	0 - 2	12/7/2010		Y
A5-T12	A5-T12	0 - 2	12/7/2010		Y
A5-T13	A5-T13	0 - 2	12/7/2010		Y
A5-T14	A5-T14	0 - 2	12/7/2010		Y
A5-T15	A5-T15	0 - 2	11/30/2010		Y
A5-T16	A5-T16	0 - 2	11/30/2010		Y
A5-T17	A5-T17	0 - 2	12/2/2010		Y
A5-T18	A5-T18	0 - 2	12/6/2010		Y
A5-T19	A5-T19	0 - 2	12/7/2010		Y
A5-T20	A5-T20	0 - 2	12/7/2010		Y
A5-T21	A5-T21	0 - 2	12/7/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 (continued)					
A5-T22	A5-T22	0 - 2	12/7/2010		Y
A5-T23	A5-T23	0 - 2	11/30/2010		Y
A5-T24	A5-T224	0 - 2	11/30/2010	Duplicate sample (3)	N
A5-T24	A5-T24	0 - 2	11/30/2010		Y
A5-T25	A5-T25	0 - 2	11/30/2010		Y
A5-T26	A5-T26	0 - 2	12/2/2010		Y
A5-T27	A5-T27	0 - 2	12/6/2010		Y
A5-T28	A5-T28	0 - 2	12/7/2010		Y
A5-T29	A5-T29	0 - 2	12/7/2010		Y
A5-T29	A5-T229	0 - 2	12/7/2010	Duplicate sample (3)	N
A5-T30	A5-T30	0 - 2	12/7/2010		Y
A5-T31	A5-T31	0 - 2	12/7/2010		Y
A5-T32	A5-T32	0 - 2	1/5/2011		Y
A5-T33	A5-T33	0 - 2	11/30/2010		Y
A5-T34	A5-T34	0 - 2	12/2/2010		Y
A5-T35	A5-T35	0 - 2	12/2/2010		Y
A5-T36	A5-T36	0 - 2	12/6/2010		Y
A5-T36	A5-T236	0 - 2	12/6/2010	Duplicate sample (3)	N
A5-T37	A5-T37	0 - 2	12/6/2010		Y
A5-T38	A5-T38	0 - 2	12/7/2010		Y
A5-T39	A5-T39	0 - 2	12/7/2010		Y
A5-T40	A5-T40	0 - 2	12/7/2010		Y
A5-T41	A5-T41	0 - 2	12/7/2010		Y
A5-T42	A5-T42	0 - 2	12/7/2010		Y
A5-T43	A5-T43	0 - 2	12/7/2010		Y
A5-T43	A5-T243	0 - 2	12/7/2010	Duplicate sample (3)	N
A5-T44	A5-T44	0 - 2	11/30/2010		Y
A5-T45	A5-T45	0 - 2	11/30/2010		Y
A5-T46	A5-T46	0 - 2	12/2/2010		Y
A5-T47	A5-T47	0 - 2	12/7/2010		Y
A5-T48	A5-T48	0 - 2	12/7/2010		Y
A5-T49	A5-T49	0 - 2	12/7/2010		Y
A5-T50	A5-T50	0 - 2	12/7/2010		Y
A5-T51	A5-T51	0 - 2	12/7/2010		Y
A5-T52	A5-T52	0 - 2	12/7/2010		Y
A5-T53	A5-T53	0 - 2	12/7/2010		Y
A5-T54	A5-T54	0 - 2	12/7/2010		Y
A5-T55	A5-T55	0 - 2	11/30/2010		Y
A5-T56	A5-T56	0 - 2	11/30/2010		Y
A5-T57	A5-T57	0 - 2	12/8/2010		Y
A5-T58	A5-T58	0 - 2	12/7/2010		Y
A5-T59	A5-T59	0 - 2	1/20/2011		Y
A5-T59	A5-T259	0 - 2	1/20/2011	Duplicate sample (3)	N
A5-T60	A5-T60	0 - 2	1/20/2011		Y
A5-T65	A5-T65	0 - 2	11/30/2010		Y
A5-T66	A5-T66	0 - 2	11/30/2010		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 5 (continued)					
A5-T67	A5-T67	0 - 2	11/30/2010		Y
A5-T68	A5-T68	0 - 2	11/30/2010		Y
A5-T69	A5-T69	0 - 2	12/7/2010		Y
A5-T70	A5-T70	0 - 2	1/20/2011		Y
A5-T76	A5-T76	0 - 2	11/30/2010		Y
A5-T77	A5-T77	0 - 2	11/30/2010		Y
A5-T78	A5-T78	0 - 2	11/30/2010		Y
A5-T79	A5-T79	0 - 2	11/30/2010		Y
A5-T80	A5-T80	0 - 2	12/7/2010		Y
A5-T81	A5-T81	0 - 2	12/7/2010		Y
A5-T87	A5-T87	0 - 2	11/30/2010		Y
A5-T88	A5-T88	0 - 2	11/30/2010		Y
A5-T89	A5-T89	0 - 2	12/7/2010		Y
A5-T90	A5-T90	0 - 2	12/7/2010		Y
A5-T96	A5-T96	0 - 2	11/30/2010		Y
A5-T97	A5-T97	0 - 2	12/7/2010		Y
A5-T98	A5-T98	0 - 2	1/20/2011		Y
A5-T103	A5-T103	0 - 2	12/7/2010		Y
A5-T114	A5-T114	0 - 2	12/14/2010		Y
Area 6					
A6-T4	A6-T4	0 - 2	12/2/2010		Y
A6-T5	A6-T5	0 - 2	12/2/2010		Y
A6-T7	A6-T7	0 - 2	12/2/2010		Y
A6-T8	A6-T8	0 - 2	12/2/2010		Y
A6-T9	A6-T9	0 - 2	12/2/2010		Y
A6-T11	A6-T11	0 - 2	12/2/2010		Y
A6-T12	A6-T12	0 - 2	12/2/2010		Y
A6-T13	A6-T13	0 - 2	12/6/2010		Y
A6-T14	A6-T14	0 - 2	12/2/2010		Y
A6-T15	A6-T15	0 - 2	12/2/2010		Y
A6-T18	A6-T18	0 - 2	12/8/2010		Y
A6-T19	A6-T19	0 - 2	12/2/2010		Y
A6-T20	A6-T20	0 - 2	1/3/2011		Y
A6-T21	A6-T21	0 - 2	12/7/2010		Y
A6-T22	A6-T22	0 - 2	12/8/2010		Y
A6-T23	A6-T23	0 - 2	12/7/2010		Y
A6-T24	A6-T24	0 - 2	12/7/2010		Y
A6-T25	A6-T25	0 - 2	12/2/2010		Y
A6-T26	A6-T26	0 - 2	12/2/2010		Y
A6-T27	A6-T27	0 - 2	12/3/2010		Y
A6-T29	A6-T29	0 - 2	12/2/2010		Y
A6-T30	A6-T30	0 - 2	12/2/2010		Y
A6-T31	A6-T31	0 - 2	12/2/2010		Y
A6-T31	A6-T231	0 - 2	12/2/2010	Duplicate sample (3)	N
A6-T32	A6-T32	0 - 2	12/2/2010		Y
A6-T33	A6-T33	0 - 2	12/8/2010		Y

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SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 (continued)					
A6-T34	A6-T234	0 - 2	1/4/2011	Duplicate sample (3)	N
A6-T34	A6-T34	0 - 2	1/4/2011		Y
A6-T35	A6-T35	0 - 2	12/7/2010		Y
A6-T36	A6-T36	0 - 2	1/20/2011		Y
A6-T39	A6-T39	0 - 2	12/2/2010		Y
A6-T40	A6-T40	0 - 2	12/6/2010		Y
A6-T41	A6-T41	0 - 2	12/6/2010		Y
A6-T42	A6-T42	0 - 2	12/6/2010		Y
A6-T43	A6-T43	0 - 2	12/6/2010		Y
A6-T44	A6-T44	0 - 2	12/7/2010		Y
A6-T45	A6-T45	0 - 2	1/5/2011		Y
A6-T46	A6-T46	0 - 2	12/6/2010		Y
A6-T47	A6-T47	0 - 2	12/6/2010		Y
A6-T48	A6-T48	0 - 2	12/7/2010		Y
A6-T49	A6-T49	0 - 2	12/7/2010		Y
A6-T50	A6-T50	0 - 2	12/7/2010		Y
A6-T51	A6-T51	0 - 2	1/20/2011		Y
A6-T52	A6-T52	0 - 2	1/20/2011		Y
A6-T56	A6-T56	0 - 2	12/2/2010		Y
A6-T57	A6-T57	0 - 2	12/7/2010		Y
A6-T58	A6-T58	0 - 2	12/8/2010		Y
A6-T59	A6-T59	0 - 2	12/6/2010		Y
A6-T60	A6-T60	0 - 2	12/7/2010		Y
A6-T61	A6-T61	0 - 2	12/6/2010		Y
A6-T61	A6-T261	0 - 2	12/6/2010	Duplicate sample (3)	N
A6-T62	A6-T62	0 - 2	12/6/2010		Y
A6-T63	A6-T63	0 - 2	12/7/2010		Y
A6-T64	A6-T64	0 - 2	12/7/2010		Y
A6-T65	A6-T65	0 - 2	12/7/2010		Y
A6-T66	A6-T66	0 - 2	12/7/2010		Y
A6-T67	A6-T67	0 - 2	12/6/2010		Y
A6-T68	A6-T68	0 - 2	1/20/2011		Y
A6-T69	A6-T69	0 - 2	1/20/2011		Y
A6-T75	A6-T75	0 - 2	12/2/2010		Y
A6-T76	A6-T76	0 - 2	12/2/2010		Y
A6-T77	A6-T77	0 - 2	12/7/2010		Y
A6-T78	A6-T78	0 - 2	12/6/2010		Y
A6-T79	A6-T79	0 - 2	12/6/2010		Y
A6-T79	A6-T279	0 - 2	12/6/2010	Duplicate sample (3)	N
A6-T80	A6-T80	0 - 2	12/6/2010		Y
A6-T81	A6-T81	0 - 2	12/6/2010		Y
A6-T82	A6-T82	0 - 2	12/6/2010		Y
A6-T83	A6-T83	0 - 2	12/7/2010		Y
A6-T84	A6-T84	0 - 2	12/7/2010		Y
A6-T85	A6-T85	0 - 2	12/6/2010		Y
A6-T86	A6-T86	0 - 2	12/6/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6 (continued)					
A6-T87	A6-T87	0 - 2	1/20/2011		Y
A6-T88	A6-T88	0 - 2	12/7/2010		Y
A6-T95	A6-T95	0 - 2	12/6/2010		Y
A6-T96	A6-T96	0 - 2	12/8/2010		Y
A6-T97	A6-T97	0 - 2	12/6/2010		Y
A6-T98	A6-T98	0 - 2	12/6/2010		Y
A6-T99	A6-T99	0 - 2	12/6/2010		Y
A6-T100	A6-T100	0 - 2	12/6/2010		Y
A6-T101	A6-T101	0 - 2	12/6/2010		Y
A6-T101	A6-T201	0 - 2	12/6/2010	Duplicate sample (3)	N
A6-T102	A6-T102	0 - 2	1/5/2011		Y
A6-T103	A6-T103	0 - 2	1/20/2011		Y
A6-T104	A6-T104	0 - 2	1/20/2011		Y
A6-T114	A6-T114	0 - 2	12/6/2010		Y
A6-T115	A6-T115	0 - 2	12/8/2010		Y
A6-T116	A6-T116	0 - 2	12/6/2010		Y
A6-T117	A6-T117	0 - 2	12/7/2010		Y
A6-T118	A6-T118	0 - 2	12/6/2010		Y
A6-T119	A6-T119	0 - 2	12/6/2010		Y
A6-T120	A6-T120	0 - 2	1/20/2011		Y
A6-T121	A6-T121	0 - 2	12/6/2010		Y
A6-T122	A6-T122	0 - 2	12/6/2010		Y
A6-T128	A6-T128	0 - 2	12/6/2010		Y
A6-T129	A6-T129	0 - 2	12/6/2010		Y
A6-T130	A6-T130	0 - 2	12/7/2010		Y
A6-T131	A6-T131	0 - 2	12/6/2010		Y
A6-T132	A6-T132	0 - 2	12/6/2010		Y
A6-T133	A6-T133	0 - 2	1/20/2011		Y
A6-T134	A6-T134	0 - 2	12/6/2010		Y
A6-T135	A6-T135	0 - 2	12/6/2010		Y
A6-T138	A6-T138	0 - 2	12/6/2010		Y
A6-T139	A6-T139	0 - 2	12/7/2010		Y
A6-T140	A6-T140	0 - 2	12/6/2010		Y
A6-T141	A6-T141	0 - 2	12/6/2010		Y
A6-T142	A6-T142	0 - 2	12/6/2010		Y
A6-T143	A6-T143	0 - 2	1/20/2011		Y
A6-T144	A6-T144	0 - 2	1/20/2011		Y
A6-T145	A6-T145	0 - 2	12/7/2010		Y
A6-T146	A6-T146	0 - 2	12/6/2010		Y
A6-T147	A6-T147	0 - 2	12/6/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 10					
A10-T1	A10-T1	0 - 2	12/3/2010	Background (4)	N
A10-T2	A10-T2	0 - 2	12/3/2010	Background (4)	N
A10-T3	A10-T3	0 - 2	12/3/2010	Background (4)	N
A10-T4	A10-T4	0 - 2	12/3/2010	Background (4)	N
A10-T5	A10-T5	0 - 2	12/3/2010	Background (4)	N
A10-T6	A10-T6	0 - 2	12/3/2010	Background (4)	N
A10-T7	A10-T207	0 - 2	12/3/2010	Duplicate sample (3)	N
A10-T7	A10-T7	0 - 2	12/3/2010	Background (4)	N
A10-T8	A10-T8	0 - 2	12/3/2010	Background (4)	N
A10-T9	A10-T9	0 - 2	12/3/2010	Background (4)	N
A10-T10	A10-T10	0 - 2	12/3/2010	Background (4)	N
Bioavailability Samples (5)					
Area 2					
A2-B1	A2-B1	0 - 24	12/14/2010		Y
A2-B2	A2-B2	0 - 24	12/14/2010		Y
A2-B3	A2-B3	0 - 24	12/14/2010		Y
A2-B4	A2-B4	0 - 24	12/15/2010		Y
A2-B5	A2-B5	0 - 24	12/22/2010		Y
A2-B6	A2-B6	0 - 24	1/3/2011		Y
Area 3					
A3-B1	A3-B1	0 - 24	12/13/2010		Y
A3-B2	A3-B2	0 - 24	12/13/2010		Y
A3-B2	A3-B2-D	0 - 24	12/13/2010	Duplicate sample (3)	N
A3-B3	A3-B3	0 - 24	12/13/2010		Y
A3-B4	A3-B4	0 - 24	12/13/2010		Y
A3-B5	A3-B5	0 - 24	12/13/2010		Y
A3-B6	A3-B6	0 - 24	12/13/2010		Y
A3-B7	A3-B7	0 - 24	12/13/2010		Y
A3-B8	A3-B8	0 - 24	12/13/2010		Y
A3-B9	A3-B9	0 - 24	12/13/2010		Y
A3-B10	A3-B10	0 - 24	12/13/2010		Y
Area 5					
A5-B1	A5-B1	0 - 24	12/15/2010		Y
A5-B2	A5-B2	0 - 24	12/15/2010		Y
A5-B3	A5-B3	0 - 24	12/15/2010		Y
A5-B4	A5-B4	0 - 24	12/15/2010		Y
A5-B5	A5-B5	0 - 24	12/14/2010		Y
A5-B6	A5-B6	0 - 24	12/14/2010		Y
A5-B7	A5-B7	0 - 24	12/14/2010		Y
A5-B8	A5-B8	0 - 24	12/14/2010		Y
A5-B9	A5-B9	0 - 24	12/22/2010		Y
A5-B10	A5-B10	0 - 24	12/22/2010		Y

TABLE A-1
SOIL SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches) (1)	Collection Date	Comment	Use In Risk Assessment
Area 6					
A6-B1	A6-B1	0 - 24	12/15/2010		Y
A6-B2	A6-B2	0 - 24	12/15/2010		Y
A6-B3	A6-B3	0 - 24	12/15/2010		Y
A6-B3	A6-B3-D	0 - 24	12/15/2010	Duplicate sample (3)	N
A6-B4	A6-B4	0 - 24	12/22/2010		Y
A6-B4	A6-B4-D	0 - 24	12/22/2010	Duplicate sample (3)	N
Area 9					
A9-B1	A9-B1	0 - 24	12/13/2010		Y
A9-B2	A9-B2	0 - 24	12/13/2010		Y
A9-B3	A9-B3	0 - 24	12/13/2010		Y
A9-B4	A9-B4	0 - 24	12/13/2010		Y
A9-B5	A9-B5	0 - 24	12/13/2010		Y
A9-B6	A9-B6	0 - 24	12/13/2010		Y
A9-B7	A9-B7	0 - 24	12/13/2010		Y
A9-B8	A9-B8	0 - 24	12/13/2010		Y
A9-B9	A9-B9	0 - 24	12/13/2010		Y
A9-B10	A9-B10	0 - 24	12/13/2010		Y

N = No. Not used in risk assessment.
Y = Yes. Used in risk assessment.

(1) To support the ecological risk assessment, soil samples were collected from 0 to 12 inches below ground surface (bgs). To support the human health risk assessment (HHRA), soil samples were collected from 0 to 24 inches bgs. Soil samples were also collected from the 0 to 6 inch interval (Area 3) and 0 to 2 inch interval because the near surface soil represents soil and dust that children may be exposed to and is used to predict child blood lead levels using the lead model.
(2) Surface soil samples are defined as soil from the ground surface to a maximum depth of two feet.
(3) Duplicate samples are collected for quality assurance/quality control purposes, but are not included in risk assessment evaluations.
(4) Background samples are used to establish background levels. They are not included in risk assessment evaluations.
(5) These samples are used for devleoping site-specific relative bioavailability only.
(6) Soil samples collected from a depth of two to ten feet below ground surface are evaluated in the risk assessment for the upland area only.
(7) Jetty area samples are evaluated for the trespasser scenario only.
(8) Sample collected within beach area of Area 9.

TABLE A-2
SURFACE WATER SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Area	Location	Sample ID	Collection Date	Comment	Use In Risk Assessment
Bay Water					
Area-01	A1-13	A1-13-WO	12/2/2010		Y
Area-01	A1-17	A1-17-WO	10/29/2010		Y
Area-01	A1-26	A1-26-WO	10/28/2010		Y
Area-01	A1-27	A1-27-WO	10/28/2010		Y
Area-01	A1-28	A1-28-WO	10/28/2010		Y
Area-01	A1-29	A1-29-WO	10/27/2010		Y
Area-01	A1-30	A1-30-WO	10/29/2010		Y
Area-01	A1-31	A1-31-WO	10/28/2010		Y
Area-01	A1-31	A1-231-WO	10/28/2010	Duplicate sample (1)	N
Area-01	A1-32	A1-32-WO	10/27/2010		Y
Area-01	A1-33	A1-33-WO	10/27/2010		Y
Area-01	SW01	RBS-SW01	9/10/2008		Y
Area-01	SW01	RBS-SW02	9/10/2008	Duplicate sample (1)	N
Area-01	SW03	RBS-SW03	9/10/2008		Y
Area-01	SW04	RBS-SW04	9/10/2008		Y
Area-01	SW05	RBS-SW05	9/10/2008		Y
Area-01	SW06	RBS-SW06	9/10/2008		Y
Area-01	SW07	RBS-SW07	9/10/2008		Y
Area-01	SW08	RBS-SW08	9/10/2008		Y
Area-01	SW18	RBS-SW18	9/10/2008		Y
Area-01	SW37	RBS-SW37	4/22/2009		Y
Area-02	SW09	RBS-SW09	9/11/2008		Y
Area-02	SW10	RBS-SW010	9/11/2008		Y
Area-02	SW11	RBS-SW11	9/11/2008		Y
Area-05	A5-19	A5-19-WO	11/1/2010		Y
Area-05	A5-21	A5-21-WO	11/1/2010		Y
Area-05	A5-22	A5-22-WO	11/3/2010		Y
Area-05	A5-SW-37	A5-SW37	5/17/2010		Y
Area-05	A5-SW-37	Z5-SW37	5/17/2010	Duplicate sample (1)	N
Area-05	A5-SW-38	A5-SW38	5/17/2010		Y
Area-05	A5-SW-39	A5-SW39	5/17/2010		Y
Area-05	SW30	A5-SW30	5/17/2010		Y
Area-05	SW30	RBS-SW30	4/21/2009		Y
Area-05	SW31	A5-SW31	5/17/2010		Y
Area-05	SW31	RBS-SW31	4/21/2009		Y
Area-05	SW32	A5-SW32	5/17/2010		Y
Area-05	SW32	RBS-SW32	4/21/2009		Y
Area-05	SW33	A5-SW33	5/17/2010		Y
Area-05	SW33	RBS-SW33	4/21/2009		Y
Area-05	SW34	A5-SW34	5/17/2010		Y
Area-05	SW34	RBS-SW34	4/21/2009		Y
Area-05	SW35	A5-SW35	5/17/2010		Y
Area-05	SW35	RBS-SW35	4/21/2009		Y
Area-05	SW36	A5-SW36	5/17/2010		Y
Area-05	SW36	RBS-SW36	4/21/2009		Y
Area-06	A6-01	A6-01-WO	11/1/2010		Y
Area-06	A6-SW30	A6-SW30	5/11/2010		Y

TABLE A-2
SURFACE WATER SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Area	Location	Sample ID	Collection Date	Comment	Use In Risk Assessment
Bay Water (continued)					
Area-06	A6-SW31	A6-SW31	5/11/2010		Y
Area-06	A6-SW32	A6-SW32	5/11/2010		Y
Area-06	A6-SW33	A6-SW33	5/11/2010		Y
Area-06	A6-SW34	A6-SW34	5/11/2010		Y
Area-06	A6-SW35	A6-SW35	5/11/2010		Y
Area-06	A6-SW36	A6-SW36	5/11/2010		Y
Area-06	A6-SW37	A6-SW37	5/11/2010		Y
Area-06	A6-SW38	A6-SW38	5/11/2010		Y
Area-06	SW12	A6-SW12	5/11/2010		Y
Area-06	SW12	RBS-SW12	9/15/2008		Y
Area-06	SW13	A6-SW13	5/11/2010		Y
Area-06	SW13	RBS-SW13	9/15/2008		Y
Area-06	SW14	A6-SW14	5/11/2010		Y
Area-06	SW14	RBS-SW14	9/15/2008		Y
Area-06	SW25	RBS-SW25	4/23/2009		Y
Area-06	SW26	RBS-SW26	4/23/2009		Y
Area-06	SW26	RBS-SW27	4/23/2009	Duplicate sample (1)	N
Area-06	SW28	RBS-SW28	4/23/2009		Y
Area-06	SW29	RBS-SW29	4/23/2009		Y
Area-07	A7-07	A7-07-WO	11/1/2010		Y
Area-07	A7-08	A7-08-WO	11/1/2010		Y
Area-07	A7-12	A7-12-WO	11/29/2010		Y
Area-07	A7-14	A7-14-WO	11/29/2010		Y
Area-07	A7-15	A7-15-WO	11/2/2010		Y
Area-07	A7-15	A7-215-WO	11/2/2010	Duplicate sample (1)	N
Area-07	Cheesquake Creek	CNE1-1	12/14/2010		Y
Area-07	Cheesquake Creek	CNE1-2	12/14/2010		Y
Area-07	Cheesquake Creek	CNE1-3	12/14/2010		Y
Area-07	Cheesquake Creek	CNE2-1	12/14/2010		Y
Area-07	Cheesquake Creek	CNE2-2	12/14/2010		Y
Area-07	Cheesquake Creek	CNE2-3	12/14/2010		Y
Area-07	Cheesquake Creek	CNE3-1	12/14/2010		Y
Area-07	Cheesquake Creek	CNE3-2	12/14/2010		Y
Area-07	Cheesquake Creek	CNE3-3	12/14/2010		Y
Area-07	Cheesquake Creek	CNE3-1D	12/14/2010	Duplicate sample (1)	N
Area-07	Cheesquake Creek	CNF1-1	12/14/2010		Y
Area-07	Cheesquake Creek	CNF1-2	12/14/2010		Y
Area-07	Cheesquake Creek	CNF1-3	12/14/2010		Y
Area-07	Cheesquake Creek	CNF2-1	12/14/2010		Y
Area-07	Cheesquake Creek	CNF2-2	12/14/2010		Y
Area-07	Cheesquake Creek	CNF2-3	12/14/2010		Y
Area-07	Cheesquake Creek	CNF3-1	12/14/2010		Y
Area-07	Cheesquake Creek	CNF3-2	12/14/2010		Y
Area-07	Cheesquake Creek	CNF3-3	12/14/2010		Y
Area-07	Cheesquake Creek	CSE1-1	12/3/2010		Y
Area-07	Cheesquake Creek	CSE1-2	12/3/2010		Y
Area-07	Cheesquake Creek	CSE1-3	12/3/2010		Y

TABLE A-2
SURFACE WATER SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Area	Location	Sample ID	Collection Date	Comment	Use In Risk Assessment
Bay Water (continued)					
Area-07	Cheesquake Creek	CSE2-1	12/3/2010		Y
Area-07	Cheesquake Creek	CSE2-2	12/3/2010		Y
Area-07	Cheesquake Creek	CSE2-3	12/3/2010		Y
Area-07	Cheesquake Creek	CSE3-1	12/3/2010		Y
Area-07	Cheesquake Creek	CSE3-2	12/3/2010		Y
Area-07	Cheesquake Creek	CSE3-3	12/3/2010		Y
Area-07	Cheesquake Creek	CSF1-1	12/3/2010		Y
Area-07	Cheesquake Creek	CSF1-2	12/3/2010		Y
Area-07	Cheesquake Creek	CSF1-3	12/3/2010		Y
Area-07	Cheesquake Creek	CSF2-1	12/3/2010		Y
Area-07	Cheesquake Creek	CSF2-2	12/3/2010		Y
Area-07	Cheesquake Creek	CSF2-3	12/3/2010		Y
Area-07	Cheesquake Creek	CSF3-1	12/3/2010		Y
Area-07	Cheesquake Creek	CSF3-2	12/3/2010		Y
Area-07	Cheesquake Creek	CSF3-3	12/3/2010		Y
Area-07	Cheesquake Creek	CSF1-1D	12/3/2010	Duplicate sample (1)	N
Area-08	A8-09	A8-09-WO	11/18/2010		Y
Area-08	A8-10	A8-10-WO	11/5/2010		Y
Area-08	A8-11	A8-11-WO	11/18/2010		Y
Area-08	A8-11	A8-211-WO	11/18/2010	Duplicate sample (1)	N
Area-08	A8-12	A8-12-WO	11/5/2010		Y
Area-08	A8-14	A8-14-WO	11/5/2010		Y
Area-08	A8-14	A8-214-WO	11/5/2010	Duplicate sample (1)	N
Area-08	A8-16	A8-16-WO	11/5/2010		Y
Area-08	A8-18	A8-18-WO	11/5/2010		Y
Area-08	SW15	RBS-SW15	9/15/2008		Y
Area-08	SW16	RBS-SW16	9/15/2008		Y
Area-08	SW21	RBS-SW21	9/15/2008		Y
Area-08	SW21	RBS-SW24	9/15/2008	Duplicate sample (1)	N
Area-08	SW22	RBS-SW22	9/15/2008		Y
Area-08	SW23	RBS-SW23	9/15/2008		Y
Area-09	A9-64	A9-64-WO	12/8/2010		Y
Area-09	A9-67	A9-67-WO	12/8/2010		Y
Area-09	A9-67	A9-267-WO	12/8/2010	Duplicate sample (1)	N
Area-09	SW17	RBS-SW17	9/10/2008		Y
Area-09	SW19	RBS-SW19	9/10/2008		Y
Area-09	SW20	RBS-SW20	9/10/2008		Y
Area-09	SW38	RBS-SW38	4/22/2009		Y
Area-09	SW39	RBS-SW39	4/22/2009		Y
Area-09	SW40	RBS-SW40	4/22/2009		Y
Area-09	SW41	RBS-SW41	4/22/2009		Y
Area-11	A11-14	A11-14-WO	11/23/2010		Y
Area-11	A11-16	A11-16-WO	11/3/2010		Y
Area-11	A11-19	A11-19-WO	11/2/2010		Y
Area-11	A11-23	A11-23-WO	11/29/2010		Y
Area-11	A11-25	A11-25-WO	11/3/2010		Y
Area-11	A11-26	A11-26-WO	11/19/2010		Y

TABLE A-2
SURFACE WATER SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Area	Location	Sample ID	Collection Date	Comment	Use In Risk Assessment
Bay Water (continued)					
Area-11	A11-29	A11-29-WO	11/18/2010		Y
Area-11	A11-30	A11-30-WO	11/23/2010		Y
Area-11	A11-30	A11-230-WO	11/23/2010	Duplicate sample (1)	N
Area-11	A11-31	A11-31-WO	11/23/2010		Y
Area-10	A10-12	A10-12-WO	11/10/2010	Background (2)	N
Area-10	A10-14	A10-14-WO	11/10/2010	Background (2)	N
Area-10	A10-14	A10-214-WO	11/10/2010	Duplicate sample (1)	N
Area-10	A10-16	A10-16-WO	11/16/2010	Background (2)	N
Area-10	A10-18	A10-18-WO	11/16/2010	Background (2)	N
Area-10	A10-19	A10-19-WO	11/19/2010	Background (2)	N
Area-10	A10-21	A10-21-WO	11/19/2010	Background (2)	N
Area-10	A10-23	A10-23-WO	11/22/2010	Background (2)	N
Area-10	A10-25	A10-25-WO	11/22/2010	Background (2)	N
Area-10	A10-25	A10-225-WO	11/22/2010	Background (2)/ Duplicate sample (1)	N
Area-10	A10-26	A10-26-WO	11/22/2010	Background (2)	N
Area-10	A10-27	A10-27-WO	11/22/2010	Background (2)	N
Creek Water					
Area-09	A9-70	A9-70-WS	11/9/2010		Y
Area-09	A9-72	A9-72-WS	11/8/2010		Y
Area-09	A9-74	A9-74-WS	11/8/2010		Y
Area-09	A9-75	A9-75-WS	11/8/2010		Y
Area-09	A9-77	A9-77-WS	11/8/2010		Y
Area-09	A9-78	A9-78-WS	11/8/2010		Y
Area-09	A9-80	A9-80-WS	12/15/2010		Y
Area-09	A9-81	A9-81-WS	12/15/2010		Y
Area-09	A9-82	A9-82-WS	11/15/2010		Y
Area-09	A9-87	A9-87-WS	12/15/2010		Y
Area-09	A9-89	A9-89-WS	12/13/2010		Y
Area-09	A9-91	A9-91-WS	12/16/2010		Y
Area-09	A9-93	A9-93-WS	12/8/2010		Y
Area-09	A9-95	A9-95-WS	12/13/2010		Y
Area-09	A9-96	A9-96-WS	12/13/2010		Y
Area-09	A9-97	A9-97-WS	12/13/2010		Y
Area-09	A9-99	A9-99-WS	12/15/2010		Y
Area-09	A9-102	A9-102-WS	12/9/2010		Y
Area-09	Margaret's Creek	MSE1	12/6/2010		Y
Area-09	Margaret's Creek	MSE2	12/6/2010		Y
Area-09	Margaret's Creek	MSE3	12/6/2010		Y
Area-09	Margaret's Creek	MNE1	12/15/2010		Y
Area-09	Margaret's Creek	MNE2	12/15/2010		Y
Area-09	Margaret's Creek	MNE3	12/15/2010		Y

N = No. Not used in risk assessment.
Y = Yes. Used in risk assessment.
(1) Duplicate samples are collected for quality assurance/quality control purposes, but are not included in risk assessment evaluations.
(2) Background samples are used to establish background levels. They are not included in risk assessment evaluations.

TABLE A-3
SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 1					
A60	A60 0-6	0 - 6	7/14/2009		Y
A60	A60 0-12	0 - 12	7/14/2009	(1)	N
A61	A61 0-6	0 - 6	7/22/2009		Y
A61	A61 0-12	0 - 12	7/22/2009	(1)	N
A61	A61 12-24	12 - 24	7/22/2009	(1)	N
A62	A62 0-6	0 - 6	7/20/2009		Y
A62	A62 0-12	0 - 12	7/20/2009	(1)	N
A62	A62 12-24	12 - 24	7/20/2009	(1)	N
A63	A63 0-6	0 - 6	7/20/2009		Y
A63	A63 0-12	0 - 12	7/20/2009	(1)	N
A63	A63 12-24	12 - 24	7/20/2009	(1)	N
A64	A64 0-6	0 - 6	7/20/2009		Y
A64	A64 0-12	0 - 12	7/20/2009	(1)	N
A64	A64 12-24	12 - 24	7/20/2009	(1)	N
A65	A65 0-6	0 - 6	7/20/2009		Y
A65	A65 0-12	0 - 12	7/20/2009	(1)	N
A65	A65 12-24	12 - 24	7/20/2009	(1)	N
A66	A66 0-6	0 - 6	7/20/2009		Y
A66	A66 0-12	0 - 12	7/20/2009	(1)	N
A66	Z66 0-12	0 - 12	7/20/2009	Duplicate sample (2)	N
A66	A66 12-24	12 - 24	7/20/2009	(1)	N
A67	A67 0-6	0 - 6	7/20/2009		Y
A67	A67 0-12	0 - 12	7/20/2009	(1)	N
A67	A67 12-24	12 - 24	7/20/2009	(1)	N
A68	A68 0-6	0 - 6	7/17/2009		Y
A68	A68 0-12	0 - 12	7/17/2009	(1)	N
A68	A68-12-24	12 - 24	7/17/2009	(1)	N
A69	A69 0-6	0 - 6	7/20/2009		Y
A69	A69 0-12	0 - 12	7/20/2009	(1)	N
A69	A69 12-24	12 - 24	7/20/2009	(1)	N
A70	A70 0-6	0 - 6	7/20/2009		Y
A70	A70 0-12	0 - 12	7/20/2009	(1)	N
A70	A70 12-24	12 - 24	7/20/2009	(1)	N
A71	A71 0-6	0 - 6	7/17/2009		Y
A71	A71 0-12	0 - 12	7/17/2009	(1)	N
A71	A71 12-24	12 - 24	7/17/2009	(1)	N
A72	A72 0-6	0 - 6	7/17/2009		Y
A72	A72 0-12	0 - 12	7/17/2009	(1)	N
A72	A72 12-24	12 - 24	7/17/2009	(1)	N
A81	A81 0-6	0 - 6	7/20/2009		Y
A81	A81 0-12	0 - 12	7/20/2009	(1)	N
A81	A81 12-24	12 - 24	7/20/2009	(1)	N
A82	A82 0-6	0 - 6	7/20/2009		Y
A82	A82 0-12	0 - 12	7/20/2009	(1)	N
A82	A82 12-24	12 - 24	7/20/2009	(1)	N
A83	A83 0-6	0 - 6	7/20/2009		Y
A83	A83 0-12	0 - 12	7/20/2009	(1)	N
A83	A83 12-24	12 - 24	7/20/2009	(1)	N
A84	A84 0-6	0 - 6	7/20/2009		Y
A84	A84 0-12	0 - 12	7/20/2009	(1)	N
A84	A84 12-24	12 - 24	7/20/2009	(1)	N
A85	A85 0-6	0 - 6	7/20/2009		Y

TABLE A-3
SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 1 (continued)					
A85	A85 0-12	0 - 12	7/20/2009	(1)	N
A85	A85 12-24	12 - 24	7/20/2009	(1)	N
A86	A86 0-6	0 - 6	7/20/2009		Y
A86	A86 0-12	0 - 12	7/20/2009	(1)	N
A86	Z86 0-12	0 - 12	7/20/2009	Duplicate sample (2)	N
A86	A86 12-24	12 - 24	7/20/2009	(1)	N
A87	A87 0-6	0 - 6	7/20/2009		Y
A87	A87 0-12	0 - 12	7/20/2009	(1)	N
A87	A87 12-24	12 - 24	7/20/2009	(1)	N
A88	A88 0-6	0 - 6	7/20/2009		Y
A88	A88 0-12	0 - 12	7/20/2009	(1)	N
A88	Z88 0-12	0 - 12	7/20/2009	Duplicate sample (2)	N
A88	A88 12-24	12 - 24	7/20/2009	(1)	N
A89	A89 0-6	0 - 6	7/20/2009		Y
A89	A89 0-12	0 - 12	7/20/2009	(1)	N
A89	A89 12-24	12 - 24	7/20/2009	(1)	N
A90	A90 0-6	0 - 6	7/20/2009		Y
A90	A90 0-12	0 - 12	7/20/2009	(1)	N
A90	A90 12-24	12 - 24	7/20/2009	(1)	N
A101	A101 0-6	0 - 6	7/20/2009		Y
A101	A101 0-12	0 - 12	7/20/2009	(1)	N
A101	A101 12-24	12 - 24	7/20/2009	(1)	N
A102	A102 0-6	0 - 6	7/20/2009		Y
A102	A102 0-12	0 - 12	7/20/2009	(1)	N
A102	A102 12-24	12 - 24	7/20/2009	(1)	N
A134	A134 0-6	0 - 6	7/15/2009		Y
A134	A134 0-12	0 - 12	7/15/2009	(1)	N
A134	A134 12-24	12 - 24	7/15/2009	(1)	N
A137	A137 0-6	0 - 6	7/14/2009		Y
A137	A137 0-12	0 - 12	7/14/2009	(1)	N
A137	A137 12-24	12 - 24	7/14/2009	(1)	N
A138	A138 0-6	0 - 6	7/15/2009		Y
A138	A138 0-12	0 - 12	7/15/2009	(1)	N
A138	A138 12-24	12 - 24	7/15/2009	(1)	N
A139	A139 0-6	0 - 6	7/15/2009		Y
A139	A139 0-12	0 - 12	7/15/2009	(1)	N
A139	A139 12-24	12 - 24	7/15/2009	(1)	N
A140	A140 0-6	0 - 6	7/14/2009		Y
A140	A140 0-12	0 - 12	7/14/2009	(1)	N
A140	A140 12-24	12 - 24	7/14/2009	(1)	N
A141	A141 0-6	0 - 6	7/14/2009		Y
A141	A141 0-12	0 - 12	7/14/2009	(1)	N
A141	A141 12-24	12 - 24	7/14/2009	(1)	N
A142	A142 0-6	0 - 6	7/15/2009		Y
A142	A142 0-12	0 - 12	7/15/2009	(1)	N
A142	A142 12-24	12 - 24	7/15/2009	(1)	N
A143	A143 0-6	0 - 6	7/15/2009		Y
A143	A143 0-12	0 - 12	7/15/2009	(1)	N
A143	A143 12-24	12 - 24	7/15/2009	(1)	N
A144	A144 0-6	0 - 6	7/15/2009		Y

TABLE A-3
SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 1 (continued)					
A144	A144 0-12	0 - 12	7/15/2009	(1)	N
A144	A144 12-24	12 - 24	7/15/2009	(1)	N
A145	A145 0-6	0 - 6	7/15/2009		Y
A145	A145 0-12	0 - 12	7/15/2009	(1)	N
A145	Z145 0-12	0 - 12	7/15/2009	Duplicate sample (2)	N
A145	A145 12-24	12 - 24	7/15/2009	(1)	N
A146	A146 0-6	0 - 6	7/14/2009		Y
A146	A146 0-12	0 - 12	7/14/2009	(1)	N
A146	Z146 0-12	0 - 12	7/14/2009	Duplicate sample (2)	N
A146	A146 12-24	12 - 24	7/14/2009	(1)	N
A147	A147 0-6	0 - 6	7/16/2009		Y
A147	A147 0-12	0 - 12	7/16/2009	(1)	N
A147	A147 12-24	12 - 24	7/16/2009	(1)	N
A148	A148 0-6	0 - 6	7/16/2009		Y
A148	A148 0-12	0 - 12	7/16/2009	(1)	N
A148	A148 12-24	12 - 24	7/16/2009	(1)	N
A149	A149 0-6	0 - 6	7/16/2009		Y
A149	A149 0-12	0 - 12	7/16/2009	(1)	N
A149	A149 12-24	12 - 24	7/16/2009	(1)	N
A150	A150 0-6	0 - 6	7/16/2009		Y
A150	A150 0-12	0 - 12	7/16/2009	(1)	N
A150	Z150 0-12	0 - 12	7/16/2009	Duplicate sample (2)	N
A150	A150 12-24	12 - 24	7/16/2009	(1)	N
A151	A151 0-6	0 - 6	7/22/2009		Y
A151	A151 0-12	0 - 12	7/22/2009	(1)	N
A151	A151 12-24	12 - 24	7/22/2009	(1)	N
A152	A152 0-6	0 - 6	7/22/2009		Y
A152	A152 0-12	0 - 12	7/22/2009	(1)	N
A152	A152 12-24	12 - 24	7/22/2009	(1)	N
A153	A153 0-6	0 - 6	7/21/2009		Y
A153	A153 0-12	0 - 12	7/21/2009	(1)	N
A154	A154 0-6	0 - 6	7/21/2009		Y
A154	A154 0-12	0 - 12	7/21/2009	(1)	N
A154	A154 12-24	12 - 24	7/21/2009	(1)	N
A155	A155 0-6	0 - 6	7/21/2009		Y
A155	A155 0-12	0 - 12	7/21/2009	(1)	N
A155	A155 12-24	12 - 24	7/21/2009	(1)	N
A156	A156 0-6	0 - 6	7/21/2009		Y
A156	A156 0-12	0 - 12	7/21/2009	(1)	N
A156	A156 12-24	12 - 24	7/21/2009	(1)	N
A157	A157 0-6	0 - 6	7/21/2009		Y
A157	A157 0-12	0 - 12	7/21/2009	(1)	N
A157	A157 12-24	12 - 24	7/21/2009	(1)	N
A158	A158 0-6	0 - 6	7/21/2009		Y
A158	A158 0-12	0 - 12	7/21/2009	(1)	N
A158	A158 12-24	12 - 24	7/21/2009	(1)	N
A1-11	A1-11-A	0 - 6	12/2/2010		Y
A1-11	A1-11-D	6 - 24	12/2/2010	(1)	N
A1-11	A1-11-F	24 - 48	12/2/2010	(1)	N

TABLE A-3
SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 1 (continued)					
A1-12	A1-12-A	0 - 6	12/2/2010		Y
A1-12	A1-12-D	6 - 24	12/2/2010	(1)	N
A1-12	A1-12-F	24 - 48	12/2/2010	(1)	N
A1-13	A1-13-A	0 - 6	12/2/2010		Y
A1-13	A1-13-D	6 - 24	12/2/2010	(1)	N
A1-13	A1-13-F	24 - 48	12/2/2010	(1)	N
A1-14	A1-14-A	0 - 6	10/25/2010		Y
A1-14	A1-14-D	6 - 24	10/25/2010	(1)	N
A1-14	A1-14-F	24 - 48	10/25/2010	(1)	N
A1-15	A1-15-A	0 - 6	10/25/2010		Y
A1-15	A1-15-D	6 - 24	10/25/2010	(1)	N
A1-15	A1-15-F	24 - 48	10/25/2010	(1)	N
A1-16	A1-16-A	0 - 6	10/25/2010		Y
A1-16	A1-16-D	6 - 24	10/25/2010	(1)	N
A1-16	A1-16-F	24 - 48	10/25/2010	(1)	N
A1-17	A1-17-A	0 - 6	10/29/2010		Y
A1-17	A1-17-D	6 - 24	10/29/2010	(1)	N
A1-17	A1-17-F	24 - 48	10/29/2010	(1)	N
A1-18	A1-18-A	0 - 6	10/25/2010		Y
A1-18	A1-218-A	0 - 6	10/25/2010	Duplicate sample (2)	N
A1-18	A1-18-D	6 - 24	10/25/2010	(1)	N
A1-18	A1-18-F	24 - 48	10/25/2010	(1)	N
A1-19	A1-19-A	0 - 6	10/25/2010		Y
A1-19	A1-19-D	6 - 24	10/25/2010	(1)	N
A1-19	A1-19-F	24 - 48	10/25/2010	(1)	N
A1-20	A1-20-A	0 - 6	10/29/2010		Y
A1-20	A1-20-D	6 - 24	10/29/2010	(1)	N
A1-20	A1-20-F	24 - 48	10/29/2010	(1)	N
A1-21	A1-21-A	0 - 6	10/26/2010		Y
A1-21	A1-21-D	6 - 24	10/26/2010	(1)	N
A1-21	A1-21-F	24 - 48	10/26/2010	(1)	N
A1-22	A1-22-A	0 - 6	10/26/2010		Y
A1-22	A1-22-D	6 - 24	10/26/2010	(1)	N
A1-22	A1-22-F	24 - 48	10/26/2010	(1)	N
A1-23	A1-23-A	0 - 6	10/26/2010		Y
A1-23	A1-23-D	6 - 24	10/26/2010	(1)	N
A1-23	A1-23-F	24 - 48	10/26/2010	(1)	N
A1-24	A1-24-A	0 - 6	10/25/2010		Y
A1-24	A1-224-A	0 - 6	10/25/2010	Duplicate sample (2)	N
A1-24	A1-24-D	6 - 24	10/25/2010	(1)	N
A1-24	A1-24-F	24 - 48	10/26/2010	(1)	N
A1-25	A1-25-A	0 - 6	10/26/2010		Y
A1-25	A1-25-D	6 - 24	10/26/2010	(1)	N
A1-25	A1-25-F	24 - 48	10/26/2010	(1)	N
A1-29	A1-29-F	24 - 48	10/27/2010	(1)	N
A1-30	A1-30-A	0 - 6	10/29/2010		Y
A1-30	A1-30-D	6 - 24	10/29/2010	(1)	N
A1-30	A1-30-F	24 - 48	10/29/2010	(1)	N
A1-34	A1-34-A	0 - 6	10/26/2010		Y

TABLE A-3
SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 1 (continued)					
A1-36	A1-36-A	0 - 6	12/3/2010		Y
A1-37	A1-37-A	0 - 6	12/3/2010		Y
A1-37	A1-37-D	6 - 24	12/3/2010	(1)	N
A1-37	A1-37-F	24 - 48	12/3/2010	(1)	N
A1-38	A1-38-A	0 - 6	12/3/2010		Y
A1-38	A1-38-D	6 - 24	12/3/2010	(1)	N
A1-38	A1-38-F	24 - 48	12/3/2010	(1)	N
A1-39	A1-39-A	0 - 6	12/3/2010		Y
A1-39	A1-39-D	6 - 24	12/3/2010	(1)	N
A1-39	A1-39-F	24 - 48	12/3/2010	(1)	N
A1-40	A1-40-A	0 - 6	11/30/2010		Y
A1-40	A1-40-D	6 - 24	11/30/2010	(1)	N
A1-40	A1-40-F	24 - 48	11/30/2010	(1)	N
A1-41	A1-41-A	0 - 6	11/30/2010		Y
A1-41	A1-41-D	6 - 24	11/30/2010	(1)	N
A1-41	A1-41-F	24 - 48	11/30/2010	(1)	N
A1-41	A1-241-F	24 - 48	11/30/2010	Duplicate sample (2)	N
A1-42	A1-42-A	0 - 6	11/30/2010		Y
A1-42	A1-42-D	6 - 24	11/30/2010	(1)	N
A1-42	A1-42-F	24 - 48	11/30/2010	(1)	N
A1-43	A1-43-A	0 - 6	12/2/2010		Y
A1-43	A1-243-A	0 - 6	12/2/2010	Duplicate sample (2)	N
A1-43	A1-43-D	6 - 24	12/2/2010	(1)	N
A1-43	A1-43-F	24 - 48	12/2/2010	(1)	N
Area 2					
A161	A161 0-6	0 - 6	7/22/2009		Y
A161	A161 0-12	0 - 12	7/22/2009	(1)	N
A161	A161 12-24	12 - 24	7/22/2009	(1)	N
Area 5					
B11	B11 0-6	0 - 6	7/23/2009		Y
B11	B11 0-12	0 - 12	7/23/2009	(1)	N
B11	B11 12-24	12 - 24	7/23/2009	(1)	N
B12	B12 0-6	0 - 6	7/23/2009		Y
B12	B12 0-12	0 - 12	7/23/2009	(1)	N
B12	B12 12-24	12 - 24	7/23/2009	(1)	N
B13	B13 0-6	0 - 6	7/23/2009		Y
B13	B13 0-12	0 - 12	7/23/2009	(1)	N
B13	B13 12-24	12 - 24	7/23/2009	(1)	N
B17	B17 0-6	0 - 6	7/23/2009		Y
B17	B17 0-12	0 - 12	7/23/2009	(1)	N
B17	B17 12-24	12 - 24	7/23/2009	(1)	N
B18	B18 0-6	0 - 6	7/23/2009		Y
B18	B18 0-12	0 - 12	7/23/2009	(1)	N
B18	B18 12-24	12 - 24	7/23/2009	(1)	N
B19	B19 0-6	0 - 6	7/23/2009		Y
B19	B19 0-12	0 - 12	7/23/2009	(1)	N
B23	B23 0-6	0 - 6	7/23/2009		Y
B23	B23 0-12	0 - 12	7/23/2009	(1)	N
B23	B23 12-24	12 - 24	7/23/2009	(1)	N
B24	B24 0-6	0 - 6	7/23/2009		Y
B24	B24 0-12	0 - 12	7/23/2009	(1)	N

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SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 5 (continued)					
B24	B24 12-24	12 - 24	7/23/2009	(1)	N
B29	B29 0-6	0 - 6	7/23/2009		Y
B29	B29 0-12	0 - 12	7/23/2009	(1)	N
B29	B29 12-24	12 - 24	7/23/2009	(1)	N
A5-17	A5-17-A	0 - 6	10/27/2010		Y
A5-17	A5-17-D	6 - 24	10/27/2010	(1)	N
A5-17	A5-17-F	24 - 48	10/27/2010	(1)	N
A5-18	A5-18-A	0 - 6	10/26/2010		Y
A5-18	A5-18-D	6 - 24	10/26/2010	(1)	N
A5-18	A5-18-F	24 - 48	10/26/2010	(1)	N
A5-19	A5-19-A	0 - 6	11/1/2010		Y
A5-19	A5-19-D	6 - 24	11/1/2010	(1)	N
A5-19	A5-19-F	24 - 48	11/1/2010	(1)	N
A5-20	A5-20-A	0 - 6	12/2/2010		Y
A5-20	A5-20-D	6 - 24	12/2/2010	(1)	N
A5-20	A5-20-F	24 - 48	12/2/2010	(1)	N
Area 6					
B30	B30 0-6	0 - 6	7/23/2009		Y
B30	B30 0-12	0 - 12	7/23/2009	(1)	N
B30	Z30 0-12	0 - 12	7/23/2009	Duplicate sample (2)	N
B30	B30 12-24	12 - 24	7/23/2009	(1)	N
B31	B31 0-6	0 - 6	7/23/2009		Y
B31	B31 0-12	0 - 12	7/23/2009	(1)	N
B31	B31 12-24	12 - 24	7/23/2009	(1)	N
B38	B38 0-6	0 - 6	7/27/2009		Y
B38	B38 0-12	0 - 12	7/27/2009	(1)	N
B38	B38 12-24	12 - 24	7/27/2009	(1)	N
B39	B39 0-6	0 - 6	7/27/2009		Y
B39	B39 0-12	0 - 12	7/27/2009	(1)	N
B39	B39 12-24	12 - 24	7/27/2009	(1)	N
B40	B40 0-6	0 - 6	7/27/2009		Y
B40	B40 0-12	0 - 12	7/27/2009	(1)	N
B40	B40 12-24	12 - 24	7/27/2009	(1)	N
B49	B49 0-6	0 - 6	7/27/2009		Y
B49	B49 0-12	0 - 12	7/27/2009	(1)	N
B49	B49 12-24	12 - 24	7/27/2009	(1)	N
B50	B50 0-6	0 - 6	7/27/2009		Y
B50	B50 0-12	0 - 12	7/27/2009	(1)	N
B50	B50 12-24	12 - 24	7/27/2009	(1)	N
B51	B51 0-6	0 - 6	7/27/2009		Y
B51	B51 0-12	0 - 12	7/27/2009	(1)	N
B51	Z51 0-12	0 - 12	7/27/2009	Duplicate sample (2)	N
B51	B51 12-24	12 - 24	7/27/2009	(1)	N
B58	B58 0-6	0 - 6	7/27/2009		Y
B58	B58 0-12	0 - 12	7/27/2009	(1)	N
B58	B58 12-24	12 - 24	7/27/2009	(1)	N
B58	Z58 12-24	12 - 24	7/27/2009	Duplicate sample (2)	N
Area 9					
SED65	RBS-SED65	0 - 3	9/10/2008		Y
SED67	RBS-SED67	0 - 3	9/10/2008		Y
SED68	RBS-SED68	0 - 3	9/10/2008		Y

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SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 9 (continued)					
A1	A1 0-6	0 - 6	7/1/2009		Y
S203	RBS-S203	0 - 2	4/22/2009		Y
S204	RBS-S204	0 - 2	4/22/2009		Y
SED206	RBS-SED206	0 - 3	4/22/2009		Y
A9-69	A9-69-A	0 - 6	11/29/2010		Y
A9-70	A9-70-A	0 - 6	11/9/2010		Y
A9-70	A9-70-A	0 - 6	11/9/2010		Y
A9-71	A9-71-A	0 - 6	11/9/2010		Y
A9-72	A9-72-A	0 - 6	11/8/2010		Y
A9-73	A9-73-A	0 - 6	12/10/2010		Y
A9-74	A9-74-A	0 - 6	11/8/2010		Y
A9-75	A9-75-A	0 - 6	11/8/2010		Y
A9-76	A9-76-A	0 - 6	11/11/2010		Y
A9-77	A9-77-A	0 - 6	11/8/2010		Y
A9-78	A9-78-A	0 - 6	11/8/2010		Y
A9-79	A9-79-A	0 - 6	12/15/2010		Y
A9-80	A9-80-BE7	0 - 1	12/13/2010		Y
A9-80	A9-80-A	0 - 6	12/15/2010		Y
A9-81	A9-281-BE7	0 - 1	12/13/2010	Duplicate sample (2)	N
A9-81	A9-81-BE7	0 - 1	12/13/2010		Y
A9-81	A9-81-A	0 - 6	12/15/2010		Y
A9-82	A9-82-A	0 - 6	11/15/2010		Y
A9-83	A9-83-A	0 - 6	11/9/2010		Y
A9-84	A9-84-A	0 - 6	11/11/2010		Y
A9-85	A9-85-A	0 - 6	11/15/2010		Y
A9-86	A9-86-A	0 - 6	11/15/2010		Y
A9-87	A9-87-A	0 - 6	12/15/2010		Y
A9-88	A9-88-BE7	0 - 1	12/13/2010		Y
A9-88	A9-88-A	0 - 6	12/13/2010		Y
A9-89	A9-89-BE7	0 - 1	12/13/2010		Y
A9-89	A9-89-A	0 - 6	12/13/2010		Y
A9-90	A9-90-BE7	0 - 1	12/13/2010		Y
A9-90	A9-90-A	0 - 6	12/16/2010		Y
A9-91	A9-91-BE7	0 - 1	12/13/2010		Y
A9-91	A9-91-A	0 - 6	12/16/2010		Y
A9-92	A9-92-A	0 - 6	12/10/2010		Y
A9-93	A9-93-BE7	0 - 1	12/13/2010		Y
A9-93	A9-93-A	0 - 6	12/8/2010		Y
A9-94	A9-94-A	0 - 6	12/10/2010		Y
A9-95	A9-95-BE7	0 - 1	12/13/2010		Y
A9-95	A9-95-A	0 - 6	12/13/2010		Y
A9-96	A9-96-BE7	0 - 1	12/13/2010		Y
A9-96	A9-96-A	0 - 6	12/13/2010		Y
A9-97	A9-97-BE7	0 - 1	12/13/2010		Y
A9-97	A9-97-A	0 - 6	12/13/2010		Y
A9-98	A9-98-A	0 - 6	12/8/2010		Y
A9-99	A9-99-BE7	0 - 1	12/13/2010		Y
A9-99	A9-99-A	0 - 6	12/15/2010		Y
A9-100	A9-100-A	0 - 6	12/1/2010		Y

TABLE A-3
SEDIMENT SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Location	Sample ID	Sample Depth (inches)	Collection Date	Comment	Use In Risk Assessment
Area 9 (continued)					
A9-101	A9-101-A	0 - 6	12/10/2010		Y
A9-102	A9-102-A	0 - 6	12/9/2010		Y
A9-103	A9-103-A	0 - 6	12/15/2010		Y
A9-104	A9-104-A	0 - 6	12/9/2010		Y
A9-105	A9-105-A	0 - 6	12/9/2010		Y
A9-106	A9-106-A	0 - 6	12/9/2010		Y
A9-112	A9-112-A	0 - 6	12/1/2010		Y
Area 10					
A10-11	A10-11-A	0 - 6	11/10/2010	Background (3)	N
A10-11	A10-211-A	0 - 6	11/10/2010	Duplicate sample (2)	N
A10-12	A10-12-A	0 - 6	11/10/2010	Background (3)	N
A10-13	A10-13-A	0 - 6	11/10/2010	Background (3)	N
A10-14	A10-14-A	0 - 6	11/10/2010	Background (3)	N
A10-15	A10-15-A	0 - 6	11/16/2010	Background (3)	N
A10-15	A10-215-A	0 - 6	11/16/2010	Duplicate sample (2)	N
A10-16	A10-16-A	0 - 6	11/16/2010	Background (3)	N
A10-17	A10-17-A	0 - 6	11/16/2010	Background (3)	N
A10-17	A10-217-A	0 - 6	11/16/2010	Duplicate sample (2)	N
A10-18	A10-18-A	0 - 6	11/16/2010	Background (3)	N
A10-19	A10-19-A	0 - 6	11/19/2010	Background (3)	N
A10-20	A10-20-A	0 - 6	11/19/2010	Background (3)	N
A10-31	A10-31-A	0 - 6	11/30/2010	Background (3)	N
A10-31	A10-31-A-GS	0 - 6	12/10/2010	Background (3)	N
A10-31	A10-33-A-GS	0 - 6	12/10/2010	Background (3)	N
A10-31	A10-34-A-GS	0 - 6	12/10/2010	Background (3)	N
A10-31	A10-35-A-GS	0 - 6	12/10/2010	Background (3)	N
A10-32	A10-232-A	0 - 6	11/30/2010	Duplicate sample (2)	N
A10-32	A10-232-A-GS	0 - 6	12/10/2010	Duplicate sample (2)	N
A10-32	A10-32-A	0 - 6	11/30/2010	Background (3)	N
A10-32	A10-32-A-GS	0 - 6	12/10/2010	Background (3)	N
A10-33	A10-33-A	0 - 6	11/30/2010	Background (3)	N
A10-34	A10-34-A	0 - 6	11/30/2010	Background (3)	N
A10-35	A10-35-A	0 - 6	11/30/2010	Background (3)	N
A10-36	A10-36-A	0 - 6	11/30/2010	Background (3)	N
A10-37	A10-37-A	0 - 6	12/3/2010	Background (3)	N
A10-38	A10-38-A	0 - 6	12/3/2010	Background (3)	N
A10-38	A10-38-A-GS	0 - 6	12/14/2010	Background (3)	N
A10-39	A10-39-A	0 - 6	11/30/2010	Background (3)	N
A10-40	A10-240-A	0 - 6	12/3/2010	Duplicate sample (2)	N
A10-40	A10-240-A-GS	0 - 6	12/14/2010	Duplicate sample (2)	N
A10-40	A10-40-A	0 - 6	12/3/2010	Background (3)	N
A10-40	A10-40-A-GS	0 - 6	12/14/2010	Background (3)	N

N = No. Not used in risk assessment.
Y = Yes. Used in risk assessment.
(1) Only sediment samples from 0 to 6 inches of the sediment horizon is evaluated in the risk assessment.
(2) Duplicate samples are collected for quality assurance/quality control purposes, but are not included in risk assessment evaluations.
(3) Background samples are used to establish background levels. They are not included in risk assessment evaluations.

TABLE A-4
GROUNDWATER SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Area	Location	Sample ID	Sample Depth (feet bgs)	Collection Date	Comment	Use In Risk Assessment
Groundwater (depth to water <10 feet bgs)						
Area-06	MW-02S	MW-02S-R1	10 - 20	1/6/2011		Y
Area-08	MW-01D	MW-01D-R1	30 - 40	1/5/2011		Y
Area-08	MW-01S	MW-01S-R1	10 - 20	1/5/2011		Y
Area-09	MW-12S	MW-12S-R1	6 - 16	1/6/2011		Y
Area-09	MW-13S	MW-13S-R1	5 - 15	1/6/2011		Y
Area-09	MW-14S	MW-14S-R1	7 - 17	1/6/2011		Y
Area-09	MW-15S	MW-15S-R1	14 - 19	1/6/2011		Y
Area-09	MW-15S	MW-115S-R1	14 - 19	1/6/2011	Duplicate sample (1)	N
Groundwater (depth to water ≥10 feet bgs)						
Area-01	MW-05D	MW-05D-R1	30 - 40	1/4/2011		Y
Area-01	MW-05S	MW-05S-R1	10 - 20	1/4/2011		Y
Area-01	MW-06D	MW-06D-R1	25 - 35	1/4/2011		Y
Area-01	MW-06S	MW-06S-R1	6 - 16	1/4/2011		Y
Area-01	MW-10D	MW-10D-R1	29 - 39	1/5/2011		Y
Area-01	MW-10S	MW-10S-R1	6 - 12	1/5/2011		Y
Area-04	MW-04D	MW-04D-R1	30 - 40	1/4/2011		Y
Area-04	MW-04S	MW-04S-R1	14 - 24	1/4/2011		Y
Area-04	MW-07S	MW-07S-R1	14 - 24	1/5/2011		Y
Area-04	MW-07S	MW-107S-R1	14 - 24	1/5/2011	Duplicate sample (1)	N
Area-04	MW-08D	MW-08D-R1	30 - 40	1/5/2011		Y
Area-04	MW-08S	MW-08S-R1	13 - 23	1/5/2011		Y
Area-04	MW-09S	MW-09S-R1	11 - 21	1/5/2011		Y
Area-05	MW-03S	MW-03S-R1	10 - 20	1/6/2011		Y
Background						
Background	MW-11S	MW-11S-R1	34 - 44	1/4/2011	Background (2)	N

feet bgs = feet below ground surface
N = No. Not used in risk assessment.
Y = Yes. Used in risk assessment.
(1) Duplicate samples are collected for quality assurance/quality control purposes, but are not included in risk assessment evaluations.
(2) Background samples are used to establish background levels. They are not included in risk assessment evaluations.

TABLE A-5
BIOTA SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge and Sayreville, New Jersey

Location	Sample ID	Collection Date	Common Name	Individual or Composite Sample	Sample Type	Comment	Use In Risk Assessment
Blue Crab							
BC-1	BC-1AH	10/4/2010	Blue crab	composite	hepatopancreas		Y
BC-1	BC-1AM	10/4/2010	Blue crab	composite	muscle tissue		Y
BC-2	BC-2AH	10/19/2010	Blue crab	composite	hepatopancreas		Y
BC-2	BC-2AM	10/19/2010	Blue crab	composite	muscle tissue		Y
BC-3	BC-3AH	10/20/2010	Blue crab	composite	hepatopancreas		Y
BC-3	BC-3AM	10/20/2010	Blue crab	composite	muscle tissue		Y
BC-4	BC-4AH	10/21/2010	Blue crab	composite	hepatopancreas		Y
BC-4	BC-4AM	10/21/2010	Blue crab	composite	muscle tissue		Y
BC-5	BC-5AH	10/22/2010	Blue crab	composite	hepatopancreas		Y
BC-5	BC-5AM	10/22/2010	Blue crab	composite	muscle tissue		Y
Fish Tissue (1)							
FT-1	FT-1	10/19/2010	Winter flounder	individual	skin-on filet		Y
FT-2	FT-2	10/20/2010	Summer flounder	composite	skin-on filet		Y
FT-3	FT-3	10/20/2010	Striped bass	individual	skin-on filet		Y
FT-4	FT-4	10/22/2010	Tautog	individual	skin-on filet		Y
FT-5	FT-5-REP	10/22/2010	Bluefish	individual	skin-on filet	Duplicate sample (2)	N
FT-5	FT-5	10/22/2010	Bluefish	individual	skin-on filet		Y
FT-6	FT-6	10/22/2010	Windowpane flounder	individual	skin-on filet		Y
Forage Fish							
FF	FF-1	9/18/2008	Killifish	composite	whole body		N
FF	FF-2	9/18/2008	Killifish	composite	whole body		N
FF	FF-3	9/18/2008	Killifish	composite	whole body		N
FF	FF-4	9/18/2008	Killifish	composite	whole body		N
FF	FF-5	9/18/2008	Killifish	composite	whole body		N
Hard Clam (not including shell)							
MER	MER-1	9/18/2008	Hard clam	composite	whole body		Y
MER	MER-2	9/18/2008	Hard clam	composite	whole body		Y
MER	MER-3	9/18/2008	Hard clam	composite	whole body		Y
ML-1	ML-1A	9/28/2010	Hard clam	composite	whole body		Y
ML-2	ML-2A	9/28/2010	Hard clam	composite	whole body		Y
Macroalgae							
ULVA-1	ULVA-1	9/18/2008	Sea lettuce	composite	*ulva* blades	(3)	N
ULVA-2	ULVA-2	9/18/2008	Sea lettuce	composite	*ulva* blades	(3)	N
ULVA-3	ULVA-3	9/18/2008	Sea lettuce	composite	*ulva* blades	(3)	N
ULVA-4	ULVA-4	9/18/2008	Sea lettuce	composite	*ulva* blades	(3)	N
ULVA-5	ULVA-5	9/18/2008	Sea lettuce	composite	*ulva* blades	(3)	N
Ribbed Mussel (not including shell)							
ML-3	ML-3A	10/5/2010	Ribbed mussel	composite	whole body		Y
ML-4	ML-4A	10/5/2010	Ribbed mussel	composite	whole body		Y
ML-5	ML-5A	10/5/2010	Ribbed mussel	composite	whole body		Y
ML-6	ML-6A	10/5/2010	Ribbed mussel	composite	whole body		Y
RM-1	RM-1	9/18/2008	Ribbed mussel	composite	whole body		Y
RM-2	RM-2	9/18/2008	Ribbed mussel	composite	whole body		Y
RM-3	RM-3	9/18/2008	Ribbed mussel	composite	whole body		Y
RM-4	RM-4	9/18/2008	Ribbed mussel	composite	whole body		Y
RM-5	RM-5	9/18/2008	Ribbed mussel	composite	whole body		Y
RM-6	RM-6	9/18/2008	Ribbed mussel	composite	whole body		Y

TABLE A-5
BIOTA SAMPLE LIST
Raritan Bay Slag Superfund Site
Old Bridge and Sayreville, New Jersey

Location	Sample ID	Collection Date	Common Name	Individual or Composite Sample	Sample Type	Comment	Use In Risk Assessment
Soft Shell Clam (not including shell)							
MYA-1	MYA-1	9/18/2008	Soft shell clam	composite	whole body	(4)	N
MYA-2	MYA-2	9/18/2008	Soft shell clam	composite	whole body	(4)	N
MYA-3	MYA-3	9/18/2008	Soft shell clam	composite	whole body	(4)	N
MYA-4	MYA-4	9/18/2008	Soft shell clam	composite	whole body	(4)	N
MYA-5	MYA-5	9/18/2008	Soft shell clam	composite	whole body	(4)	N

N = No. Not used in risk assessment.
Y = Yes. Used in risk assessment.

(1) All fish samples are filets with skin on/scales off. A specific area is not provided for fish samples because fish are not confined to a particular area.
(2) Duplicate samples are collected for quality assurance/quality control purposes, but are not included in risk assessment evaluations.
(3) Samples are not used in risk assessment because sea lettuce is not used for human consumption.
(4) Samples are not used in the risk assessment because clam sizes are extremely small ranging from 10 millimeter (mm) to 40 mm.

Appendix B
RAGS D Tables for RME Scenario

Appendix B Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

B-1 Selection of Exposure Pathways

B-2 Occurrence, Distribution and Selection of Chemicals of Potential Concern

- B-2.1a Current/Future Surface Soil - Area 1
- B-2.1b Current/Future Surface Soil - Area 2
- B-2.1c Current/Future Surface Soil - Areas 3 and 4
- B-2.1d Current/Future Surface Soil - Areas 5, 6, and Beach Area of Area 9
- B-2.1e Current/Future Surface Soil - Upland Area of Area 9
- B-2.1f Current Surface Soil - All Areas (except Areas 2, 8, and 11)
- B-2.1g Future Surface Soil - All Areas (except Areas 8 and 11)
- B-2.1h Current/Future Surface Soil - Areas 8 and 11
- B-2.2 Current/Future Surface/Subsurface Soil - All Upland Areas
- B-2.3a Current/Future Groundwater (<10 Feet Bgs)
- B-2.3b Future Groundwater (All Wells)
- B-2.4a Current/Future Surface Water - All Areas (except Wetland Area of Area 9)
- B-2.4b Current/Future Surface Water - Wetland Area of Area 9
- B-2.5a Current/Future Sediment - Area 1
- B-2.5b Current/Future Sediment - Area 2
- B-2.5c Current/Future Sediment - Areas 5, 6, and Beach Area of Area 9
- B-2.5d Current/Future Sediment - Wetland Area of Area 9
- B-2.6a Current/Future Fish
- B-2.6b Current/Future Hard Clam
- B-2.6c Current/Future Ribbed Mussel
- B-2.6d Current/Future Blue Crab (Muscle)
- B-2.6e Current/Future Blue Crab (Muscle plus Hepatopancreas)

B-3 Medium-Specific Exposure Point Concentration Summary

- B-3.1a Current/Future Surface Soil - Area 1
- B-3.1b Current/Future Surface Soil - Area 2
- B-3.1c Current/Future Surface Soil - Areas 3 and 4
- B-3.1d Current/Future Surface Soil - Areas 5, 6, and Beach Area of Area 9
- B-3.1e Current/Future Surface Soil - Upland Area of Area 9
- B-3.1f Current Surface Soil - All Areas (except Areas 2, 8, and 11)
- B-3.1g Future Surface Soil - All Areas (except Areas 8 and 11)
- B-3.1h Current/Future Surface Soil - Areas 8 and 11
- B-3.2 Current/Future Surface/Subsurface Soil - All Upland Areas
- B-3.3a Current/Future Groundwater (<10 Feet Bgs)
- B-3.3b Future Groundwater
- B-3.4a Current/Future Surface Water - All Areas (except Wetland Area of Area 9)
- B-3.4b Current/Future Surface Water - Wetland Area of Area 9
- B-3.5a Current/Future Sediment - Area 1
- B-3.5b Current/Future Sediment - Area 2
- B-3.5c Current/Future Sediment - Areas 5, 6, and Beach Area of Area 9
- B-3.5d Current/Future Sediment - Wetland Area of Area 9
- B-3.6a Current/Future Fish
- B-3.6b Current/Future Hard Clam
- B-3.6c Current/Future Ribbed Mussel
- B-3.6d Current/Future Blue Crab (Muscle)
- B-3.6e Current/Future Blue Crab (Muscle plus Hepatopancreas)

B-4 Values and Equations Used for Intake Calculations

- B-4.1 Soil
- B-4.2 Groundwater
- B-4.3 Surface Water
- B-4.4 Sediment
- B-4.5 Fish/Shellfish
- B-4.6 Chemical-Specific Information Used for Daily Intake Calculations
- B-4.7 Particulate Emission Factor

Appendix B Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

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- B-5.1 Oral/Dermal
- B-5.2a Inhalation (Chronic)
- B-5.2b Inhalation (Subchronic)
- B-5.2c Inhalation (Acute)

B-6 Cancer Toxicity Data
- B-6.1 Oral/Dermal
- B-6.2 Inhalation

B-7 Calculation of Chemical Cancer Risks and Noncancer Hazards - Reasonable Maximum Exposure
- B-7.1a Current/Future Recreational User - Area 1 (Adult)
- B-7.1b Current/Future Recreational User - Area 1 (Adolescent [6-18 years])
- B-7.2a Future Recreational User - Area 2 (Adult)
- B-7.2b Future Recreational User - Area 2 (Child [0-6 years])
- B-7.3a Current/Future Recreational User - Areas 3 and 4 (Adult)
- B-7.3b Current/Future Recreational User - Areas 3 and 4 (Adolescent [6-18 years])
- B-7.3c Current/Future Recreational User - Areas 3 and 4 (Child [0-6 years])
- B-7.4a Current/Future Recreational User - Areas 5, 6, and Beach Area of Area 9 (Adult)
- B-7.4b Current/Future Recreational User - Areas 5, 6, and Beach Area of Area 9 (Child [0-6 years])
- B-7.5a Current/Future Recreational User - Upland Area of Area 9 (Adult)
- B-7.5b Current/Future Recreational User - Upland Area of Area 9 (Adolescent [6-18 years])
- B-7.6a Current Pedestrian - All Areas (except Areas 2, 8, and 11) (Adult)
- B-7.6b Current Pedestrian - All Areas (except Areas 2, 8, and 11) (Adolescent [6-18 years])
- B-7.7a Future Pedestrian - All Areas (except Areas 8 and 11) (Adult)
- B-7.7b Future Pedestrian - All Areas (except Areas 8 and 11) (Adolescent [6-18 years])
- B-7.8a Current/Future Angler - Fish (Adult)
- B-7.8b Current/Future Angler - Fish (Child [0-6 years])
- B-7.9a Current/Future Angler - Hard Clam (Adult)
- B-7.9b Current/Future Angler - Hard Clam (Child [0-6 years])
- B-7.10a Current/Future Angler - Ribbed Mussel (Adult)
- B-7.10b Current/Future Angler - Ribbed Mussel (Child [0-6 years])
- B-7.11a Current/Future Angler - Blue Crab (Muscle) (Adult)
- B-7.11b Current/Future Angler - Blue Crab (Muscle) (Child [0-6 years])
- B-7.12a Current/Future Angler - Blue Crab (Muscle plus Hepatopancreas) (Adult)
- B-7.12b Current/Future Angler - Blue Crab (Muscle plus Hepatopancreas) (Child [0-6 years])
- B-7.13a Current Trespasser - Area 2 (Adult)
- B-7.13b Current Trespasser - Area 2 (Adolescent [6-18 years])
- B-7.14a Current/Future Trespasser - Areas 8 and 11 (Adult)
- B-7.14b Current/Future Trespasser - Areas 8 and 11 (Adolescent [6-18 years])
- B-7.15 Current/Future Outdoor Worker - Areas 3 and 4
- B-7.16 Current/Future Construction/Utility Worker - All Upland Areas
- B-7.17 Future Resident - All Areas

B-8 Calculation of Radiation Cancer Risks - NOT APPLICABLE TO THIS SITE

B-9 Summary of Receptor Risks and Hazards for Chemical of Potential Concerns - Reasonable Maximum Exposure
- B-9.1a Current/Future Recreational User - Area 1 (Adult)
- B-9.1b Current/Future Recreational User - Area 1 (Adolescent [6-18 years])
- B-9.2a Future Recreational User - Area 2 (Adult)
- B-9.2b Future Recreational User - Area 2 (Child [0-6 years])
- B-9.3a Current/Future Recreational User - Areas 3 and 4 (Adult)
- B-9.3b Current/Future Recreational User - Areas 3 and 4 (Adolescent [6-18 years])
- B-9.3c Current/Future Recreational User - Areas 3 and 4 (Child [0-6 years])
- B-9.4a Current/Future Recreational User - Areas 5, 6, and Beach Area of Area 9 (Adult)
- B-9.4b Current/Future Recreational User - Areas 5, 6, and Beach Area of Area 9 (Child [0-6 years])
- B-9.5a Current/Future Recreational User - Upland Area of Area 9 (Adult)
- B-9.5b Current/Future Recreational User - Upland Area of Area 9 (Adolescent [6-18 years])
- B-9.6a Current Pedestrian - All Areas (except Areas 2, 8, and 11) (Adult)
- B-9.6b Current Pedestrian - All Areas (except Areas 2, 8, and 11) (Adolescent [6-18 years])
- B-9.7a Future Pedestrian - All Areas (except Areas 8 and 11) (Adult)
- B-9.7b Future Pedestrian - All Areas (except Areas 8 and 11) (Adolescent [6-18 years])

Appendix B Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

B-9 Summary of Receptor Risks and Hazards for Chemical of Potential Concerns - Reasonable Maximum Exposure (cont'd)
B-9.8a Current/Future Angler - Fish (Adult)
B-9.8b Current/Future Angler - Fish (Child [0-6 years])
B-9.9a Current/Future Angler - Hard Clam (Adult)
B-9.9b Current/Future Angler - Hard Clam (Child [0-6 years])
B-9.10a Current/Future Angler - Ribbed Mussel (Adult)
B-9.10b Current/Future Angler - Ribbed Mussel (Child [0-6 years])
B-9.11a Current/Future Angler - Blue Crab (Muscle) (Adult)
B-9.11b Current/Future Angler - Blue Crab (Muscle) (Child [0-6 years])
B-9.12a Current/Future Angler - Blue Crab (Muscle plus Hepatopancreas) (Adult)
B-9.12b Current/Future Angler - Blue Crab (Muscle plus Hepatopancreas) (Child [0-6 years])
B-9.13a Current Trespasser - Area 2 (Adult)
B-9.13b Current Trespasser - Area 2 (Adolescent [6-18 years])
B-9.14a Current/Future Trespasser - Areas 8 and 11 (Adult)
B-9.14b Current/Future Trespasser - Areas 8 and 11 (Adolescent [6-18 years])
B-9.15 Current/Future Outdoor Worker - Areas 3 and 4
B-9.16 Current/Future Construction/Utility Worker - All Upland Areas
B-9.17 Future Resident - All Areas
B-10 Risk Assessment Summary - Reasonable Maximum Exposure
B-10.1a Current/Future Recreational User - Area 1 (Adult)
B-10.1b Current/Future Recreational User - Area 1 (Adolescent [6-18 years])
B-10.2a Future Recreational User - Area 2 (Adult)
B-10.2b Future Recreational User - Area 2 (Child [0-6 years])
B-10.3a Current/Future Recreational User - Areas 3 and 4 (Adult)
B-10.3b Current/Future Recreational User - Areas 3 and 4 (Adolescent [6-18 years])
B-10.3c Current/Future Recreational User - Areas 3 and 4 (Child [0-6 years])
B-10.4a Current/Future Recreational User - Areas 5, 6, and Beach Area of Area 9 (Adult)
B-10.4b Current/Future Recreational User - Areas 5, 6, and Beach Area of Area 9 (Child [0-6 years])
B-10.5a Current/Future Recreational User - Upland Area of Area 9 (Adult)
B-10.5b Current/Future Recreational User - Upland Area of Area 9 (Adolescent [6-18 years])
B-10.6a Current Pedestrian - All Areas (except Areas 2, 8, and 11) (Adult)
B-10.6b Current Pedestrian - All Areas (except Areas 2, 8, and 11) (Adolescent [6-18 years])
B-10.7a Future Pedestrian - All Areas (except Areas 8 and 11) (Adult)
B-10.7b Future Pedestrian - All Areas (except Areas 8 and 11) (Adolescent [6-18 years])
B-10.8a Current/Future Angler - Fish (Adult)
B-10.8b Current/Future Angler - Fish (Child [0-6 years])
B-10.9a Current/Future Angler - Hard Clam (Adult)
B-10.9b Current/Future Angler - Hard Clam (Child [0-6 years])
B-10.10a Current/Future Angler - Ribbed Mussel (Adult)
B-10.10b Current/Future Angler - Ribbed Mussel (Child [0-6 years])
B-10.11a Current/Future Angler - Blue Crab (Muscle) (Adult)
B-10.11b Current/Future Angler - Blue Crab (Muscle) (Child [0-6 years])
B-10.12a Current/Future Angler - Blue Crab (Muscle plus Hepatopancreas) (Adult)
B-10.12b Current/Future Angler - Blue Crab (Muscle plus Hepatopancreas) (Child [0-6 years])
B-10.13a Current Trespasser - Area 2 (Adult)
B-10.13b Current Trespasser - Area 2 (Adolescent [6-18 years])
B-10.14a Current/Future Trespasser - Areas 8 and 11 (Adult)
B-10.14b Current/Future Trespasser - Areas 8 and 11 (Adolescent [6-18 years])
B-10.15 Current/Future Outdoor Worker - Areas 3 and 4
B-10.16 Current/Future Construction/Utility Worker - All Upland Areas
B-10.17 Future Resident - All Areas

TABLE B-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Area 1.
						Ingestion	Quant	
						Inhalation	Quant	
			Area 2	Trespassers	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Access to Area 2 is currently restricted by a fence. Public health hazard signs are posted warning no swimming, no sunbathing, and no fishing in the area. However, trespassers may gain access to the fenced area. While trespassing, trespassers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil .
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 3 and 4	Recreational Users	Adult, Adolescent (6-18 yrs), and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting playground and the surrounding area.
						Ingestion	Quant	
						Inhalation	Quant	
				Outdoor Worker	Adult	Dermal	Quant	Outdoor workers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the area.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting beach in these areas.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 8 and 11	Trespassers	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Access to Areas 8 and 11 is currently restricted by a fence. However, trespassers may gain access to the fenced area. While trespassing, trespassers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil.
						Ingestion	Quant	
						Inhalation	Quant	
			Upland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Margaret's Creek.
						Ingestion	Quant	
						Inhalation	Quant	
			All Areas (except Areas 2, 8, and 11)	Pedestrian	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Pedestrians may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting the site.
						Ingestion	Quant	
						Inhalation	Quant	

TABLE B-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current (cont'd)	Soil	Surface and Subsurface Soil	All Upland Areas	Construction/ Utility Worker	Adult	Dermal	Quant	Construction/Utility workers may come into contact with contaminants in soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the upland areas.
						Ingestion	Quant	
						Inhalation	Quant	
	Groundwater	Groundwater	All Areas	Resident	Adult and Child (0-6 yrs)	Dermal	None	Residents in the area are connected to the municipal water system. Groundwater is not used as a potable drinking water supply due to high salinity.
						Ingestion	None	
						Inhalation	None	
			All Upland Areas	Construction/ Utility Worker	Adult	Dermal	Quant	Construction/utility workers may encounter shallow groundwater at upland areas of Areas 6, 8, and 9 where depth to groundwater is 10 feet or less. Routes of exposure include incidental ingestion of and dermal contact with groundwater.
						Ingestion	Quant	
						Inhalation	None	
	Surface Water	Surface Water	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
	Sediment	Sediment	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
	Biota	Biota	All Areas (except Areas 3 and 4)	Angler	Adult and Child (0-6 yrs)	Ingestion	Quant	People may consume self-caught fish and shellfish from the site. The angler scenario assesses exposure to adult anglers and young children (0 to 6 years old) who may consume fish and shellfish caught at the site by anglers.

TABLE B-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Soil	Surface Soil	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Area 1.
						Ingestion	Quant	
						Inhalation	Quant	
			Area 2	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Area 2 may be open to the public in the future. Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil .
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 3 and 4	Recreational Users	Adult, Adolescent (6-18 yrs), and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting playground and the surrounding area.
						Ingestion	Quant	
						Inhalation	Quant	
				Outdoor Worker	Adult	Dermal	Quant	Outdoor workers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the area.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting beach in these areas.
						Ingestion	Quant	
						Inhalation	Quant	
			Areas 8 and 11	Trespassers	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Trespassers may gain access to restricted areas. Trespassers may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil.
						Ingestion	Quant	
						Inhalation	Quant	
			Upland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational users may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting Margaret's Creek.
						Ingestion	Quant	
						Inhalation	Quant	
			All Areas (except Areas 8 and 11)	Pedestrian	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Pedestrians may come into contact with contaminants in surface soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while visiting the site.
						Ingestion	Quant	
						Inhalation	Quant	

TABLE B-1

SELECTION OF EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor (Age)	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (cont'd)	Soil	Surface and Subsurface Soil	All Upland Areas	Construction/ Utility Worker	Adult	Dermal	Quant	Construction/Utility workers may come into contact with contaminants in soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the upland areas.
						Ingestion	Quant	
						Inhalation	Quant	
	Groundwater	Groundwater	All Areas	Resident	Adult and Child (0-6 yrs)	Dermal	Quant	Future development of the groundwater resource at the site is unlikely; however, in theory, potable water wells could be installed in the future. Future residents may come into contact with contaminants through ingestion of and dermal contact with groundwater, and inhalation of VOCs in groundwater while bathing or showering.
						Ingestion	Quant	
						Inhalation	Quant	
			All Upland Areas	Construction/ Utility Worker	Adult	Dermal	Quant	Construction/utility workers may encounter shallow groundwater at upland areas of Areas 6, 8, and 9 where depth to groundwater is 10 feet or less. Routes of exposure include incidental ingestion of and dermal contact with groundwater.
						Ingestion	Quant	
						Inhalation	None	
	Surface Water	Surface Water	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Areas 2, 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with surface water while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with surface water.
						Ingestion	Quant	
	Sediment	Sediment	Area 1	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting Area 1. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Areas 2, 5, 6, and Beach Area of Area 9	Recreational Users	Adult and Child (0-6 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting beach in these areas. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
			Wetland Area of Area 9	Recreational Users	Adult and Adolescent (6-18 yrs)	Dermal	Quant	Recreational visitors may come into contact with sediment while visiting wetlands in Area 9. Routes of exposure include incidental ingestion of and dermal contact with sediment.
						Ingestion	Quant	
	Biota	Biota	All Areas (except Areas 3 and 4)	Angler	Adult and Child (0-6 yrs)	Ingestion	Quant	People may consume self-caught fish and shellfish from the site. The angler scenario assesses exposure to adult anglers and young children (0 to 6 years old) who may consume fish and shellfish caught at the site by anglers.

Quant = Quantitative risk analysis performed
None = Risk analysis not performed

TABLE B-2.1a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 1

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	13	28	µg/kg	A116	3 / 31	9.2 - 49	28	6100000 n	70000000	[4]	No	BSL
	78-93-3	Butanone, 2-	15	15	µg/kg	A92	1 / 31	9.2 - 49	15	2800000 n	3100000	[4]	No	IFD
	75-15-0	Carbon disulfide	0.42 J	5.0 J	µg/kg	A41	7 / 31	4.6 - 24	5.0	82000 n	7800000	[4]	No	BSL
	108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	3 / 31	4.6 - 24	1.2	29000 n	510000	[4]	No	BSL
	127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 31	4.6 - 24	0.41	550 c	2000	[4]	No	IFD
	75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 31	4.6 - 24	0.38	79000 n	23000000	[4]	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	12 J	68 J	µg/kg	A1-S14	2 / 31	180 - 910	68	340000 n	3400000	[4]	No	BSL
	208-96-8	Acenaphthylene	9.4 J	28 J	µg/kg	A1-S11	3 / 31	180 - 910	28	340000 n [5]	NA	[4]	No	BSL
	98-86-2	Acetophenone	14 J	61 J	µg/kg	A56	12 / 31	180 - 910	61	780000 n	2000	[4]	No	BSL
	120-12-7	Anthracene	6 J	150 J	µg/kg	A1-S14	10 / 31	180 - 910	150	1700000 n	17000000	[4]	No	BSL
	100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A56	11 / 31	180 - 910	140	780000 n	6100000	[4]	No	BSL
	56-55-3	**Benzo(a)anthracene**	**3.2 J**	**600**	**µg/kg**	**A1-S14**	**25 / 31**	**3.6 - 910**	**600**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**6.8 J**	**530**	**µg/kg**	**A1-S14**	**22 / 31**	**3.6 - 910**	**530**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**5.9 J**	**580**	**µg/kg**	**A1-S14**	**24 / 31**	**3.6 - 910**	**580**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	6.8 J	290	µg/kg	A1-S14	14 / 31	180 - 910	290	170000 n [6]	380000000	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	6.9 J	450	µg/kg	A1-S14	14 / 31	180 - 910	450	1500 c	6000	[4]	No	BSL
	92-52-4	Biphenyl, 1,1'-	15 J	15 J	µg/kg	A1-S14	1 / 31	180 - 910	15	390000 n	3100000	[4]	No	IFD
	117-81-7	Bis(2-ethylhexyl)phthalate	15 J	51 J	µg/kg	A1-07	13 / 31	180 - 910	51	35000 c	35000	[4]	No	BSL
	85-68-7	Butylbenzylphthalate	7 J	7 J	µg/kg	A80	1 / 31	180 - 910	7	260000 c	1200000	[4]	No	IFD
	86-74-8	Carbazole	5.7 J	53 J	µg/kg	A1-S14	7 / 31	180 - 910	53	NA	24000	[4]	No	NTX
	218-01-9	Chrysene	6.6 J	550	µg/kg	A1-S14	20 / 31	180 - 910	550	15000 c	62000	[4]	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**2 J**	**110 J**	**µg/kg**	**A1-S14**	**16 / 31**	**3.6 - 910**	**110**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	132-64-9	Dibenzofuran	8.5 J	96 J	µg/kg	A1-S14	2 / 31	180 - 910	96	7800 n	NA	[4]	No	BSL
	84-66-2	Diethylphthalate	7.5 J	13 J	µg/kg	A80	4 / 31	180 - 910	13	4900000 n	49000000	[4]	No	BSL
	84-74-2	Di-n-butylphthalate	8.7 J	12 J	µg/kg	A136	5 / 31	180 - 910	12	610000 n	6100000	[4]	No	BSL
	206-44-0	Fluoranthene	13 J	1100	µg/kg	A1-S14	21 / 31	180 - 910	1100	230000 n	2300000	[4]	No	BSL
	86-73-7	Fluorene	11 J	130 J	µg/kg	A1-S14	2 / 31	180 - 910	130	230000 n	2300000	[4]	No	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**7.3**	**290**	**µg/kg**	**A1-S14**	**18 / 31**	**3.6 - 910**	**290**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	5.7 J	59 J	µg/kg	A1-S14	7 / 31	180 - 910	59	31000 n	230000	[4]	No	BSL
	106-44-5	Methylphenol, 4-	6.8 J	6.8 J	µg/kg	A80	1 / 31	180 - 910	6.8	31000 n	31000	[4]	No	IFD
	91-20-3	Naphthalene	5.6 J	58 J	µg/kg	A1-S14	15 / 31	180 - 910	58	3600 c	6000	[4]	No	BSL
	86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 31	180 - 910	25	99000 c	99000	[4]	No	IFD
	85-01-8	Phenanthrene	6.5 J	960	µg/kg	A1-S14	21 / 31	180 - 910	960	1700000 n [7]	NA	[4]	No	BSL
	108-95-2	Phenol	13 J	73 J	µg/kg	A56	10 / 31	180 - 910	73	1800000 n	18000000	[4]	No	BSL
	129-00-0	Pyrene	10 J	990	µg/kg	A1-S14	22 / 31	180 - 910	990	170000 n	1700000	[4]	No	BSL

TABLE B-2.1a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 1

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**PCBs/Pesticides**												
	5103-71-9	Alpha-chlordane	1.4 J	52 JN	µg/kg	A1-S05	5 / 31	0.93 - 5.4	52	1600 c [8]	NA	[4]	No	BSL
	11097-69-1	**Aroclor 1254**	**51**	**3100**	**µg/kg**	**A1-S15**	**12 / 31**	**35 - 100**	**3100**	**110 n**	**NA**	**[4]**	**Yes**	**ASL**
	319-85-7	Beta-BHC	0.72 J	0.72 J	µg/kg	A1-S16	1 / 31	0.93 - 5.4	0.72	270 c	400	[4]	No	IFD
	72-54-8	DDD, 4,4'-	4	4	µg/kg	A1-S11	1 / 31	1.8 - 10	4.0	2000 c	3000	[4]	No	IFD
	72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	7 / 31	1.8 - 10	130	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	0.56 J	160 JN	µg/kg	A1-10	12 / 31	1.8 - 10	160	1700 c	2000	[4]	No	BSL
	319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 31	0.93 - 5.4	2.0	270 c [9]	NA	[4]	No	BSL
	60-57-1	Dieldrin	2.3 JN	4.4 JN	µg/kg	A1-07	2 / 31	1.8 - 10	4.4	30 c	40	[4]	No	BSL
	959-98-8	Endosulfan I	0.047 J	0.087 J	µg/kg	A17	2 / 31	0.93 - 5.4	0.087	37000 n [10]	NA	[4]	No	BSL
	33213-65-9	Endosulfan II	4.9 J	96	µg/kg	A1-10	3 / 31	1.8 - 10	96	37000 n [10]	NA	[4]	No	BSL
	1031-07-8	Endosulfan sulfate	58 JN	58 JN	µg/kg	A1-10	1 / 31	1.8 - 10	58	37000 n [10]	470000	[4]	No	IFD
	72-20-8	Endrin	0.65 J	24 JN	µg/kg	A1-10	5 / 31	1.8 - 10	24	1800 n	23000	[4]	No	BSL
	7421-93-4	Endrin aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 31	1.8 - 10	11	1800 n [11]	NA	[4]	No	IFD
	53494-70-5	Endrin ketone	0.059 J	1.4 J	µg/kg	A1-S14	6 / 31	1.8 - 10	1.4	1800 n [11]	NA	[4]	No	BSL
	5103-74-2	Gamma-chlordane	3.9	71 JN	µg/kg	A1-10	8 / 31	0.93 - 5.4	71	1600 c [8]	NA	[4]	No	BSL
	76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	2 / 31	0.93 - 5.4	3.6	110 c	100	[4]	No	BSL
	1024-57-3	Heptachlor epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 31	0.93 - 5.4	8.5	53 c	70	[4]	No	BSL
	72-43-5	Methoxychlor	3.3 J	3.3 J	µg/kg	A1-S05	1 / 31	9.3 - 54	3.3	31000 n	390000	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**271 J**	**8710 J**	**mg/kg**	**A54**	**220 / 228**	**14.9 - 85.1**	**8710**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.22**	**2390**	**mg/kg**	**A19**	**118 / 244**	**0.14 - 232**	**2390**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.73 J**	**760 J**	**mg/kg**	**A4**	**227 / 242**	**0.19 - 157**	**760**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	1.7 J	162	mg/kg	A1-03	139 / 230	0.18 - 23.3	162	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.15 J	1.2	mg/kg	A26	115 / 230	0.18 - 1.3	1.2	16 n	16	[4]	No	BSL
	7440-43-9	Cadmium	0.035 J	5.9	mg/kg	A14	110 / 230	0.021 - 1	5.9	7 n	78	[4]	No	BSL
	7440-70-2	Calcium	143 J	42900	mg/kg	A93	193 / 228	371 - 2128	42900	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	2	62.5 J	mg/kg	A13	244 / 244	0.28 - 2	62.5	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [12]	2.1	11	mg/kg	A1-03	16 / 18	1 - 1	10.65	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.31 J**	**8.3 J**	**mg/kg**	**A1-10**	**14 / 18**	**1.1 - 1.2**	**8.3**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.29 J**	**9.2 J**	**mg/kg**	**A48**	**196 / 230**	**0.24 - 5.8**	**9.2**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**1.5 J**	**1730**	**mg/kg**	**A1-10**	**232 / 243**	**0.17 - 248**	**1730**	**310 n**	**3100**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**2750**	**96800**	**mg/kg**	**A13**	**229 / 229**	**7.4 - 42.6**	**96800**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**8.2 J**	**47700 J**	**mg/kg**	**A19**	**222 / 241**	**0.1 - 12.4**	**47700**	**400 n [13]**	**400**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	65.2 J	6960 J	mg/kg	A56	199 / 228	371 - 2128	6960	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**6.1**	**355 J**	**mg/kg**	**A43**	**231 / 242**	**0.2 - 174**	**355**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.017 J	0.54	mg/kg	A98	138 / 198	0.032 - 0.17	0.54	2.3 n [14]	23	[4]	No	BSL
	7440-02-0	Nickel	0.6 J	68	mg/kg	A1-10	229 / 244	0.22 - 4.7	68.4	150 n [15]	1600	[4]	No	BSL
	7440-09-7	Potassium	41.1 J	2120 J	mg/kg	A54	169 / 223	371 - 2128	2120	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.081 J	2.1	mg/kg	A73	131 / 230	0.062 - 5	2.1	39 n	390	[4]	No	BSL

TABLE B-2.1a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 1

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Inorganics (continued)**												
	7440-22-4	Silver	0.08	2.8	mg/kg	A1-10	33 / 244	0.087 - 1.5	2.8	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	140 J	21600 J	mg/kg	A56	191 / 228	371 - 2128	21600	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.15 J	0.65 J	mg/kg	A103	5 / 230	0.11 - 2.9	0.65	NA	5	[4]	No	IFD
	7440-31-5	Tin	8 J	1020	mg/kg	SED26	14 / 40	8.7 - 15	1020	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**5.5**	**118 J**	**mg/kg**	**A48**	**229 / 230**	**0.23 - 5.8**	**118**	**39 n [16]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	Zinc	4.7 J	497	mg/kg	A19	241 / 242	0.25 - 7.9	497	2300 n	23000	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

[4] Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

[5] Screening level for acenaphthene is applied to acenaphthylene.

[6] Screening level for pyrene is applied to benzo(g,h,i)perylene.

[7] Screening level for anthracene is applied to phenanthrene.

[8] Screening level for chlordane is applied to alpha- and gamma-chlordane.

[9] Screening level for hexachlorocyclohexane is applied to delta-BHC.

[10] Screening level for endosulfan is applied to endosulfan I, endosulfan II, and endosulfan sulfate.

[11] Screening level for endrin is applied to endrin aldehyde and endrin ketone.

[12] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration. Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

[13] Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

[14] Screening level for mercuric chloride is applied to mercury.

[15] Screening level for nickel soluble salts is applied to nickel.

[16] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.1b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 2

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	8.9	16	µg/kg	A122	2 / 11	8.5 - 13	16	6100000 n	70000000	[4]	No	BSL
	75-15-0	Carbon disulfide	0.62 J	0.72 J	µg/kg	A122	2 / 11	4.3 - 6.3	0.72	82000 n	7800000	[4]	No	BSL
		Semi-volatile Organic Compounds												
	98-86-2	Acetophenone	37 J	38 J	µg/kg	A122	2 / 13	120 - 220	38	780000 n	2000	[4]	No	BSL
	100-52-7	Benzaldehyde	61 J	78 J	µg/kg	A110	2 / 13	120 - 220	78	780000 n	6100000	[4]	No	BSL
	56-55-3	Benzo(a)anthracene	14 J	14 J	µg/kg	A122	1 / 13	120 - 220	14	150 c	600	[4]	No	BSL
	50-32-8	**Benzo(a)pyrene**	**16 J**	**16 J**	**µg/kg**	**A122**	**1 / 13**	**120 - 220**	**16**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	205-99-2	Benzo(b)fluoranthene	18 J	18 J	µg/kg	A122	1 / 13	120 - 220	18	150 c	600	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	9.5 J	9.5 J	µg/kg	A122	1 / 13	120 - 220	9.5	1500 c	6000	[4]	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	21 J	3100	µg/kg	A2-07	3 / 13	120 - 380	3100	35000 c	35000	[4]	No	BSL
	218-01-9	Chrysene	15 J	15 J	µg/kg	A122	1 / 13	120 - 220	15	15000 c	62000	[4]	No	BSL
	206-44-0	Fluoranthene	22 J	22 J	µg/kg	A122	1 / 13	120 - 220	22	230000 n	2300000	[4]	No	BSL
	85-01-8	Phenanthrene	11 J	11 J	µg/kg	A122	1 / 13	120 - 220	11	1700000 n [5]	NA	[4]	No	BSL
	108-95-2	Phenol	12 J	13 J	µg/kg	A110	2 / 13	120 - 220	13	1800000 n	18000000	[4]	No	BSL
	129-00-0	Pyrene	9.7 J	22 J	µg/kg	A122	2 / 13	120 - 220	22	170000 n	1700000	[4]	No	BSL
		PCBs/Pesticides												
	11097-69-1	**Aroclor 1254**	**42**	**480**	**µg/kg**	**A122**	**2 / 13**	**31 - 43**	**480**	**110 n**	**NA**	**[4]**	**Yes**	**ASL**
	72-55-9	DDE, 4,4'-	1.1 J	19	µg/kg	A122	2 / 13	4.2 - 5.3	19	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	3.2 J	60	µg/kg	A122	2 / 13	4.2 - 5.3	60	1700 c	2000	[4]	No	BSL
		Inorganics												
	7429-90-5	Aluminum	441	6000	mg/kg	A2-03	93 / 93	20 - 31.6	6000	7700 n	78000	[4]	No	BSL
	7440-36-0	**Antimony**	**0.77 J**	**190**	**mg/kg**	**A2-10**	**83 / 94**	**1.3 - 188**	**190**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**1.5**	**150**	**mg/kg**	**A2-10**	**94 / 94**	**1 - 1**	**150**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	3.6 J	120	mg/kg	A2-09	60 / 94	6.2 - 20	120	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.026 J	0.87 J	mg/kg	SED33	58 / 94	0.26 - 0.5	0.87	16 n	16	[4]	No	BSL
	7440-43-9	Cadmium	0.011 J	2.0	mg/kg	SED88	31 / 94	0.26 - 0.5	2.0	7 n	78	[4]	No	BSL
	7440-70-2	Calcium	61	32800	mg/kg	S22	68 / 93	45 - 790	32800	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	2.5	33	mg/kg	SED33	94 / 94	1 - 1	32.6	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [6]	3.85	29	mg/kg	A2-10	21 / 21	1 - 1	28.95	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.12**	**2.0**	**mg/kg**	**A2-02**	**5 / 21**	**0.1 - 0.11**	**2.0**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.32 J**	**4.0 J**	**mg/kg**	**SED30**	**56 / 94**	**0.62 - 5**	**4.0**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**2.8**	**330**	**mg/kg**	**A2-07**	**94 / 94**	**2.5 - 2.5**	**330**	**310 n**	**3100**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**2260**	**74800 J**	**mg/kg**	**A113**	**93 / 93**	**10 - 35.4**	**74800**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**6.7**	**3000**	**mg/kg**	**A2-07**	**94 / 94**	**1 - 1**	**3000**	**400 n [7]**	**400**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead - TRW[8]**	**25**	**8800**	**mg/kg**	**A2-T5**	**32 / 32**	**1 - 1**	**8800**	**400 n**	**400**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	70	1360	mg/kg	A129	77 / 93	500 - 790	1360	NA	NA	[4]	No	NUT
	7439-96-5	Manganese	5.1 J	180	mg/kg	S09	94 / 94	1.5 - 1.5	180	180 n	11000	[4]	No	BSL
	7439-97-6	Mercury	0.028 J	0.24	mg/kg	A118	32 / 65	0.03 - 0.069	0.24	2.3 n [9]	23	[4]	No	BSL
	7440-02-0	Nickel	1.1	15	mg/kg	SED30	80 / 94	1.7 - 4	14.5	150 n [10]	1600	[4]	No	BSL
	7440-09-7	Potassium	67.4 J	873	mg/kg	A162	58 / 93	500 - 790	873	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.33 J	1.3 J	mg/kg	SED30/SED33	32 / 94	0.52 - 3.5	1.3	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.086 J	0.38 J	mg/kg	S09	16 / 94	0.26 - 1	0.38	39 n	390	[4]	No	BSL

TABLE B-2.1b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 2

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Inorganics (continued)**												
	7440-23-5	Sodium	110	3090	mg/kg	SED32	59 / 93	87 - 790	3090	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.62 J	0.63 J	mg/kg	A126	2 / 94	0.52 - 2.5	0.63	NA	5	[4]	No	IFD
	7440-31-5	Tin	16.6	67	mg/kg	S09	18 / 29	10 - 10	67	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**5 J**	**54**	**mg/kg**	**SED33**	**94 / 94**	**5 - 5**	**54**	**39 n [11]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	Zinc	6.1	180	mg/kg	A2-06	94 / 94	6 - 6	180	2300 n	23000	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

[4] Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

[5] Screening level for anthracene is applied to phenanthrene.

[6] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration.
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

[7] Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

[8] These samples were collected in accordance with EPA Technical Review Workgroup (TRW) guidance (EPA 2000).
TRW samples are composite samples collected from the near-surface (0 to 2 inches below ground surface).
Soil samples consisted of a composite of five subsamples located randomly within a sampling section.
Each sampling section is approximately 0.25 acre (10,000 square feet) in area.
The composite samples were sieved to less than 250 micrometer (µm).

[9] Screening level for mercuric chloride is applied to mercury.

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
EPA - September 2008
EPA - April 2009
EPA - June/July 2009

Pre-Remedial Investigation (2010):
Beach Sampling - May 2010
Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
September/December 2010
January 2011

TABLE B-2.1c

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 3 and 4

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	11 J	190 J	µg/kg	S71	3 / 50	9.5 - 93	190	6100000 n	70000000	[4]	No	BSL
	123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 50	95 - 930	420	4900 c	NA	[4]	No	IFD
	79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 50	4.7 - 46	7.9	2800 c	7000	[4]	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	61 J	61 J	µg/kg	S76	1 / 50	170 - 890	61	340000 n	3400000	[4]	No	IFD
	120-12-7	Anthracene	120 J	120 J	µg/kg	S76	1 / 50	170 - 890	120	1700000 n	17000000	[4]	No	IFD
	100-52-7	Benzaldehyde	27 J	140 J	µg/kg	A4-10	5 / 50	170 - 890	140	780000 n	6100000	[4]	No	BSL
	56-55-3	**Benzo(a)anthracene**	**2.1 J**	**290**	**µg/kg**	**S76**	**25 / 50**	**3.5 - 890**	**290**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**1.9 J**	**240**	**µg/kg**	**S76**	**24 / 50**	**3.5 - 890**	**240**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**2.9 J**	**340**	**µg/kg**	**S76**	**32 / 50**	**3.5 - 890**	**340**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	22 J	150 J	µg/kg	S84	6 / 50	170 - 890	150	170000 n [5]	380000000	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	25 J	200 J	µg/kg	S76	13 / 50	170 - 890	200	1500 c	6000	[4]	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	260 J	2300	µg/kg	S71	6 / 50	170 - 890	2300	35000 c	35000	[4]	No	BSL
	85-68-7	Butylbenzylphthalate	39 J	39 J	µg/kg	S70	1 / 50	170 - 890	39	260000 c	1200000	[4]	No	IFD
	218-01-9	Chrysene	30 J	280	µg/kg	S76	20 / 50	170 - 890	280	15000 c	62000	[4]	No	BSL
	53-70-3	Dibenzo(a,h)anthracene	2.4 J	9.1	µg/kg	A4-13	5 / 50	3.5 - 890	9.1	15 c	200	[4]	No	BSL
	117-84-0	Di-n-octyl phthalate	57 J	790 J	µg/kg	S76	3 / 50	170 - 890	790	NA	2400000	[4]	No	NTX
	206-44-0	Fluoranthene	23 J	730	µg/kg	S76	26 / 50	170 - 890	730	230000 n	2300000	[4]	No	BSL
	86-73-7	Fluorene	67 J	67 J	µg/kg	S76	1 / 50	170 - 890	67	230000 n	2300000	[4]	No	IFD
	193-39-5	Indeno(1,2,3-cd)pyrene	2.2 J	130 J	µg/kg	S84	17 / 50	3.5 - 890	130	150 c	600	[4]	No	BSL
	87-86-5	Pentachlorophenol	5.5 J	5.5 J	µg/kg	A4-02	1 / 50	7.2 - 1700	5.5	890 c	3000	[4]	No	IFD
	85-01-8	Phenanthrene	35 J	460	µg/kg	S76	11 / 50	170 - 890	460	1700000 n [6]	NA	[4]	No	BSL
	129-00-0	Pyrene	27 J	580	µg/kg	S76	25 / 50	170 - 890	580	170000 n	1700000	[4]	No	BSL
		PCBs/Pesticides												
	319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 50	0.91 - 8.9	13	77 c	100	[4]	No	BSL
	5103-71-9	Alpha-chlordane	0.93 J	4.9 J	µg/kg	A3-S88	5 / 50	0.91 - 8.9	4.9	1600 c [7]	NA	[4]	No	BSL
	11097-69-1	Aroclor 1254	60	140 J	µg/kg	A4-02	2 / 50	33 - 170	140	110 n	NA	[4]	No	IFD
	72-55-9	DDE, 4,4'-	1.8 J	2 JN	µg/kg	S76	3 / 50	1.8 - 17	2.0	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	2 J	20 JN	µg/kg	A4-02	7 / 50	1.8 - 17	20	1700 c	2000	[4]	No	BSL
	60-57-1	Dieldrin	0.85 J	0.85 J	µg/kg	A4-04	1 / 50	1.8 - 17	0.85	30 c	40	[4]	No	IFD
	1031-07-8	Endosulfan sulfate	5.6 J	8.6 J	µg/kg	S73	3 / 50	1.8 - 17	8.6	37000 n [8]	470000	[4]	No	BSL
	53494-70-5	Endrin ketone	6.8 J	6.8 J	µg/kg	S84	1 / 50	1.8 - 17	6.8	1800 n [9]	NA	[4]	No	IFD
	5103-74-2	Gamma-chlordane	0.96 J	21 J	µg/kg	S79	9 / 50	0.91 - 8.9	21	1600 c [7]	NA	[4]	No	BSL
	76-44-8	Heptachlor	1.5 J	1.5 J	µg/kg	S76	1 / 50	0.91 - 8.9	1.5	110 c	100	[4]	No	IFD
	72-43-5	Methoxychlor	85 JN	85 JN	µg/kg	S84	1 / 50	9.1 - 89	85	31000 n	390000	[4]	No	IFD

TABLE B-2.1c

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 3 and 4

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Inorganics**												
	7429-90-5	**Aluminum**	**302 J**	**27600 J**	**mg/kg**	**S77**	**91 / 91**	**20 - 105**	**27600**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.11 J**	**5.5 J**	**mg/kg**	**S82**	**50 / 91**	**0.057 - 31.4**	**5.5**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.16 J**	**144**	**mg/kg**	**S85**	**87 / 91**	**0.078 - 5.2**	**144**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	3.7	1050	mg/kg	A4-14	65 / 91	0.076 - 105	1050	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.05 J	0.93	mg/kg	S82	26 / 91	0.1 - 2.6	0.93	16 n	16	[4]	No	BSL
	7440-43-9	Cadmium	0.013 J	3.3 J	mg/kg	S77	44 / 91	0.008 - 2.6	3.3	7 n	78	[4]	No	BSL
	7440-70-2	Calcium	257 J	10900 J	mg/kg	S75	76 / 91	500 - 2619	10900	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	3	81 J	mg/kg	S77	86 / 91	0.12 - 5.2	81	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [10]	2.4	19	mg/kg	A4-04	30 / 30	0.12 - 5.2	19	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.31 J**	**2.4 J**	**mg/kg**	**A4-09**	**23 / 30**	**1 - 1.2**	**2.4**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.14 J**	**11**	**mg/kg**	**S82**	**38 / 91**	**0.099 - 26.2**	**11.3**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	Copper	3	131 J	mg/kg	S61	91 / 91	0.071 - 13.1	131	310 n	3100	[4]	No	BSL
	7439-89-6	**Iron**	**912 J**	**62800 J**	**mg/kg**	**S77**	**91 / 91**	**10 - 52.4**	**62800**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	Lead	7.7	98 J	mg/kg	S61	91 / 91	0.042 - 5.2	97.8	400 n [11]	400	[4]	No	BSL
	7439-92-1	Lead - TRW [12]	21	27	mg/kg	A3-T3	3 / 3	1 - 1	27	400 n	400	[4]	No	BSL
	7439-95-4	Magnesium	118 J	2450	mg/kg	A4-13	49 / 91	500 - 2619	2450	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**3**	**940 J**	**mg/kg**	**S85**	**91 / 91**	**0.08 - 7.9**	**940**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.015 J	0.073	mg/kg	A4-04	28 / 30	0.052 - 0.062	0.073	2.3 n [13]	23	[4]	No	BSL
	7440-02-0	Nickel	0.36 J	13.8 J	mg/kg	S77	88 / 91	0.088 - 21	13.8	150 n [14]	1600	[4]	No	BSL
	7440-09-7	Potassium	179 J	1240	mg/kg	S81	28 / 53	500 - 606	1240	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.03 J	4.1 J	mg/kg	S77	59 / 91	0.025 - 18.3	4.1	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.1 J	1.1 J	mg/kg	S61	7 / 91	0.071 - 5.2	1.1	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	8.8 J	816 J	mg/kg	S65	55 / 91	500 - 2619	816	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	10 / 91	0.046 - 13.1	2.8	NA	5	[4]	No	NTX
	7440-62-2	**Vanadium**	**3.2 J**	**112 J**	**mg/kg**	**S77**	**81 / 91**	**0.092 - 26.2**	**112**	**39 n [15]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	**Zinc**	**2.1 J**	**5160 J**	**mg/kg**	**S69**	**91 / 91**	**0.1 - 31.4**	**5160**	**2300 n**	**23000**	**[4]**	**Yes**	**ASL**

TABLE B-2.1c

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 3 and 4

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

(4) Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

(5) Screening level for pyrene is applied to benzo(g,h,i)perylene.

(6) Screening level for anthracene is applied to phenanthrene.

(7) Screening level for chlordane is applied to alpha- and gamma-chlordane.

(8) Screening level for endosulfan is applied to endosulfan sulfate.

(9) Screening level for endrin is applied to endrin ketone.

(10) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium

(11) Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

(12) These samples were collected in accordance with EPA Technical Review Workgroup (TRW) guidance (EPA 2000).
TRW samples are composite samples collected from the near-surface (0 to 2 inches below ground surface).
Soil samples consisted of a composite of five subsamples located randomly within a sampling section.
Each sampling section is approximately 0.25 acre (10,000 square feet) in area.
The composite samples were sieved to less than 250 micrometer (µm).

(13) Screening level for mercuric chloride is applied to mercury.

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
BHC = benzene hexachloride

DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.1d
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 5, 6, and Beach Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	6.1 J	27	µg/kg	A5-13	5 / 11	10 - 14	27	6100000 n	70000000	[4]	No	BSL
	78-93-3	Butanone, 2-	6.3 J	6.3 J	µg/kg	B4	1 / 11	10 - 14	6.3	2800000 n	3100000	[4]	No	BSL
	75-15-0	Carbon disulfide	0.58 J	1.7 J	µg/kg	B14	5 / 11	5 - 7.1	1.7	82000 n	7800000	[4]	No	BSL
	108-90-7	Chlorobenzene	0.73 J	0.73 J	µg/kg	B63	1 / 11	5 - 7.1	0.73	29000 n	510000	[4]	No	BSL
		Semi-volatile Organic Compounds												
	98-86-2	Acetophenone	21 J	41 J	µg/kg	B63	5 / 11	180 - 240	41	780000 n	2000	[4]	No	BSL
	100-52-7	Benzaldehyde	29 J	64 J	µg/kg	A133	5 / 11	180 - 240	64	780000 n	6100000	[4]	No	BSL
	56-55-3	Benzo(a)anthracene	5.4	33	µg/kg	A9-15	8 / 11	3.4 - 240	33	150 c	600	[4]	No	BSL
	50-32-8	**Benzo(a)pyrene**	**3.5 J**	**40 J**	**µg/kg**	**A133**	**6 / 11**	**3.4 - 240**	**40**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	205-99-2	Benzo(b)fluoranthene	3.9	54 J	µg/kg	A133	8 / 11	3.4 - 240	54	150 c	600	[4]	No	BSL
	191-24-2	Benzo(g,h,i)perylene	13 J	23 J	µg/kg	A133	2 / 11	180 - 240	23	170000 n [5]	380000000	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	10 J	16 J	µg/kg	A133	2 / 11	180 - 240	16	1500 c	6000	[4]	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	17 J	52 J	µg/kg	A5-13	7 / 11	180 - 240	52	35000 c	35000	[4]	No	BSL
	218-01-9	Chrysene	7 J	32 J	µg/kg	A9-15	4 / 11	180 - 240	32	15000 c	62000	[4]	No	BSL
	53-70-3	Dibenzo(a,h)anthracene	3.2 J	3.6	µg/kg	A9-15	2 / 11	3.4 - 240	3.6	15 c	200	[4]	No	BSL
	84-66-2	Diethylphthalate	6.5 J	9.2 J	µg/kg	B34	2 / 11	180 - 240	9.2	4900000 n	49000000	[4]	No	BSL
	84-74-2	Di-n-butylphthalate	8.2 J	11 J	µg/kg	B4	4 / 11	180 - 240	11	610000 n	6100000	[4]	No	BSL
	206-44-0	Fluoranthene	7.5 J	54 J	µg/kg	A9-15	5 / 11	180 - 240	54	230000 n	2300000	[4]	No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	4	32 J	µg/kg	A133	6 / 11	3.4 - 240	32	150 c	600	[4]	No	BSL
	85-01-8	Phenanthrene	14 J	23 J	µg/kg	A133	3 / 11	180 - 240	23	1700000 n [6]	NA	[4]	No	BSL
	108-95-2	Phenol	19 J	45 J	µg/kg	B4	5 / 11	180 - 240	45	1800000 n	18000000	[4]	No	BSL
	129-00-0	Pyrene	9.1 J	68 J	µg/kg	A9-15	6 / 11	180 - 240	68	170000 n	1700000	[4]	No	BSL
		PCBs/Pesticides												
	11097-69-1	Aroclor 1254	50	50	µg/kg	A133	1 / 11	34 - 46	50	110 n	NA	[4]	No	BSL
	319-85-7	Beta-BHC	0.11 J	0.11 J	µg/kg	B63	1 / 11	0.89 - 2.4	0.11	270 c	400	[4]	No	BSL
	72-55-9	DDE, 4,4'-	1.4 J	1.4 J	µg/kg	A133	1 / 11	1.7 - 4.6	1.4	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	4.3 J	4.3 J	µg/kg	A133	1 / 11	1.7 - 4.6	4.3	1700 c	2000	[4]	No	BSL
	72-20-8	Endrin	0.11 J	0.13 J	µg/kg	B34	2 / 11	1.7 - 4.6	0.13	1800 n	23000	[4]	No	BSL
	53494-70-5	Endrin ketone	0.074 J	0.11 J	µg/kg	B63	2 / 11	1.7 - 4.6	0.11	1800 n [7]	NA	[4]	No	BSL
		Inorganics												
	7429-90-5	**Aluminum**	**160**	**11600**	**mg/kg**	**A9-65**	**309 / 310**	**8 - 36**	**11600**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.18 J**	**210**	**mg/kg**	**S213**	**110 / 458**	**0.056 - 10.7**	**210**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.51**	**54**	**mg/kg**	**S162**	**453 / 465**	**0.077 - 1.8**	**54**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	0.77 J	109 J	mg/kg	S128	195 / 352	0.075 - 35.7	109	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	147 / 352	0.1 - 0.89	2.0	16 n	16	[4]	No	BSL
	7440-43-9	Cadmium	0.007 J	3.1	mg/kg	SED120	159 / 352	0.008 - 0.89	3.1	7 n	78	[4]	No	BSL
	7440-70-2	Calcium	18.6 J	26500	mg/kg	A6-02	255 / 316	174 - 901	26500	NA	NA	[4]	No	NUT

TABLE B-2.1d

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 5, 6, and Beach Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Inorganics (continued)**												
	7440-47-3	Chromium	0.96 J	230	mg/kg	B47	457 / 458	0.11 - 1.8	230	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [8]	0.46	29	mg/kg	A9-65	28 / 28	0.11 - 1.8	29	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.37 J**	**1.1 J**	**mg/kg**	**A6-02**	**10 / 28**	**1 - 1.9**	**1.1**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.14 J**	**11.1**	**mg/kg**	**A5-14**	**189 / 352**	**0.098 - 8.9**	**11**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	Copper	0.44 J	93	mg/kg	A130	452 / 465	0.071 - 4.5	93	310 n	3100	[4]	No	BSL
	7439-89-6	**Iron**	**1670**	**77000 J**	**mg/kg**	**SED198**	**310 / 310**	**4.3 - 18**	**77000**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**1.1**	**1090**	**mg/kg**	**SED150**	**447 / 465**	**0.042 - 1.8**	**1090**	**400 n [9]**	**400**	**[4]**	**Yes**	**ASL**
	7439-92-1	Lead - TRW[10]	3.3	400	mg/kg	A5-T114	188 / 188	1 - 1	400	400 n	400	[4]	No	BSL
	7439-95-4	Magnesium	22.8 J	9920	mg/kg	SED120	276 / 316	198 - 901	9920	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**2.3**	**3470 J**	**mg/kg**	**SED120**	**352 / 355**	**0.079 - 2.7**	**3470**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.016 J	0.29	mg/kg	A130	72 / 119	0.029 - 0.18	0.29	2.3 n [11]	23	[4]	No	BSL
	7440-02-0	Nickel	0.074 J	24	mg/kg	SED195	305 / 352	0.088 - 7.1	23.8	150 n [12]	1600	[4]	No	BSL
	7440-09-7	Potassium	12.7 J	2830	mg/kg	A9-65	182 / 316	191 - 901	2830	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.027 J	4.4 J	mg/kg	SED157	168 / 352	0.025 - 6.2	4.4	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.055 J	16 J	mg/kg	SED198	75 / 352	0.071 - 1.8	16	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	6.4 J	8610 J	mg/kg	S29	196 / 316	207 - 901	8610	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.16 J	0.17 J	mg/kg	A5-14	2 / 352	0.046 - 4.5	0.17	NA	5	[4]	No	IFD
	7440-31-5	Tin	12.1 J	24 J	mg/kg	S27	4 / 46	10 - 10	24	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**0.52**	**125**	**mg/kg**	**B15**	**346 / 352**	**0.092 - 8.9**	**125**	**39 n [13]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	Zinc	3.3 J	245	mg/kg	SED127	324 / 359	0.1 - 14.6	245	2300 n	23000	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

[4] Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
BHC = benzene hexachloride
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

TABLE B-2.1d

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 5, 6, and Beach Area of Area 9

(5) Screening level for pyrene is used as a surrogate for benzo(g,h,i)perylene.

(6) Screening level for anthracene is used as a surrogate for phenanthrene.

(7) Screening level for endrin is applied to endrin ketone.

(8) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium

(9) Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

(10) These samples were collected in accordance with EPA Technical Review Workgroup (TRW) guidance (EPA 2000).
TRW samples are composite samples collected from the near-surface (0 to 2 inches below ground surface).
Soil samples consisted of a composite of five subsamples located randomly within a sampling section.
Each sampling section is approximately 0.25 acre (10,000 square feet) in area.
The composite samples were sieved to less than 250 micrometer (µm).

(11) Screening level for mercuric chloride is applied to mercury.

(12) Screening level for nickel soluble salts is applied to nickel.

(13) Screening level for vanadium and compounds is applied to vanadium.

*Includes the following data:

Historical Data:

EPA - September 2008

EPA - April 2009

EPA - June/July 2009

Pre-Remedial Investigation (2010):

Beach Sampling - May 2010

Area 2 - August 2010 - EPA-DESA

Remedial Investigation:

September/December 2010

January 2011

TABLE B-2.1e

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Upland Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion (3)
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	5 J	180	µg/kg	A9-111	22 / 128	4.6 - 16	180	6100000 n	70000000	(4)	No	BSL
	75-15-0	Carbon disulfide	3 J	4.9 J	µg/kg	A9-54	3 / 128	2.3 - 8.2	4.9	82000 n	7800000	(4)	No	IFD
	67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 128	2.3 - 8.2	13	290 c	600	(4)	No	IFD
	98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 128	2.3 - 8.2	11	260000 ns	NA	(4)	No	IFD
	75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 128	2.3 - 8.2	4.4	11000 c	34000	(4)	No	BSL
	100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 128	2.3 - 8.2	130	820000 ns	90000	(4)	No	BSL
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	25 J	1000 J	µg/kg	A9-23	6 / 128	180 - 260	1000	340000 n	3400000	(4)	No	IFD
	208-96-8	Acenaphthylene	39 J	84 J	µg/kg	A9-42	4 / 128	180 - 260	84	340000 n (5)	NA	(4)	No	IFD
	98-86-2	Acetophenone	27 J	230 J	µg/kg	A9-23	8 / 128	180 - 260	230	780000 n	2000	(4)	No	BSL
	120-12-7	Anthracene	24 J	2700 J	µg/kg	A9-23	12 / 128	180 - 260	2700	1700000 n	17000000	(4)	No	BSL
	100-52-7	Benzaldehyde	25 J	78 J	µg/kg	A9-52	5 / 128	180 - 260	78	780000 n	6100000	(4)	No	IFD
	56-55-3	**Benzo(a)anthracene**	**2.2 J**	**3000 J**	**µg/kg**	**A9-23**	**87 / 128**	**3.4 - 37**	**3000**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**2 J**	**2200 J**	**µg/kg**	**A9-23**	**78 / 128**	**3.4 - 37**	**2200**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**2 J**	**2100 J**	**µg/kg**	**A9-23**	**95 / 128**	**3.4 - 37**	**2100**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	25 J	890 J	µg/kg	A9-23	24 / 128	180 - 260	890	170000 n (6)	380000000	(4)	No	BSL
	207-08-9	Benzo(k)fluoranthene	19 J	1100 J	µg/kg	A9-23	20 / 128	180 - 260	1100	1500 c	6000	(4)	No	BSL
	92-52-4	Biphenyl, 1,1'-	32 J	200 J	µg/kg	A9-23	3 / 128	180 - 260	200	390000 n	3100000	(4)	No	IFD
	117-81-7	Bis(2-ethylhexyl)phthalate	23 J	2000 J	µg/kg	A9-109	37 / 128	180 - 260	2000	35000 c	35000	(4)	No	BSL
	85-68-7	Butylbenzylphthalate	65 J	61000	µg/kg	A9-111	6 / 128	180 - 260	61000	260000 c	1200000	(4)	No	IFD
	86-74-8	Carbazole	26 J	890 J	µg/kg	A9-23	6 / 128	180 - 260	890	NA	24000	(4)	No	IFD
	218-01-9	Chrysene	19 J	3800 J	µg/kg	A9-23	41 / 128	180 - 260	3800	15000 c	62000	(4)	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**2.3 J**	**520 J**	**µg/kg**	**A9-23**	**41 / 128**	**3.4 - 37**	**520**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	132-64-9	Dibenzofuran	24 J	920 J	µg/kg	A9-23	5 / 128	180 - 260	920	7800 n	NA	(4)	No	IFD
	84-74-2	Di-n-butylphthalate	30 J	11000	µg/kg	A9-04	4 / 128	180 - 260	11000	610000 n	6100000	(4)	No	IFD
	117-84-0	Di-n-octyl phthalate	43 J	44 J	µg/kg	A9-109	2 / 128	180 - 260	44	NA	2400000	(4)	No	IFD
	206-44-0	Fluoranthene	21 J	7800 J	µg/kg	A9-23	43 / 128	180 - 260	7800	230000 n	2300000	(4)	No	BSL
	86-73-7	Fluorene	26 J	1200 J	µg/kg	A9-23	8 / 128	180 - 260	1200	230000 n	2300000	(4)	No	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.8 J**	**1200 J**	**µg/kg**	**A9-23**	**68 / 128**	**3.4 - 37**	**1200**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	37 J	870 J	µg/kg	A9-23	5 / 128	180 - 260	870	31000 n	230000	(4)	No	IFD
	95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 128	180 - 260	170	310000 n	310000	(4)	No	IFD
	91-20-3	Naphthalene	28 J	920	µg/kg	A9-14	10 / 128	180 - 260	920	3600 c	6000	(4)	No	BSL
	87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	8 / 128	6.9 - 76	12	890 c	3000	(4)	No	BSL
	85-01-8	Phenanthrene	20 J	13000 J	µg/kg	A9-23	25 / 128	180 - 260	13000	1700000 n (7)	NA	(4)	No	BSL
	108-95-2	Phenol	38 J	38 J	µg/kg	A9-23	1 / 128	180 - 260	38	1800000 n	18000000	(4)	No	IFD
	129-00-0	Pyrene	18 J	6800 J	µg/kg	A9-23	46 / 128	180 - 260	6800	170000 n	1700000	(4)	No	BSL

TABLE B-2.1e

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Upland Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion (3)
Surface Soil		**PCBs/Pesticides**												
	5103-71-9	Alpha-chlordane	1.6 JN	14 JN	µg/kg	A9-06	14 / 128	0.87 - 13	14	1600 c (8)	NA	(4)	No	BSL
	11097-69-1	**Aroclor 1254**	**25 J**	**62000**	**µg/kg**	**A9-61**	**23 / 128**	**34 - 410**	**62000**	**110 n**	**NA**	**(4)**	**Yes**	**ASL**
	11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 128	34 - 410	36	220 c	NA	(4)	No	IFD
	72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	6 / 128	1.7 - 25	14	2000 c	3000	(4)	No	IFD
	72-55-9	DDE, 4,4'-	1.8 J	17 JN	µg/kg	A9-17	8 / 128	1.7 - 25	17	1400 c	2000	(4)	No	BSL
	50-29-3	DDT, 4,4'-	2 JN	1300 JN	µg/kg	A9-25	11 / 128	1.7 - 25	1300	1700 c	2000	(4)	No	BSL
	60-57-1	Dieldrin	1.2 J	4.7	µg/kg	A9-42	6 / 128	1.7 - 25	4.7	30 c	40	(4)	No	IFD
	959-98-8	Endosulfan I	2.1 JN	2.1 JN	µg/kg	A9-26	1 / 128	0.87 - 13	2.1	37000 n (9)	NA	(4)	No	IFD
	33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	5 / 128	1.7 - 25	280	37000 n (9)	NA	(4)	No	IFD
	72-20-8	Endrin	3	3	µg/kg	A9-42	1 / 128	1.7 - 25	3	1800 n	23000	(4)	No	IFD
	5103-74-2	Gamma-chlordane	1.2 J	180 JN	µg/kg	A9-25	18 / 128	0.87 - 13	180	1600 c (8)	NA	(4)	No	BSL
	72-43-5	Methoxychlor	11 JN	19 JN	µg/kg	A9-29	2 / 128	8.7 - 130	19	31000 n	390000	(4)	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**187**	**13500**	**mg/kg**	**A9-37**	**135 / 135**	**9 - 43.7**	**13500**	**7700 n**	**78000**	**(4)**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.15 J**	**2200**	**mg/kg**	**A9-109**	**62 / 135**	**0.13 - 39.6**	**2200**	**3.1 n**	**31**	**(4)**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.23**	**594**	**mg/kg**	**A9-109**	**130 / 135**	**0.18 - 54.3**	**594**	**0.39 c**	**19***	**(4)**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	1.4 J	1120	mg/kg	A9-109	131 / 135	0.17 - 52.8	1120	1500 n	16000	(4)	No	BSL
	7440-41-7	Beryllium	0.28 J	0.81 J	mg/kg	A9-34	30 / 135	0.24 - 0.62	0.81	16 n	16	(4)	No	BSL
	7440-43-9	**Cadmium**	**0.021 J**	**13**	**mg/kg**	**A9-109**	**114 / 135**	**0.019 - 0.5**	**12.5**	**7 n**	**78**	**(4)**	**Yes**	**ASL**
	7440-70-2	Calcium	223 J	29600	mg/kg	A9-58	55 / 135	196 - 1090	29600	NA	NA	(4)	No	NUT
	7440-47-3	Chromium	1.4 J	155	mg/kg	A9-21	135 / 135	0.27 - 1	155	NA	NA	(4)	No	NTX
	16065-83-1	Chromium III (10)	0.6	152.9	mg/kg	A9-21	130 / 130	0.27 - 1	152.9	12000 n	NA	(4)	No	BSL
	18540-29-9	**Chromium VI**	**0.3 J**	**3.4 J-**	**mg/kg**	**A9-50**	**58 / 130**	**1 - 2.5**	**3.4**	**0.29 c**	**NA**	**(4)**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.25 J**	**13**	**mg/kg**	**A9-34**	**107 / 135**	**0.23 - 5**	**12.7**	**2.3 n**	**1600**	**(4)**	**Yes**	**ASL**
	7440-50-8	**Copper**	**1.3 J**	**1170**	**mg/kg**	**A9-21**	**127 / 135**	**0.17 - 49.9**	**1170**	**310 n**	**3100**	**(4)**	**Yes**	**ASL**
	7439-89-6	**Iron**	**2150**	**70300**	**mg/kg**	**A9-109**	**135 / 135**	**4.8 - 25.1**	**70300**	**5500 n**	**NA**	**(4)**	**Yes**	**ASL**
	7439-92-1	**Lead**	**5.3**	**10200 J**	**mg/kg**	**S63**	**125 / 135**	**0.097 - 29.3**	**10200**	**400 n (11)**	**400**	**(4)**	**Yes**	**ASL**
	7439-95-4	Magnesium	53.5 J	4310	mg/kg	A9-58	73 / 135	222 - 1090	4310	NA	NA	(4)	No	NUT
	7439-96-5	**Manganese**	**2 J**	**1020**	**mg/kg**	**A9-109**	**135 / 135**	**0.18 - 55.8**	**1020**	**180 n**	**11000**	**(4)**	**Yes**	**ASL**
	7439-97-6	Mercury	0.017 J	1.9	mg/kg	A9-109	96 / 130	0.052 - 0.11	1.9	2.3 n (12)	23	(4)	No	BSL
	7440-02-0	Nickel	0.25	47	mg/kg	A9-109	131 / 135	0.2 - 4	46.8	150 n (13)	1600	(4)	No	BSL
	7440-09-7	Potassium	31.8 J	3080	mg/kg	A9-35	93 / 135	216 - 1090	3080	NA	NA	(4)	No	NUT
	7782-49-2	Selenium	0.064 J	8.5	mg/kg	A9-42	57 / 135	0.058 - 3.5	8.5	39 n	390	(4)	No	BSL
	7440-22-4	Silver	0.19 J	10	mg/kg	A9-23	20 / 135	0.17 - 1	10.3	39 n	390	(4)	No	BSL
	7440-23-5	Sodium	6.2 J	2620	mg/kg	A9-35	21 / 135	233 - 1090	2620	NA	NA	(4)	No	NUT
	7440-28-0	Thallium	0.12 J	0.68	mg/kg	A9-109	6 / 135	0.11 - 2.5	0.68	NA	5	(4)	No	IFD
	7440-31-5	Tin	28.1	313	mg/kg	S63	2 / 5	10 - 10	313	4700 n	NA	(4)	No	BSL
	7440-62-2	**Vanadium**	**2.2**	**202**	**mg/kg**	**A9-33**	**134 / 135**	**0.21 - 5**	**202**	**39 n (14)**	**78**	**(4)**	**Yes**	**ASL**
	7440-66-6	Zinc	1.1	596	mg/kg	A9-109	134 / 135	0.24 - 71.9	596	2300 n	23000	(4)	No	BSL

TABLE B-2.1e

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Upland Area of Area 9

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

(4) Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

(5) Screening level for acenaphthene is used as a surrogate for acenaphthylene.

(6) Screening level for pyrene is used as a surrogate for benzo(g,h,i)perylene.

(7) Screening level for anthracene is used as a surrogate for phenanthrene.

(8) Screening level for chlordane is applied to alpha- and gamma-chlordane.

(9) Screening level for endosulfan is applied to endosulfan I and endosulfan II.

(10) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration. Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

(11) Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

(12) Screening level for mercuric chloride is applied to mercury.

(13) Screening level for nickel soluble salts is applied to nickel.

(14) Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
J- = estimated value, biased low
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.1f

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 2, 8, and 11)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion (3)
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	5 J	190 J	µg/kg	S71	33 / 224	4.6 - 93	190	6100000 n	70000000	(4)	No	BSL
	78-93-3	Butanone, 2-	6.3 J	15	µg/kg	A92	2 / 224	4.6 - 93	15	2800000 n	3100000	(4)	No	IFD
	75-15-0	Carbon disulfide	0.42 J	5 J	µg/kg	A41	15 / 224	0.88 - 46	5	82000 n	7800000	(4)	No	BSL
	108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	4 / 224	2.3 - 46	1.2	29000 n	510000	(4)	No	IFD
	67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 224	2.3 - 46	13	290 c	600	(4)	No	IFD
	123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 224	46 - 930	420	4900 c	NA	(4)	No	IFD
	98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 224	2.3 - 46	11	260000 ns	NA	(4)	No	IFD
	75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 224	2.3 - 46	4.4	11000 c	34000	(4)	No	IFD
	100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 224	2.3 - 46	130	820000 ns	90000	(4)	No	IFD
	127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 224	2.3 - 46	0.41	550 c	2000	(4)	No	IFD
	79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 224	2.3 - 46	7.9	2800 c	7000	(4)	No	IFD
	75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 224	2.3 - 46	0.38	79000 n	23000000	(4)	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	4.9	1000 J	µg/kg	A9-23	10 / 224	3.8 - 910	1000	340000 n	3400000	(4)	No	IFD
	208-96-8	Acenaphthylene	9.4 J	84 J	µg/kg	A9-42	7 / 224	3.8 - 910	84	340000 n (5)	NA	(4)	No	IFD
	98-86-2	Acetophenone	14 J	230 J	µg/kg	A9-23	25 / 224	170 - 910	230	780000 n	2000	(4)	No	BSL
	120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	23 / 224	98 - 910	2700	1700000 n	17000000	(4)	No	BSL
	100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A4-10	26 / 224	170 - 910	140	780000 n	6100000	(4)	No	BSL
	56-55-3	**Benzo(a)anthracene**	**2.1 J**	**3000 J**	**µg/kg**	**A9-23**	**146 / 224**	**3.4 - 910**	**3000**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**1.9 J**	**2200 J**	**µg/kg**	**A9-23**	**130 / 224**	**3.4 - 910**	**2200**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**2 J**	**2100 J**	**µg/kg**	**A9-23**	**159 / 224**	**3.4 - 910**	**2100**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	6.8 J	890 J	µg/kg	A9-23	46 / 224	170 - 910	890	170000 n (6)	380000000	(4)	No	BSL
	207-08-9	Benzo(k)fluoranthene	6.9 J	1100 J	µg/kg	A9-23	49 / 224	170 - 910	1100	1500 c	6000	(4)	No	BSL
	92-52-4	Biphenyl, 1,1'-	15 J	200 J	µg/kg	A9-23	4 / 224	170 - 910	200	390000 n	3100000	(4)	No	IFD
	117-81-7	Bis(2-ethylhexyl)phthalate	15 J	2300	µg/kg	S71	63 / 224	170 - 910	2300	35000 c	35000	(4)	No	BSL
	85-68-7	Butylbenzylphthalate	7 J	61000	µg/kg	A9-111	8 / 224	170 - 910	61000	260000 c	1200000	(4)	No	IFD
	86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	13 / 224	170 - 910	890	NA	24000	(4)	No	NTX
	218-01-9	Chrysene	4.5	3800 J	µg/kg	A9-23	86 / 224	3.8 - 910	3800	15000 c	62000	(4)	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**2 J**	**520 J**	**µg/kg**	**A9-23**	**64 / 224**	**3.4 - 910**	**520**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	132-64-9	Dibenzofuran	8.5 J	920 J	µg/kg	A9-23	7 / 224	170 - 910	920	7800 n	NA	(4)	No	IFD
	84-66-2	Diethylphthalate	6.5 J	13 J	µg/kg	A80	6 / 224	170 - 910	13	4900000 n	49000000	(4)	No	IFD
	84-74-2	Di-n-butylphthalate	8.2 J	11000	µg/kg	A9-04	13 / 224	170 - 910	11000	610000 n	6100000	(4)	No	BSL
	117-84-0	Di-n-octyl phthalate	43 J	790 J	µg/kg	S76	5 / 224	170 - 910	790	NA	2400000	(4)	No	IFD
	206-44-0	Fluoranthene	7.5 J	7800 J	µg/kg	A9-23	95 / 224	170 - 910	7800	230000 n	2300000	(4)	No	BSL
	86-73-7	Fluorene	11 J	1200 J	µg/kg	A9-23	11 / 224	3.8 - 910	1200	230000 n	2300000	(4)	No	IFD
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.8 J**	**1200 J**	**µg/kg**	**A9-23**	**109 / 224**	**3.4 - 910**	**1200**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	5.7 J	870 J	µg/kg	A9-23	13 / 224	3.8 - 910	870	31000 n	230000	(4)	No	BSL
	95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 224	98 - 910	170	310000 n	310000	(4)	No	IFD
	106-44-5	Methylphenol, 4-	6.8 J	6.8 J	µg/kg	A80	1 / 224	170 - 910	6.8	31000 n	31000	(4)	No	IFD
	91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	25 / 224	170 - 910	920	3600 c	6000	(4)	No	BSL
	86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 224	170 - 910	25	99000 c	99000	(4)	No	IFD
	87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	9 / 224	6.9 - 1800	12	890 c	3000	(4)	No	IFD
	85-01-8	Phenanthrene	6.5 J	13000 J	µg/kg	A9-23	60 / 224	170 - 910	13000	1700000 n (7)	NA	(4)	No	BSL

TABLE B-2.1f
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 2, 8, and 11)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Semi-volatile Organic Compounds (continued)**												
	108-95-2	Phenol	13 J	73 J	µg/kg	A56	16 / 224	170 - 910	73	1800000 n	18000000	[4]	No	BSL
	129-00-0	Pyrene	9.1 J	6800 J	µg/kg	A9-23	99 / 224	170 - 910	6800	170000 n	1700000	[4]	No	BSL
		PCBs/Pesticides												
	319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 224	0.39 - 13	13	77 c	100	[4]	No	IFD
	5103-71-9	Alpha-chlordane	0.93 J	52 JN	µg/kg	A1-S05	24 / 224	0.39 - 13	52	1600 c [8]	NA	[4]	No	BSL
	11097-69-1	**Aroclor 1254**	**25 J**	**62000**	**µg/kg**	**A9-61**	**38 / 224**	**7.5 - 410**	**62000**	**110 n**	**NA**	**[4]**	**Yes**	**ASL**
	11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 224	7.5 - 410	36	220 c	NA	[4]	No	IFD
	319-85-7	Beta-BHC	0.11 J	0.72 J	µg/kg	A1-S16	2 / 224	0.39 - 13	0.72	270 c	400	[4]	No	IFD
	72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	7 / 224	0.75 - 25	14	2000 c	3000	[4]	No	IFD
	72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	19 / 224	0.75 - 25	130	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	0.56 J	1300 JN	µg/kg	A9-25	31 / 224	0.75 - 25	1300	1700 c	2000	[4]	No	BSL
	319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 224	0.39 - 13	2	270 c [9]	NA	[4]	No	IFD
	60-57-1	Dieldrin	0.85 J	4.7	µg/kg	A9-42	9 / 224	0.75 - 25	4.7	30 c	40	[4]	No	IFD
	959-98-8	Endosulfan I	0.047 J	2.1 JN	µg/kg	A9-26	3 / 224	0.39 - 13	2.1	37000 n [10]	NA	[4]	No	IFD
	33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	8 / 224	0.75 - 25	280	37000 n [10]	NA	[4]	No	IFD
	1031-07-8	Endosulfan Sulfate	5.6 J	58 JN	µg/kg	A1-10	4 / 224	0.75 - 25	58	37000 n [10]	470000	[4]	No	IFD
	72-20-8	Endrin	0.11 J	24 JN	µg/kg	A1-10	8 / 224	0.75 - 25	24	1800 n	23000	[4]	No	IFD
	7421-93-4	Endrin Aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 224	0.75 - 25	11	1800 n [11]	NA	[4]	No	IFD
	53494-70-5	Endrin Ketone	0.059 J	6.8 J	µg/kg	S84	9 / 224	0.75 - 25	6.8	1800 n [11]	NA	[4]	No	IFD
	5103-74-2	Gamma-chlordane	0.96 J	180 JN	µg/kg	A9-25	35 / 224	0.39 - 13	180	1600 c [8]	NA	[4]	No	BSL
	76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	3 / 224	0.39 - 13	3.6	110 c	100	[4]	No	IFD
	1024-57-3	Heptachlor Epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 224	0.39 - 13	8.5	53 c	70	[4]	No	IFD
	72-43-5	Methoxychlor	3.3 J	85 JN	µg/kg	S84	4 / 224	3.9 - 130	85	31000 n	390000	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**149**	**27600 J**	**mg/kg**	**S77**	**777 / 792**	**8 - 105**	**27600**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.11 J**	**2390**	**mg/kg**	**A19**	**342 / 948**	**0.056 - 232**	**2390**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.16 J**	**760 J**	**mg/kg**	**A4**	**911 / 953**	**0.077 - 157**	**760**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	0.77 J	1120	mg/kg	A9-109	538 / 827	0.075 - 105	1120	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	320 / 828	0.1 - 2.6	2	16 n	16	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.007 J**	**13**	**mg/kg**	**A9-109**	**428 / 828**	**0.008 - 2.6**	**12.5**	**7 n**	**78**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	18.6 J	42900	mg/kg	A93	597 / 790	174 - 2619	42900	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.96 J	230	mg/kg	B47	942 / 948	0.11 - 5.2	230	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [12]	0.46	153	mg/kg	A9-21	216 / 218	0.11 - 5.2	152.9	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.3 J**	**8.3 J**	**mg/kg**	**A1-10**	**114 / 218**	**1 - 2.5**	**8.3**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.14 J**	**13**	**mg/kg**	**A9-34**	**539 / 828**	**0.098 - 26.2**	**12.7**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**0.44 J**	**1730**	**mg/kg**	**A1-10**	**916 / 954**	**0.071 - 248**	**1730**	**310 n**	**3100**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**912 J**	**96800**	**mg/kg**	**A13**	**793 / 793**	**4.3 - 52.4**	**96800**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**1.1**	**47700 J**	**mg/kg**	**A19**	**905 / 952**	**0.042 - 29.3**	**47700**	**400 n [13]**	**400**	**[4]**	**Yes**	**ASL**
	7439-92-1	Lead - TRW[14]	3.3	400	mg/kg	A5-T114	191 / 191	1 - 1	400	400 n	400	[4]	No	BSL
	7439-95-4	Magnesium	22.8 J	9920	mg/kg	SED120	617 / 790	198 - 2619	9920	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**2 J**	**3470 J**	**mg/kg**	**SED120**	**816 / 836**	**0.079 - 174**	**3470**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.015 J	1.9	mg/kg	A9-109	346 / 491	0.029 - 0.18	1.9	2.3 n [15]	23	[4]	No	BSL
	7440-02-0	Nickel	0.074 J	68	mg/kg	A1-10	764 / 842	0.088 - 21	68.4	150 n [16]	1600	[4]	No	BSL
	7440-09-7	Potassium	12.7 J	3080	mg/kg	A9-35	481 / 747	191 - 2128	3080	NA	NA	[4]	No	NUT

TABLE B-2.1f

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 2, 8, and 11)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Inorganics (continued)**												
	7782-49-2	Selenium	0.027 J	8.5	mg/kg	A9-42	421 / 828	0.025 - 18.3	8.5	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.055 J	16 J	mg/kg	SED198	135 / 842	0.071 - 5.2	15.6	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	6.2 J	21600 J	mg/kg	A56	480 / 790	207 - 2619	21600	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	23 / 828	0.046 - 13.1	2.8	NA	5	[4]	No	IFD
	7440-31-5	Tin	8 J	1020	mg/kg	SED26	20 / 120	8.7 - 15	1020	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**0.52**	**202**	**mg/kg**	**A9-33**	**809 / 828**	**0.092 - 26.2**	**202**	**39 n [17]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	**Zinc**	**1.1**	**5160 J**	**mg/kg**	**S69**	**810 / 847**	**0.1 - 71.9**	**5160**	**2300 n**	**23000**	**[4]**	**Yes**	**ASL**

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

[4] Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

[5] Screening level for acenaphthene is applied to acenaphthylene.

[6] Screening level for pyrene is applied to benzo(g,h,i)perylene.

[7] Screening level for anthracene is applied to phenanthrene.

[8] Screening level for chlordane is applied to alpha- and gamma-chlordane.

[9] Screening level for hexachlorocyclohexane is applied to delta-BHC.

[10] Screening level for endosulfan is applied to endosulfan I, endosulfan II and endosulfan sulfate.

[11] Screening level for endrin is applied to endrin aldehyde and endrin ketone.

[12] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration.
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

[13] Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

[14] These samples were collected in accordance with EPA Technical Review Workgroup (TRW) guidance (EPA 2000).
TRW samples are composite samples collected from the near-surface (0 to 2 inches below ground surface).
Soil samples consisted of a composite of five subsamples located randomly within a sampling section.
Each sampling section is approximately 0.25 acre (10,000 square feet) in area.
The composite samples were sieved to less than 250 micrometer (µm).

[15] Screening level for mercuric chloride is applied to mercury.

[16] Screening level for nickel soluble salts is applied to nickel.

[17] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
J-= estimated value, biased low
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:
Historical Data:
EPA - September 2008
EPA - April 2009
EPA - June/July 2009
Pre-Remedial Investigation (2010):
Beach Sampling - May 2010
Area 2 - August 2010 - EPA-DESA
Remedial Investigation:
September/December 2010
January 2011

TABLE B-2.1g

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 8 and 11)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion (3)
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	5 J	190 J	µg/kg	S71	35 / 235	4.6 - 93	190	6100000 n	70000000	(4)	No	BSL
	78-93-3	Butanone, 2-	6.3 J	15	µg/kg	A92	2 / 235	4.6 - 93	15	2800000 n	3100000	(4)	No	IFD
	75-15-0	Carbon disulfide	0.42 J	5 J	µg/kg	A41	17 / 235	0.88 - 46	5	82000 n	7800000	(4)	No	BSL
	108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	4 / 235	2.3 - 46	1.2	29000 n	510000	(4)	No	IFD
	67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 235	2.3 - 46	13	290 c	600	(4)	No	IFD
	123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 226	46 - 930	420	4900 c	NA	(4)	No	IFD
	98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 235	2.3 - 46	11	260000 ns	NA	(4)	No	IFD
	75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 235	2.3 - 46	4.4	11000 c	34000	(4)	No	IFD
	100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 235	2.3 - 46	130	820000 ns	90000	(4)	No	IFD
	127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 235	2.3 - 46	0.41	550 c	2000	(4)	No	IFD
	79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 235	2.3 - 46	7.9	2800 c	7000	(4)	No	IFD
	75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 235	2.3 - 46	0.38	79000 n	23000000	(4)	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	4.9	1000 J	µg/kg	A9-23	10 / 237	3.8 - 910	1000	340000 n	3400000	(4)	No	IFD
	208-96-8	Acenaphthylene	9.4 J	84 J	µg/kg	A9-42	7 / 237	3.8 - 910	84	340000 n (5)	NA	(4)	No	IFD
	98-86-2	Acetophenone	14 J	230 J	µg/kg	A9-23	27 / 237	120 - 910	230	780000 n	2000	(4)	No	BSL
	120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	23 / 237	98 - 910	2700	1700000 n	17000000	(4)	No	BSL
	100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A4-10	28 / 237	120 - 910	140	780000 n	6100000	(4)	No	BSL
	56-55-3	**Benzo(a)anthracene**	**2.1 J**	**3000 J**	**µg/kg**	**A9-23**	**147 / 237**	**3.4 - 910**	**3000**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**1.9 J**	**2200 J**	**µg/kg**	**A9-23**	**131 / 237**	**3.4 - 910**	**2200**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**2 J**	**2100 J**	**µg/kg**	**A9-23**	**160 / 237**	**3.4 - 910**	**2100**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	6.8 J	890 J	µg/kg	A9-23	46 / 237	120 - 910	890	170000 n (6)	380000000	(4)	No	BSL
	207-08-9	Benzo(k)fluoranthene	6.9 J	1100 J	µg/kg	A9-23	50 / 237	120 - 910	1100	1500 c	6000	(4)	No	BSL
	92-52-4	Biphenyl, 1,1'-	15 J	200 J	µg/kg	A9-23	4 / 237	120 - 910	200	390000 n	3100000	(4)	No	IFD
	117-81-7	Bis(2-ethylhexyl)phthalate	15 J	3100	µg/kg	A2-07	66 / 237	120 - 910	3100	35000 c	35000	(4)	No	BSL
	85-68-7	Butylbenzylphthalate	7 J	61000	µg/kg	A9-111	8 / 237	120 - 910	61000	260000 c	1200000	(4)	No	IFD
	86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	13 / 237	120 - 910	890	NA	24000	(4)	No	NTX
	218-01-9	Chrysene	4.5	3800 J	µg/kg	A9-23	87 / 237	3.8 - 910	3800	15000 c	62000	(4)	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**2 J**	**520 J**	**µg/kg**	**A9-23**	**64 / 237**	**3.4 - 910**	**520**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	132-64-9	Dibenzofuran	8.5 J	920 J	µg/kg	A9-23	7 / 237	120 - 910	920	7800 n	NA	(4)	No	IFD
	84-66-2	Diethylphthalate	6.5 J	13 J	µg/kg	A80	6 / 237	120 - 910	13	4900000 n	49000000	(4)	No	IFD
	84-74-2	Di-n-butylphthalate	8.2 J	11000	µg/kg	A9-04	13 / 237	170 - 2300	11000	610000 n	6100000	(4)	No	BSL
	117-84-0	Di-n-octyl phthalate	43 J	790 J	µg/kg	S76	5 / 237	120 - 910	790	NA	2400000	(4)	No	IFD
	206-44-0	Fluoranthene	7.5 J	7800 J	µg/kg	A9-23	96 / 237	120 - 910	7800	230000 n	2300000	(4)	No	BSL
	86-73-7	Fluorene	11 J	1200 J	µg/kg	A9-23	11 / 237	3.8 - 910	1200	230000 n	2300000	(4)	No	IFD
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.8 J**	**1200 J**	**µg/kg**	**A9-23**	**109 / 237**	**3.4 - 910**	**1200**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	5.7 J	870 J	µg/kg	A9-23	13 / 237	3.8 - 910	870	31000 n	230000	(4)	No	BSL
	95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 237	98 - 910	170	310000 n	310000	(4)	No	IFD
	106-44-5	Methylphenol, 4-	6.8 J	6.8 J	µg/kg	A80	1 / 237	120 - 910	6.8	31000 n	31000	(4)	No	IFD
	91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	25 / 237	120 - 910	920	3600 c	6000	(4)	No	BSL
	86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 237	120 - 910	25	99000 c	99000	(4)	No	IFD
	87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	9 / 237	6.9 - 1800	12	890 c	3000	(4)	No	IFD
	85-01-8	Phenanthrene	6.5 J	13000 J	µg/kg	A9-23	61 / 237	120 - 910	13000	1700000 n (7)	NA	(4)	No	BSL

TABLE B-2.1g
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 8 and 11)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Semi-volatile Organic Compounds (continued)**												
	108-95-2	Phenol	12 J	73 J	µg/kg	A56	18 / 237	120 - 910	73	1800000 n	18000000	[4]	No	BSL
	129-00-0	Pyrene	9.1 J	6800 J	µg/kg	A9-23	101 / 237	120 - 910	6800	170000 n	1700000	[4]	No	BSL
		PCBs/Pesticides												
	319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 237	0.39 - 13	13	77 c	100	[4]	No	IFD
	5103-71-9	Alpha-chlordane	0.93 J	52 JN	µg/kg	A1-S05	24 / 237	0.39 - 13	52	1600 c [8]	NA	[4]	No	BSL
	11097-69-1	**Aroclor 1254**	**25 J**	**62000**	**µg/kg**	**A9-61**	**40 / 237**	**7.5 - 410**	**62000**	**110 n**	**NA**	**[4]**	**Yes**	**ASL**
	11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 237	7.5 - 410	36	220 c	NA	[4]	No	IFD
	319-85-7	Beta-BHC	0.11 J	0.72 J	µg/kg	A1-SS16	2 / 237	0.39 - 13	0.72	270 c	400	[4]	No	IFD
	72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	7 / 237	0.75 - 25	14	2000 c	3000	[4]	No	IFD
	72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	21 / 237	0.75 - 25	130	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	0.56 J	1300 JN	µg/kg	A9-25	33 / 237	0.75 - 25	1300	1700 c	2000	[4]	No	BSL
	319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 237	0.39 - 13	2	270 c [9]	NA	[4]	No	IFD
	60-57-1	Dieldrin	0.85 J	4.7	µg/kg	A9-42	9 / 237	0.75 - 25	4.7	30 c	40	[4]	No	IFD
	959-98-8	Endosulfan I	0.047 J	2.1 JN	µg/kg	A9-26	3 / 237	0.39 - 13	2.1	37000 n [10]	NA	[4]	No	IFD
	33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	8 / 237	0.75 - 25	280	37000 n [10]	NA	[4]	No	IFD
	1031-07-8	Endosulfan Sulfate	5.6 J	58 JN	µg/kg	A1-10	4 / 237	0.75 - 25	58	37000 n [10]	470000	[4]	No	IFD
	72-20-8	Endrin	0.11 J	24 JN	µg/kg	A1-10	8 / 237	0.75 - 25	24	1800 n	23000	[4]	No	IFD
	7421-93-4	Endrin Aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 237	0.75 - 25	11	1800 n [11]	NA	[4]	No	IFD
	53494-70-5	Endrin Ketone	0.059 J	6.8 J	µg/kg	S84	9 / 237	0.75 - 25	6.8	1800 n [11]	NA	[4]	No	IFD
	5103-74-2	Gamma-chlordane	0.96 J	180 JN	µg/kg	A9-25	35 / 237	0.39 - 13	180	1600 c [8]	NA	[4]	No	BSL
	76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	3 / 237	0.39 - 13	3.6	110 c	100	[4]	No	IFD
	1024-57-3	Heptachlor Epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 237	0.39 - 13	8.5	53 c	70	[4]	No	IFD
	72-43-5	Methoxychlor	3.3 J	85 JN	µg/kg	S84	4 / 237	3.9 - 130	85	31000 n	390000	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**149**	**27600 J**	**mg/kg**	**S77**	**870 / 885**	**8 - 105**	**27600**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.11 J**	**2390**	**mg/kg**	**A19**	**425 / 1042**	**0.056 - 232**	**2390**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.16 J**	**760 J**	**mg/kg**	**A4**	**1005 / 1047**	**0.077 - 157**	**760**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	0.77 J	1120	mg/kg	A9-109	599 / 922	0.075 - 105	1120	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	378 / 922	0.1 - 2.6	2	16 n	16	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.007 J**	**13**	**mg/kg**	**A9-109**	**459 / 922**	**0.008 - 2.6**	**12.5**	**7 n**	**78**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	18.6 J	42900	mg/kg	A93	665 / 883	45 - 2619	42900	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.96 J	230	mg/kg	B47	1036 / 1042	0.11 - 5.2	230	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [12]	0.46	152.9	mg/kg	A9-21	237 / 239	0.11 - 5.2	152.9	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.12**	**8.3 J**	**mg/kg**	**A1-10**	**119 / 239**	**0.1 - 2.5**	**8.3**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.14 J**	**13**	**mg/kg**	**A9-34**	**595 / 922**	**0.098 - 26.2**	**12.7**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**0.44 J**	**1730**	**mg/kg**	**A1-10**	**1009 / 1047**	**0.071 - 248**	**1730**	**310 n**	**3100**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**912 J**	**96800**	**mg/kg**	**A13**	**886 / 886**	**4.3 - 52.4**	**96800**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**1.1**	**47700 J**	**mg/kg**	**A19**	**999 / 1046**	**0.042 - 29.3**	**47700**	**400 n [13]**	**400**	**[4]**	**Yes**	**ASL**
	7439-92-1	Lead - TRW [14]	3.3	400	mg/kg	A5-T114	191 / 191	1 - 1	400	400 n	400	[4]	No	BSL
	7439-95-4	Magnesium	22.8 J	9920	mg/kg	SED120	694 / 883	198 - 2619	9920	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**2 J**	**3470 J**	**mg/kg**	**SED120**	**909 / 929**	**0.079 - 174**	**3470**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.015 J	1.9	mg/kg	A9-109	378 / 556	0.029 - 0.18	1.9	2.3 n [15]	23	[4]	No	BSL
	7440-02-0	Nickel	0.074 J	68.4	mg/kg	A1-10	844 / 936	0.088 - 21	68.4	150 n [16]	1600	[4]	No	BSL
	7440-09-7	Potassium	12.7 J	3080	mg/kg	A9-35	539 / 840	191 - 2128	3080	NA	NA	[4]	No	NUT

TABLE B-2.1g

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 8 and 11)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**Inorganics (continued)**												
	7782-49-2	Selenium	0.027 J	8.5	mg/kg	A9-42	453 / 922	0.025 - 18.3	8.5	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.055 J	16 J	mg/kg	SED198	151 / 936	0.071 - 5.2	15.6	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	6.2 J	21600 J	mg/kg	A56	539 / 883	87 - 2619	21600	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	25 / 922	0.046 - 13.1	2.8	NA	5	[4]	No	IFD
	7440-31-5	Tin	8 J	1020	mg/kg	SED26	38 / 149	8.7 - 15	1020	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**0.52**	**202**	**mg/kg**	**A9-33**	**903 / 922**	**0.092 - 26.2**	**202**	**39 n [17]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	**Zinc**	**1.1**	**5160 J**	**mg/kg**	**S69**	**904 / 941**	**0.1 - 71.9**	**5160**	**2300 n**	**23000**	**[4]**	**Yes**	**ASL**

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

[4] Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

[5] Screening level for acenaphthene is applied to acenaphthylene.

[6] Screening level for pyrene is applied to benzo(g,h,i)perylene.

[7] Screening level for anthracene is applied to phenanthrene.

[8] Screening level for chlordane is applied to alpha- and gamma-chlordane.

[9] Screening level for hexachlorocyclohexane is applied to delta-BHC.

[10] Screening level for endosulfan is applied to endosulfan I, endosulfan II, and endosulfan sulfate.

[11] Screening level for endrin is applied to endrin aldehyde and endrin ketone.

[12] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration.
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

[13] Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

[14] These samples were collected in accordance with EPA Technical Review Workgroup (TRW) guidance (EPA 2000).
TRW samples are composite samples collected from the near-surface (0 to 2 inches below ground surface).
Soil samples consisted of a composite of five subsamples located randomly within a sampling section.
Each sampling section is approximately 0.25 acre (10,000 square feet) in area.
The composite samples were sieved to less than 250 micrometer (µm).

[15] Screening level for mercuric chloride is applied to mercury.

[16] Screening level for nickel soluble salts is applied to nickel.

[17] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
J-= estimated value, biased low
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.1h

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 8 and 11

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion (3)
Surface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	4.8 J	89	µg/kg	A11-07	3 / 25	4.7 - 8.4	89	6100000 n	70000000	(4)	No	BSL
	78-93-3	Butanone, 2-	12 J	12 J	µg/kg	C71	1 / 25	4.6 - 8.4	12	2800000 n	3100000	(4)	No	IFD
	75-15-0	Carbon disulfide	1.1 J	13	µg/kg	A11-04	6 / 25	1.8 - 0.74	13	82000 n	7800000	(4)	No	BSL
	1634-04-4	Methyl tert-Butyl Ether	1.3 J	1.3 J	µg/kg	C91	1 / 25	1.3 - 4.2	1.3	43000 c	110000	(4)	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	6.1	220	µg/kg	A11-07	9 / 26	3.5 - 330	220	340000 n	3400000	(4)	No	BSL
	208-96-8	Acenaphthylene	7.2	160	µg/kg	A8-05	15 / 26	3.5 - 330	160	340000 n (5)	NA	(4)	No	BSL
	98-86-2	Acetophenone	21 J	150 J	µg/kg	A8-05	8 / 26	180 - 330	150	780000 n	2000	(4)	No	BSL
	120-12-7	Anthracene	7.7 J	690 J	µg/kg	A8-05	14 / 26	91 - 330	690	1700000 n	17000000	(4)	No	BSL
	100-52-7	Benzaldehyde	27 J	93 J	µg/kg	C55	5 / 26	180 - 330	93	780000 n	6100000	(4)	No	BSL
	56-55-3	**Benzo(a)anthracene**	**6**	**1900 J**	**µg/kg**	**A8-05**	**24 / 26**	**3.5 - 330**	**1900**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**7.6**	**1400 J**	**µg/kg**	**A8-05**	**24 / 26**	**3.5 - 330**	**1400**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**51 J**	**1900**	**µg/kg**	**A8-05**	**18 / 26**	**3.6 - 330**	**1900**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	33 J	960	µg/kg	A8-05	16 / 26	180 - 330	960	170000 n (6)	380000000	(4)	No	BSL
	207-08-9	Benzo(k)fluoranthene	16 J	880	µg/kg	A8-05	16 / 26	180 - 330	880	1500 c	6000	(4)	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	23 J	760	µg/kg	C71	12 / 26	180 - 330	760	35000 c	35000	(4)	No	BSL
	85-68-7	Butylbenzylphthalate	9.3 J	29 J	µg/kg	C71	2 / 26	180 - 330	29	260000 c	1200000	(4)	No	BSL
	86-74-8	Carbazole	7.3 J	140 J	µg/kg	A8-01	5 / 26	180 - 330	140	NA	24000	(4)	No	NTX
	218-01-9	Chrysene	6.4	1900 J	µg/kg	A8-05	24 / 26	3.5 - 330	1900	15000 c	62000	(4)	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**4.2**	**260**	**µg/kg**	**A8-05**	**18 / 26**	**3.5 - 330**	**260**	**15 c**	**200**	**(4)**	**Yes**	**ASL**
	132-64-9	Dibenzofuran	7.5 J	120 J	µg/kg	A8-05	3 / 26	180 - 330	120	7800 n	NA	(4)	No	BSL
	91-94-1	Dichlorobenzidine, 3,3`-	210 J	210 J	µg/kg	A11-10	1 / 26	91 - 330	210	1100 c	1000	(4)	No	IFD
	84-66-2	Diethylphthalate	7.6 J	12 J	µg/kg	C55	4 / 26	180 - 330	12	4900000 n	49000000	(4)	No	BSL
	84-74-2	Di-n-butylphthalate	9.6 J	70 J	µg/kg	A11-05	6 / 26	180 - 330	70	610000 n	6100000	(4)	No	BSL
	117-84-0	Di-n-octyl phthalate	100 J	100 J	µg/kg	C71	1 / 26	180 - 330	100	NA	2400000	(4)	No	IFD
	206-44-0	Fluoranthene	42 J	3400	µg/kg	A8-05	21 / 26	180 - 330	3400	230000 n	2300000	(4)	No	BSL
	86-73-7	Fluorene	4.4	260	µg/kg	A8-05	14 / 26	3.5 - 330	260	230000 n	2300000	(4)	No	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**32 J**	**840**	**µg/kg**	**A8-05**	**16 / 26**	**3.6 - 330**	**840**	**150 c**	**600**	**(4)**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	4.3	71 J	µg/kg	A8-05	15 / 26	3.5 - 330	71	31000 n	230000	(4)	No	BSL
	106-44-5	Methylphenol, 4-	15 J	38 J	µg/kg	C23	4 / 26	180 - 330	38	31000 n	31000	(4)	No	BSL
	91-20-3	Naphthalene	11 J	37 J	µg/kg	C91	5 / 26	180 - 330	37	3600 c	6000	(4)	No	BSL
	87-86-5	Pentachlorophenol	7.2 J	7.2 J	µg/kg	A8-07	1 / 26	7.4 - 630	7.2	890 c	3000	(4)	No	IFD
	85-01-8	Phenanthrene	33 J	2300	µg/kg	A8-05	18 / 26	180 - 330	2300	1700000 n (7)	NA	(4)	No	BSL
	108-95-2	Phenol	19 J	41 J	µg/kg	C55	5 / 26	180 - 330	41	1800000 n	18000000	(4)	No	BSL
	129-00-0	Pyrene	50 J	2500	µg/kg	A8-05	18 / 26	180 - 330	2500	170000 n	1700000	(4)	No	BSL

TABLE B-2.1h

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 8 and 11

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Soil		**PCBs/Pesticides**												
	5103-71-9	Alpha-chlordane	1 J	1 J	µg/kg	A8-07	2 / 25	0.36 / 3.3	1	1600 c [8]	NA	[4]	No	BSL
	11097-69-1	**Aroclor 1254**	**6.6 J**	**720**	**µg/kg**	**A8-05**	**8 / 25**	**7 / 63**	**720**	**110 n**	**NA**	**[4]**	**Yes**	**ASL**
	72-55-9	DDE, 4,4'-	0.45 J	5.1	µg/kg	C71	3 / 25	0.7 / 6.3	5.1	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	0.59 J	96 J	µg/kg	A8-05	6 / 25	0.7 / 6.3	96	1700 c	2000	[4]	No	BSL
	33213-65-9	Endosulfan II	0.24 J	36	µg/kg	A8-05	3 / 25	0.7 / 6.3	36	37000 n [9]	NA	[4]	No	BSL
	1031-07-8	Endosulfan Sulfate	9.1 JN	24 JN	µg/kg	A8-05	2 / 25	0.7 / 6.3	24	37000 n [9]	470000	[4]	No	BSL
	72-20-8	Endrin	1.6 J	1.6 J	µg/kg	C71	1 / 25	0.7 / 6.3	1.6	1800 n	23000	[4]	No	IFD
	53494-70-5	Endrin Ketone	0.068 J	0.068 J	µg/kg	C55	1 / 25	0.7 / 6.3	0.068	1800 n [10]	NA	[4]	No	IFD
	5103-74-2	Gamma-chlordane	19 J	52 JN	µg/kg	A8-05	2 / 25	0.36 / 3.3	52	1600 c [8]	NA	[4]	No	BSL
	76-44-8	Heptachlor	0.38 J	0.38 J	µg/kg	C71	1 / 25	0.36 / 3.3	0.38	110 c	100	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**732**	**13500 J**	**mg/kg**	**C23**	**182 / 182**	**16.5 / 54.1**	**13500**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.21 J**	**3270**	**mg/kg**	**SED89**	**60 / 186**	**0.057 / 16.2**	**3270**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.62 J**	**2470 J**	**mg/kg**	**S98**	**184 / 184**	**0.078 / 2.7**	**2470**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	1.2 J	1340 J	mg/kg	SED89	135 / 186	0.076 / 54.1	1340	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.15 J	1.4	mg/kg	A8-07	119 / 186	0.11 / 1.4	1.4	16 n	16	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.022 J**	**22**	**mg/kg**	**SED90**	**102 / 186**	**0.008 / 1.4**	**22.1**	**7 n**	**78**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	129 J	26500	mg/kg	C28	169 / 182	411 / 1350	26500	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	1.6	3500	mg/kg	SED90	186 / 186	0.12 / 2.7	3500	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [11]	1.05	121.7	mg/kg	A8-17	56 / 56	0.12 / 2.7	121.7	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.31 J-**	**2.2 J**	**mg/kg**	**A8-07**	**29 / 56**	**1.1 / 2.6**	**2.2**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.34 J**	**24**	**mg/kg**	**S98**	**155 / 186**	**0.099 / 13.5**	**24.1**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**2.4 J**	**4630**	**mg/kg**	**S98**	**184 / 184**	**0.073 / 6.8**	**4630**	**310 n**	**3100**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**1990**	**183000 J**	**mg/kg**	**S98**	**182 / 182**	**8.2 / 27.1**	**183000**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**2.9**	**198000**	**mg/kg**	**S97**	**182 / 184**	**0.1 / 5.7**	**198000**	**400 n [12]**	**400**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	256 J	10500 J	mg/kg	SED56	168 / 182	411 / 1350	10500	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**4.8**	**1710**	**mg/kg**	**SED90**	**184 / 184**	**0.08 / 4.1**	**1710**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.026 J	2.2	mg/kg	A8-17	159 / 168	0.03 / 0.26	2.2	2.3 n [13]	23	[4]	No	BSL
	7440-02-0	**Nickel**	**0.48 J**	**1500**	**mg/kg**	**SED90**	**184 / 186**	**0.088 / 10.8**	**1500**	**150 n [14]**	**1600**	**[4]**	**Yes**	**ASL**
	7440-09-7	Potassium	161 J	3870 J	mg/kg	SED56	121 / 182	411 / 1350	3870	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.03 J	5.7 J	mg/kg	C23	106 / 186	0.025 / 9.5	5.7	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.1 J	4.5 J	mg/kg	S96	73 / 186	0.072 / 2.7	4.5	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	96.4 J	60000 J	mg/kg	SED56	169 / 182	411 / 1350	60000	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.24 J	1.7 J	mg/kg	S97	3 / 186	0.046 / 64	1.7	NA	5	[4]	No	IFD
	7440-31-5	Tin	10.7	3580	mg/kg	S98	11 / 18	10 / 10	3580	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**2.8 J**	**75**	**mg/kg**	**C87**	**186 / 186**	**0.093 / 13.5**	**75.1**	**39 n [15]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	**Zinc**	**3.3 J**	**2700 J**	**mg/kg**	**S98**	**184 / 184**	**0.1 / 16.2**	**2700**	**2300 n**	**23000**	**[4]**	**Yes**	**ASL**

TABLE B-2.1h

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 8 and 11

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

(4) Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

(5) Screening level for acenaphthene is applied to acenaphthylene.

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(8) Screening level for chlordane is applied to alpha- and gamma-chlordane.

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(10) Screening level for endrin is applied to endrin ketone.

(11) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration. Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

(12) Lead screening level is from OSWER screening level for residential soil (400 mg/kg).

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(14) Screening level for nickel soluble salts is applied to nickel.

(15) Screening level for vanadium and compounds is applied to vanadium.

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NA = not available
ND = not detected
n = screening toxicity value is based on noncancer effects
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COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
J- = estimated value, biased low
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface/Subsurface Soil - All Upland Areas

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface/ Subsurface Soil		**Volatile Organic Compounds**												
	67-64-1	Acetone	5 J	190 J	µg/kg	S71	59 / 420	4.6 - 93	190	6100000 n	70000000	[4]	No	BSL
	75-15-0	Carbon disulfide	3 J	13	µg/kg	A11-04	8 / 420	0.88 - 46	13	82000 n	7800000	[4]	No	IFD
	67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 420	2.3 - 46	13	290 c	600	[4]	No	IFD
	123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 403	46 - 930	420	4900 c	NA	[4]	No	IFD
	98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 420	2.3 - 46	11	260000 ns	NA	[4]	No	IFD
	75-09-2	Methylene chloride	2.2 J	5 J	µg/kg	A9-31	12 / 420	2.3 - 46	5	11000 c	34000	[4]	No	IFD
	100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 420	2.3 - 46	130	820000 ns	90000	[4]	No	IFD
	127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 420	2.3 - 46	0.41	550 c	2000	[4]	No	IFD
	79-01-6	Trichloroethene	0.77 J	7.9	µg/kg	A3-S90	2 / 420	2.3 - 46	7.9	2800 c	7000	[4]	No	IFD
	75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 420	2.3 - 46	0.38	79000 n	23000000	[4]	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	6.5 J	1000 J	µg/kg	A9-23	24 / 423	4.1 - 990	1000	340000 n	3400000	[4]	No	BSL
	208-96-8	Acenaphthylene	6.5 J	84 J	µg/kg	A9-42	17 / 423	4.1 - 990	84	340000 n [5]	NA	[4]	No	IFD
	98-86-2	Acetophenone	27 J	230 J	µg/kg	A9-23	16 / 423	120 - 990	230	780000 n	2000	[4]	No	IFD
	120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	49 / 423	110 - 990	2700	1700000 n	17000000	[4]	No	BSL
	100-52-7	Benzaldehyde	24 J	510	µg/kg	A4-08	14 / 423	120 - 990	510	780000 n	6100000	[4]	No	IFD
	56-55-3	**Benzo(a)anthracene**	**2.1 J**	**3000 J**	**µg/kg**	**A9-23**	**241 / 423**	**3.4 - 990**	**3000**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**1.9 J**	**2300 J**	**µg/kg**	**A9-23**	**222 / 423**	**3.4 - 990**	**2300**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**2 J**	**3100 J**	**µg/kg**	**A9-23**	**265 / 423**	**3.4 - 990**	**3100**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	22 J	890 J	µg/kg	A9-23	81 / 423	120 - 990	890	170000 n [6]	380000000	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	10 J	1100 J	µg/kg	A9-23	91 / 423	120 - 990	1100	1500 c	6000	[4]	No	BSL
	92-52-4	Biphenyl, 1,1'-	6.4 J	200 J	µg/kg	A9-23	10 / 423	120 - 990	200	390000 n	3100000	[4]	No	IFD
	111-91-1	Bis(2-Chloroethoxy)methane	11 J	11 J	µg/kg	A1-S14	1 / 423	120 - 990	11	18000 n	NA	[4]	No	IFD
	111-44-4	Bis(2-Chloroethyl)ether	11 J	11 J	µg/kg	A1-S14	1 / 423	120 - 990	11	210 c	400	[4]	No	IFD
	117-81-7	Bis(2-Ethylhexyl)phthalate	23 J	3100	µg/kg	A2-07	66 / 423	120 - 990	3100	35000 c	35000	[4]	No	BSL
	85-68-7	Butylbenzylphthalate	39 J	61000	µg/kg	A9-111	8 / 423	120 - 990	61000	260000 c	1200000	[4]	No	IFD
	105-60-2	Caprolactam	49 J	86 J	µg/kg	A9-46	2 / 423	120 - 990	86	3100000 n	31000000	[4]	No	IFD
	86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	27 / 423	120 - 990	890	NA	24000	[4]	No	NTX
	58-90-2	Chlorophenols	28 J	28 J	µg/kg	A9-06	1 / 423	170 - 990	28	180000 n	NA	[4]	No	IFD
	218-01-9	Chrysene	14 J	3800 J	µg/kg	A9-23	138 / 423	4.1 - 990	3800	15000 c	62000	[4]	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**1.9 J**	**520 J**	**µg/kg**	**A9-23**	**111 / 423**	**3.4 - 990**	**520**	**15 c**	**200**	**[4]**	**Yes**	**ASL**
	132-64-9	Dibenzofuran	6.1 J	920 J	µg/kg	A9-23	21 / 423	120 - 990	920	7800 n	NA	[4]	No	IFD
	91-94-1	Dichlorobenzidine, 3,3`-	210 J	210 J	µg/kg	A11-10	1 / 423	110 - 990	210	1100 c	1000	[4]	No	IFD
	84-74-2	Di-N-Butylphthalate	30 J	11000	µg/kg	A9-04	4 / 423	170 - 4200	11000	610000 n	6100000	[4]	No	IFD
	117-84-0	Di-N-Octyl Phthalate	43 J	790 J	µg/kg	S76	5 / 423	120 - 990	790	NA	2400000	[4]	No	IFD
	206-44-0	Fluoranthene	20 J	7800 J	µg/kg	A9-23	159 / 423	120 - 990	7800	230000 n	2300000	[4]	No	BSL
	86-73-7	Fluorene	4.4	1200 J	µg/kg	A9-23	33 / 423	4.1 - 990	1200	230000 n	2300000	[4]	No	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**1.8 J**	**1200 J**	**µg/kg**	**A9-23**	**186 / 423**	**3.4 - 990**	**1200**	**150 c**	**600**	**[4]**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	4.8	870 J	µg/kg	A9-23	27 / 423	4.1 - 990	870	31000 n	230000	[4]	No	BSL

TABLE B-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface/Subsurface Soil - All Upland Areas

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface/ Subsurface Soil		**Semi-volatile Organic Compounds (continued)**												
	95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 423	110 - 990	170	310000 n	310000	[4]	No	IFD
	91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	33 / 423	120 - 990	920	3600 c	6000	[4]	No	BSL
	86-30-6	Nitrosodiphenylamine, N-	25 J	110 J	µg/kg	A1-S14	2 / 423	120 - 990	110	99000 c	99000	[4]	No	IFD
	87-86-5	Pentachlorophenol	2 J	720 J	µg/kg	A9-06	18 / 423	6.9 - 1900	720	890 c	3000	[4]	No	IFD
	85-01-8	Phenanthrene	8.4 J	13000 J	µg/kg	A9-23	97 / 423	120 - 990	13000	1700000 n [7]	NA	[4]	No	BSL
	108-95-2	Phenol	32 J	38 J	µg/kg	A9-23	2 / 423	120 - 990	38	1800000 n	18000000	[4]	No	IFD
	129-00-0	Pyrene	18 J	6800 J	µg/kg	A9-23	159 / 423	120 - 990	6800	170000 n	1700000	[4]	No	BSL
		PCBs/Pesticides												
	319-84-6	Alpha-BHC	0.29 J	13 J	µg/kg	S79	4 / 422	0.42 - 13	13	77 c	100	[4]	No	IFD
	5103-71-9	Alpha-chlordane	0.37 J	52 JN	µg/kg	A1-S05	41 / 422	0.42 - 13	52	1600 c [8]	NA	[4]	No	BSL
	11097-69-1	**Aroclor 1254**	**17 J**	**62000**	**µg/kg**	**A9-61**	**58 / 422**	**8.2 - 410**	**62000**	**110 n**	**NA**	**[4]**	**Yes**	**ASL**
	11096-82-5	Aroclor 1260	23 J	46	µg/kg	A9-44	4 / 422	8.2 - 410	46	220 c	NA	[4]	No	IFD
	319-85-7	Beta-BHC	0.72 J	0.72 J	µg/kg	A1-S16	1 / 422	0.42 - 13	0.72	270 c	400	[4]	No	IFD
	72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	13 / 422	0.82 - 25	14	2000 c	3000	[4]	No	IFD
	72-55-9	DDE, 4,4'-	0.51 J	130	µg/kg	A1-S15	28 / 422	0.82 - 25	130	1400 c	2000	[4]	No	BSL
	50-29-3	DDT, 4,4'-	0.19 J	1300 JN	µg/kg	A9-25	45 / 422	0.82 - 25	1300	1700 c	2000	[4]	No	BSL
	319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	3 / 422	0.42 - 13	2.0	270 c [9]	NA	[4]	No	IFD
	60-57-1	Dieldrin	0.85 J	41 JN	µg/kg	A9-23	12 / 422	0.82 - 25	41	30 c	40	[4]	No	IFD
	959-98-8	Endosulfan I	2.1 JN	2.1 JN	µg/kg	A9-26	1 / 422	0.42 - 13	2.1	37000 n [10]	NA	[4]	No	IFD
	33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	10 / 422	0.82 - 25	280	37000 n [10]	NA	[4]	No	IFD
	1031-07-8	Endosulfan sulfate	2.2	58 JN	µg/kg	A1-10	5 / 422	0.82 - 25	58	37000 n [10]	470000	[4]	No	IFD
	72-20-8	Endrin	0.21 J	24 JN	µg/kg	A1-10	9 / 422	0.82 - 25	24	1800 n	23000	[4]	No	IFD
	7421-93-4	Endrin aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 422	0.82 - 25	11	1800 n [11]	NA	[4]	No	IFD
	53494-70-5	Endrin ketone	1.2 J	6.8 J	µg/kg	S84	4 / 422	0.82 - 25	6.8	1800 n [11]	NA	[4]	No	IFD
	58-89-9	Gamma-BHC (lindane)	0.059 J	0.059 J	µg/kg	A1-S18	1 / 422	0.42 - 13	0.059	520 c	400	[4]	No	IFD
	5103-74-2	Gamma-chlordane	0.25 J	180 JN	µg/kg	A9-25	51 / 422	0.42 - 13	180	1600 c [8]	NA	[4]	No	BSL
	76-44-8	Heptachlor	1.5 J	3.6	µg/kg	A1-S05	5 / 422	0.42 - 13	3.6	110 c	100	[4]	No	IFD
	1024-57-3	Heptachlor epoxide	1.9	8.5 JN	µg/kg	A1-S05	7 / 422	0.42 - 13	8.5	53 c	70	[4]	No	IFD
	72-43-5	Methoxychlor	0.65 J	85 JN	µg/kg	S84	7 / 422	4.2 - 130	85	31000 n	390000	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**149**	**30400 J**	**mg/kg**	**S75**	**771 / 771**	**8 - 105**	**30400**	**7700 n**	**78000**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.061**	**3270**	**mg/kg**	**SED89**	**385 / 858**	**0.06 - 39.6**	**3270**	**3.1 n**	**31**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.13 J**	**2100 J**	**mg/kg**	**SED89**	**829 / 858**	**0.08 - 54.3**	**2100**	**0.39 c**	**19***	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	0.72 J	1340 J	mg/kg	SED89	633 / 780	0.08 - 105	1340	1500 n	16000	[4]	No	BSL
	7440-41-7	Beryllium	0.02 J	1.4 J	mg/kg	A5-14/A8-07	217 / 780	0.1 - 2.6	1.4	16 n	16	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.0083 J**	**13**	**mg/kg**	**A9-109**	**463 / 780**	**0.01 - 2.6**	**12.5**	**7 n**	**78**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	18.6 J	32800	mg/kg	S22	471 / 770	45 - 2619	32800	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.76 J	230	mg/kg	B47	855 / 858	0.11 - 5.2	230	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [12]	0.43 J	153	mg/kg	A9-21	490 / 496	0.11 - 5.2	152.9	12000 n	NA	[4]	No	BSL

TABLE B-2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface/Subsurface Soil - All Upland Areas

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface/ Subsurface Soil		**Inorganics (continued)**												
	18540-29-9	**Chromium VI**	**0.12**	**46 J**	**mg/kg**	**A9-23**	**257 / 496**	**0.1 - 6.2**	**46**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL**
	7440-48-4	**Cobalt**	**0.14 J**	**25**	**mg/kg**	**A8-06**	**493 / 780**	**0.1 - 26.2**	**24.8**	**2.3 n**	**1600**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**0.46 J**	**4950 J**	**mg/kg**	**A5**	**833 / 858**	**0.07 - 49.9**	**4950**	**310 n**	**3100**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**912 J**	**154000**	**mg/kg**	**SED89**	**771 / 771**	**4.3 - 52.4**	**154000**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**1.7 J**	**40000**	**mg/kg**	**A8-04**	**837 / 860**	**0.04 - 29.3**	**40000**	**800 n [13]**	**400**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	22.8 J	4310	mg/kg	A9-58	471 / 770	47 - 2619	4310	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**0.66 J**	**1250**	**mg/kg**	**SED89**	**782 / 780**	**0.06 - 55.8**	**1250**	**180 n**	**11000**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.014 J	1.9	mg/kg	A9-109	391 / 547	0.03 - 0.12	1.9	2.3 n [14]	23	[4]	No	BSL
	7440-02-0	Nickel	0.074 J	89 J	mg/kg	SED89	724 / 780	0.09 - 21	88.8	150 n [15]	1600	[4]	No	BSL
	7440-09-7	Potassium	12.7 J	3080	mg/kg	A9-35	444 / 703	191 - 1090	3080	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.027 J	14	mg/kg	A9-23	333 / 780	0.03 - 18.3	13.8	39 n	390	[4]	No	BSL
	7440-22-4	Silver	0.054 J	31	mg/kg	A9-23	127 / 780	0.07 - 5.2	31.1	39 n	390	[4]	No	BSL
	7440-23-5	Sodium	6.2 J	7230	mg/kg	SED89	215 / 770	87 - 2619	7230	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.049 J	2.8	mg/kg	S80	59 / 780	0.05 - 13.1	2.8	NA	5	[4]	No	NTX
	7440-31-5	Tin	10.7	1980 J	mg/kg	SED89	18 / 68	10 - 10	1980	4700 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**1.5 J**	**202**	**mg/kg**	**A9-33**	**768 / 780**	**0.09 - 26.2**	**202**	**39 n [16]**	**78**	**[4]**	**Yes**	**ASL**
	7440-66-6	**Zinc**	**0.26 J**	**5160 J**	**mg/kg**	**S69**	**752 / 780**	**0.1 - 71.9**	**5160**	**2300 n**	**23000**	**[4]**	**Yes**	**ASL**

TABLE B-2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface/Subsurface Soil - All Upland Areas

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

* ARAR/TBC value for arsenic of 19 mg/kg is based on natural background.

(4) Potential ARAR/TBC level source: NJDEP 2009. Residential Direct Contact Health Based Criteria and Soil Remediation Standards (Last Revised 11/2009); http://www.nj.gov/dep/srp/regs/rs/, downloaded September 26, 2011

(5) Screening level for acenaphthene is applied to acenaphthylene.

(6) Screening level for pyrene is applied to benzo(g,h,i)perylene.

(7) Screening level for anthracene is applied to phenanthrene.

(8) Screening level for chlordane is applied to alpha- and gamma-chlordane.

(9) Screening level for hexachlorocyclohexane is applied to delta-BHC.

(10) Screening level for endosulfan is applied to endosulfan I, endosulfan II and endosulfan sulfate.

(11) Screening level for endrin is applied to endrin aldehyde and endrin ketone.

(12) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium

(13) Lead screening level is from OSWER screening level for industrial soil (800 mg/kg).

(14) Screening level for mercuric chloride is applied to mercury.

(15) Screening level for nickel soluble salts is applied to nickel.

(16) Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.3a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater (<10 feet bgs)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Groundwater		**Semi-volatile Organic Compounds**												
	83-32-9	Acenaphthene	1.1 J	23	µg/L	MW-13S	2 / 7	5 - 5	23	220 n	400	[4]	No	BSL
	56-55-3	**Benzo(a)anthracene**	**0.17**	**0.17**	**µg/L**	**MW-13S**	**1 / 7**	**0.1 - 0.1**	**0.17**	**0.029 c**	**0.05**	**[4]**	**Yes**	**ASL**
	92-52-4	Biphenyl, 1,1'-	2.2 J	2.2 J	µg/L	MW-13S	1 / 7	5 - 5	2.2	180 n	400	[4]	No	BSL
	117-81-7	Bis(2-Ethylhexyl)phthalate	1.3 J	1.3 J	µg/L	MW-01D	1 / 7	2 - 2	1.3	4.8 c	6	[4]	No	BSL
	86-74-8	Carbazole	1.7 J	1.7 J	µg/L	MW-13S	1 / 7	5 - 5	1.7	NA	NA	[4]	No	NTX
	132-64-9	**Dibenzofuran**	**11**	**11**	**µg/L**	**MW-13S**	**1 / 7**	**5 - 5**	**11**	**3.7 n**	**NA**	**[4]**	**Yes**	**ASL**
	105-67-9	Dimethylphenol, 2,4-	4.3 J	4.3 J	µg/L	MW-13S	1 / 7	5 - 5	4.3	73 n	100	[4]	No	BSL
	206-44-0	Fluoranthene	2.6 J	2.6 J	µg/L	MW-13S	1 / 7	5 - 5	2.6	150 n	300	[4]	No	BSL
	86-73-7	Fluorene	9.5	9.5	µg/L	MW-13S	1 / 7	5 - 5	9.5	150 n	300	[4]	No	BSL
	91-57-6	Methylnaphthalene, 2-	9.6	9.6	µg/L	MW-13S	1 / 7	5 - 5	9.6	15 n	30	[4]	No	BSL
	95-48-7	Methylphenol, 2-	1.1 J	1.1 J	µg/L	MW-13S	1 / 7	5 - 5	1.1	180 n	NA	[4]	No	BSL
	106-44-5	Methylphenol, 4-	1.5 J	1.5 J	µg/L	MW-13S	1 / 7	5 - 5	1.5	18 n	NA	[4]	No	BSL
	91-20-3	**Naphthalene**	**16**	**16**	**µg/L**	**MW-13S**	**1 / 7**	**5 - 5**	**16**	**0.14 c**	**300**	**[4]**	**Yes**	**ASL**
	85-01-8	Phenanthrene	12	12	µg/L	MW-13S	1 / 7	5 - 5	12	1100 n [5]	NA	[4]	No	BSL
		PCBs/Pesticides												
	5103-71-9	Alpha-Chlordane	0.013 JN	0.013 JN	µg/L	MW-01S	1 / 7	0.01 - 0.01	0.013	0.19 c [6]	NA	[4]	No	BSL
		Inorganics												
	7429-90-5	**Aluminum**	**16.3 J**	**34800 J**	**µg/L**	**MW-15S**	**7 / 7**	**20 - 40**	**34800**	**3700 n**	**200**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**1.8 J**	**2.1 J**	**µg/L**	**MW-01S**	**2 / 7**	**2 - 4**	**2.1**	**1.5 n**	**6**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.46**	**6.8 J**	**µg/L**	**MW-13S**	**7 / 7**	**0.2 - 0.4**	**6.8**	**0.045 c**	**10**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	16.5 J	537 J	µg/L	MW-12S	7 / 7	10 - 20	537	730 n	2000	[4]	No	BSL
	7440-41-7	Beryllium	0.095 J	2	µg/L	MW-15S	2 / 7	1 - 2	2	7.3 n	4	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.055 J**	**4.7**	**µg/L**	**MW-12S**	**4 / 7**	**0.25 - 0.5**	**4.7**	**1.8 n**	**4**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	8090	185000	µg/L	MW-01D	7 / 7	500 - 1000	185000	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.76 J	24	µg/L	MW-14S	6 / 7	2 - 4	24	NA	70	[4]	No	NTX
	16065-83-1	Chromium III[7]	0.3	19	µg/L	MW-14S	4 / 7	2 - 4	18.5	5500 n	NA	[4]	No	BSL
	7440-48-4	**Cobalt**	**0.38 J**	**40 J**	**µg/L**	**MW-15S**	**7 / 7**	**1 - 2**	**40**	**1.1 n**	**100**	**[4]**	**Yes**	**ASL**
	7440-50-8	Copper	0.63 J	16	µg/L	MW-15S	7 / 7	2 - 4	16	150 n	1300	[4]	No	BSL
	7439-89-6	**Iron**	**64.2 J**	**372000**	**µg/L**	**MW-12S**	**7 / 7**	**10 - 400**	**372000**	**2600 n**	**300**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**0.4 J**	**20**	**µg/L**	**MW-12S**	**6 / 7**	**1 - 2**	**20**	**5 [8]**	**15**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	1840	473000	µg/L	MW-01D	7 / 7	500 - 2000	473000	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**2.7 J**	**1840 J**	**µg/L**	**MW-12S**	**7 / 7**	**1 - 2**	**1840**	**88 n**	**50**	**[4]**	**Yes**	**ASL**
	7440-02-0	Nickel	3.1	53	µg/L	MW-15S	6 / 7	1 - 2	53	73 n [9]	100	[4]	No	BSL
	7440-09-7	Potassium	1080	137000	µg/L	MW-01D	7 / 7	500 - 1000	137000	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.8 J	2.3 J	µg/L	MW-13S	5 / 7	5 - 10	2.3	18 n	50	[4]	No	BSL
	7440-22-4	Silver	0.037 J	0.14 J	µg/L	MW-01S	5 / 7	1 - 2	0.14	18 n	40	[4]	No	BSL
	7440-23-5	Sodium	6240	4110000	µg/L	MW-01D	7 / 7	500 - 25000	4110000	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.19 J	0.19 J	µg/L	MW-01D	1 / 7	0.5 - 1	0.19	NA	2	[4]	No	NTX
	7440-62-2	Vanadium	6.4 J	17	µg/L	MW-14S	3 / 7	5 - 10	16.5	18 n [10]	NA	[4]	No	BSL
	7440-66-6	Zinc	1.9 J	74	µg/L	MW-15S	7 / 7	2 - 4	74.2	1100 n	2000	[4]	No	BSL

TABLE B-2.3a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater (<10 feet bgs)

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen
Deletion Reason: BSL = below screening level
NUT = essential nutrient
NTX = no toxicity information available

(4) Potential ARAR/TBC level source: National Drinking Water Regulations Maximum Contaminant Levels (Last updated 5/2009); http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf
where available or NJ Specific Groundwater Quality Criteria for Class IIA (Last updated 7/2011); http://www.nj.gov/dep/standards/ground%20water.pdf.

(5) Screening level for anthracene is applied to phenanthrene.

(6) Screening level for chlordane is applied to alpha-chlordane.

(7) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium

(8) New Jersey Ground Water Quality Standards Class IIA (New Jersey Adminstrative Code 7:9C) of 5 µg/L for lead.

(9) Screening level for nickel soluble salts is applied to nickel.

(10) Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
µg/L = micrograms per liter
PCB = polychlorinated biphenyls
bgs = below ground surface

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.3b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater (All Wells)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Groundwater		**Volatile Organic Compounds**												
	1634-04-4	Methyl tert-Butyl Ether	2.5	10	µg/L	MW-05D	5 / 20	0.5 - 0.5	10	12 c	70	[4]	No	BSL
	127-18-4	**Tetrachloroethene**	**0.4**	**5.0**	**µg/L**	**MW-08S**	**5 / 20**	**0.5 - 0.5**	**5**	**0.11 c**	**5**	**[4]**	**Yes**	**ASL**
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	1.1 J	23	µg/L	MW-13S	2 / 20	5 - 5	23	220 n	400	[4]	No	BSL
	56-55-3	Benzo(a)anthracene	0.17	0.17	µg/L	MW-13S	1 / 20	0.1 - 0.1	0.17	0.029 c	0.05	[4]	No	IFD
	92-52-4	Biphenyl, 1,1'-	2.2 J	2.2 J	µg/L	MW-13S	1 / 20	5 - 5	2.2	180 n	400	[4]	No	IFD
	117-81-7	Bis(2-Ethylhexyl)phthalate	1.2 J	1.4 J	µg/L	MW-04D	3 / 20	2 - 2	1.4	4.8 c	6	[4]	No	BSL
	86-74-8	Carbazole	1.7 J	1.7 J	µg/L	MW-13S	1 / 20	5 - 5	1.7	NA	NA	[4]	No	IFD
	132-64-9	Dibenzofuran	11	11	µg/L	MW-13S	1 / 20	5 - 5	11	3.7 n	NA	[4]	No	IFD
	105-67-9	Dimethylphenol, 2,4-	4.3 J	4.3 J	µg/L	MW-13S	1 / 20	5 - 5	4.3	73 n	100	[4]	No	IFD
	206-44-0	Fluoranthene	2.6 J	2.6 J	µg/L	MW-13S	1 / 20	5 - 5	2.6	150 n	300	[4]	No	IFD
	86-73-7	Fluorene	9.5	9.5	µg/L	MW-13S	1 / 20	5 - 5	9.5	150 n	300	[4]	No	IFD
	91-57-6	Methylnaphthalene, 2-	9.6	9.6	µg/L	MW-13S	1 / 20	5 - 5	9.6	15 n	30	[4]	No	IFD
	95-48-7	Methylphenol, 2-	1.1 J	1.1 J	µg/L	MW-13S	1 / 20	5 - 5	1.1	180 n	NA	[4]	No	IFD
	106-44-5	Methylphenol, 4-	1.5 J	1.5 J	µg/L	MW-13S	1 / 20	5 - 5	1.5	18 n	NA	[4]	No	IFD
	91-20-3	Naphthalene	16	16	µg/L	MW-13S	1 / 20	5 - 5	16	0.14 c	300	[4]	No	IFD
	85-01-8	Phenanthrene	12	12	µg/L	MW-13S	1 / 20	5 - 5	12	1100 n [5]	NA	[4]	No	IFD
		PCBs/Pesticides												
	5103-71-9	Alpha-Chlordane	0.013 JN	0.013 JN	µg/L	MW-01S	1 / 20	0.01 - 0.01	0.013	0.19 c [6]	NA	[4]	No	IFD
	5103-74-2	Gamma-Chlordane	0.0056 J	0.018 J	µg/L	MW-07S	2 / 20	0.01 - 0.01	0.018	0.19 c [6]	NA	[4]	No	BSL
	1024-57-3	Heptachlor Epoxide	0.0075 J	0.0075 J	µg/L	MW-07S	1 / 20	0.005 - 0.005	0.0075	0.0074 c	0.2	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**16.3 J**	**34800 J**	**µg/L**	**MW-15S**	**20 / 20**	**20 - 40**	**34800**	**3700 n**	**200**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.036 J**	**5.4**	**µg/L**	**MW-10S**	**13 / 20**	**2 - 4**	**5.4**	**1.5 n**	**6**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.45**	**6.8 J**	**µg/L**	**MW-13S**	**20 / 20**	**0.2 - 0.4**	**6.8**	**0.045 c**	**10**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	16.5 J	537 J	µg/L	MW-12S	20 / 20	10 - 20	537	730 n	2000	[4]	No	BSL
	7440-41-7	Beryllium	0.095 J	6.2	µg/L	MW-05S	14 / 20	1 - 2	6.2	7.3 n	4	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.041 J**	**4.7**	**µg/L**	**MW-12S**	**15 / 20**	**0.25 - 0.5**	**4.7**	**1.8 n**	**4**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	7990	186000	µg/L	MW-10S	20 / 20	500 - 1000	186000	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.76 J	27	µg/L	MW-03S	19 / 20	2 - 4	27	NA	70	[4]	No	NTX
	16065-83-1	Chromium III[7]	0.2	22	µg/L	MW-03S	14 / 20	2 - 4	22	5500 n	NA	[4]	No	BSL
	7440-48-4	**Cobalt**	**0.38 J**	**40 J**	**µg/L**	**MW-15S**	**20 / 20**	**1 - 2**	**40.1**	**1.1 n**	**100**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**0.63 J**	**271**	**µg/L**	**MW-09S**	**20 / 20**	**2 - 4**	**271**	**150 n**	**1300**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**64.2 J**	**372000**	**µg/L**	**MW-12S**	**20 / 20**	**10 - 400**	**372000**	**2600 n**	**300**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**0.4 J**	**107**	**µg/L**	**MW-10S**	**19 / 20**	**1 - 2**	**107**	**5 [8]**	**15**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	1840	502000	µg/L	MW-10S	20 / 20	500 - 5000	502000	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**2.7 J**	**2060**	**µg/L**	**MW-10D**	**20 / 20**	**1 - 2**	**2060**	**88 n**	**50**	**[4]**	**Yes**	**ASL**
	7440-02-0	Nickel	3.1	53	µg/L	MW-15S	19 / 20	1 - 2	52.5	73 n [9]	100	[4]	No	BSL
	7440-09-7	Potassium	1080	153000	µg/L	MW-10S	20 / 20	500 - 1000	153000	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.49 J	2.3 J	µg/L	MW-13S	16 / 20	5 - 10	2.3	18 n	50	[4]	No	BSL

TABLE B-2.3b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater (All Wells)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Groundwater		**Inorganics (continued)**												
	7440-22-4	Silver	0.0071 J	0.14 J	µg/L	MW-01S	14 / 20	1 - 2	0.14	18 n	40	[4]	No	BSL
	7440-23-5	Sodium	6240	4420000	µg/L	MW-10S	20 / 20	500 - 25000	4420000	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.039 J	1.1	µg/L	MW-08D	13 / 20	0.5 - 1	1.1	NA	2	[4]	No	NTX
	7440-62-2	Vanadium	0.63 J	17	µg/L	MW-14S	15 / 20	5 - 10	16.5	18 n [10]	NA	[4]	No	BSL
	7440-66-6	Zinc	1.9 J	438	µg/L	MW-08S	20 / 20	2 - 4	438	1100 n	2000	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

[4] Potential ARAR/TBC level source: National Drinking Water Regulations Maximum Contaminant Levels (Last updated 5/2009); http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf
where available or NJ Specific Groundwater Quality Criteria for Class IIA (Last updated 7/2011); http://www.nj.gov/dep/standards/ground%20water.pdf.

[5] Screening level for anthracene is applied to phenanthrene.

[6] Screening level for chlordane is applied to alpha- and gamma-chlordane.

[7] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium

[8] New Jersey Ground Water Quality Standards Class IIA (New Jersey Adminstrative Code 7:9C) of 5 µg/L for lead.

[9] Screening level for nickel soluble salts is applied to nickel.

[10] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
JN = tentatively identified value
PCB = polychlorinated biphenyls
µg/L = micrograms per liter

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.4a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water - All Areas (except Wetland Area of Area 9)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Water		**Volatile Organic Compounds**												
	100-41-4	Ethylbenzene	0.55	0.55	µg/L	A1-31	1 / 15	0.5 - 0.5	0.55	1.5 c	2100	[4]	No	BSL
	75-09-2	Methylene chloride	0.54	0.63 J	µg/L	A8-14	2 / 15	0.5 - 0.5	0.63	4.8 c	310	[4]	No	BSL
	108-88-3	Toluene	0.38 J	2.4	µg/L	A1-31	4 / 15	0.5 - 0.5	2.4	230 n	15000	[4]	No	BSL
	179601-23-1	Xylene, m,p-	0.26 J	1.7	µg/L	A1-31	4 / 15	0.5 - 0.5	1.7	379 n [5]	NA	[4]	No	BSL
	95-47-6	Xylene, o-	0.23 J	0.62	µg/L	A1-31	2 / 15	0.5 - 0.5	0.62	120 n	NA	[4]	No	BSL
		Semi-volatile Organic Compounds												
	56-55-3	**Benzo(a)anthracene**	**0.055**	**0.055**	**µg/L**	**A11-26**	**1 / 7**	**0.05 - 0.05**	**0.055**	**0.029 c**	**0.18**	**[4]**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**0.063**	**0.063**	**µg/L**	**A11-26**	**1 / 7**	**0.05 - 0.05**	**0.063**	**0.029 c**	**0.18**	**[4]**	**Yes**	**ASL**
	218-01-9	Chrysene	0.067 J	0.067 J	µg/L	A11-26	1 / 7	0.1 - 0.1	0.067	2.9 c	18	[4]	No	BSL
		Inorganics												
	7429-90-5	**Aluminum**	**102 J**	**12600 J**	**µg/L**	**SW16**	**35 / 117**	**5.4 - 2000**	**12600**	**3700 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**1.6 J**	**53.2 J**	**µg/L**	**SW16**	**19 / 139**	**0.68 - 600**	**53.2**	**1.5 n**	**640**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**1.9 J**	**70.9**	**µg/L**	**SW16**	**31 / 139**	**0.052 - 100**	**70.9**	**0.045 c**	**0.061**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	20.4 J	65 J	µg/L	SW16	19 / 117	3.2 - 2000	64.9	730 n	2000	[4]	No	BSL
	7440-41-7	Beryllium	0.054 J	1.8 J	µg/L	SW28	7 / 117	0.21 - 50	1.8	7.3 n	42	[4]	No	BSL
	7440-43-9	Cadmium	0.09 J	1 J	µg/L	SW35	5 / 117	0.13 - 50	1.0	1.8 n	16	[4]	No	IFD
	7440-70-2	Calcium	26600	403000	µg/L	A7-15	116 / 117	173 - 50000	403000	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	2.1 J	28.9 J	µg/L	SW12	25 / 139	0.65 - 100	28.9	NA	750	[4]	No	NTX
	7440-48-4	**Cobalt**	**1.1 J**	**17 J**	**µg/L**	**SW12**	**15 / 117**	**0.35 - 500**	**17**	**1.1 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**4 J**	**154 J**	**µg/L**	**SW16**	**38 / 139**	**0.7 - 250**	**154**	**150 n**	**1300**	**[4]**	**Yes**	**ASL**
	7439-89-6	**Iron**	**345 J**	**74400**	**µg/L**	**SW19**	**49 / 117**	**10 - 1000**	**74400**	**2600 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**5.8 J**	**1580 J**	**µg/L**	**SW16**	**40 / 139**	**0.29 - 100**	**1580**	**5 [6]**	**5**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	38500	1230000	µg/L	A7-15	116 / 117	145 - 50000	1230000	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**60.3 J**	**2620 J**	**µg/L**	**SW12**	**43 / 117**	**0.31 - 150**	**2620**	**88 n**	**100**	**[4]**	**Yes**	**ASL**
	7440-02-0	Nickel	1.4 J	22 J	µg/L	SW16	23 / 117	0.3 - 400	22	73 n [7]	1700	[4]	No	BSL
	7440-09-7	Potassium	17600	365000	µg/L	A7-15	108 / 112	177 - 50000	365000	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	2.4 J	3.9 J	µg/L	SW01	12 / 117	1.5 - 350	3.9	18 n	4200	[4]	No	BSL
	7440-22-4	Silver	1.3 J	2 J	µg/L	SW14	3 / 117	0.35 - 100	2.0	18 n	40000	[4]	No	IFD
	7440-23-5	Sodium	1850000	8390000	µg/L	A7-15	91 / 111	166 - 85000	8390000	NA	NA	[4]	No	NUT
	7440-31-5	Tin	0.9 J	33 J	µg/L	SW11	6 / 22	100 - 100	33	2200 n	NA	[4]	No	BSL
	7440-62-2	**Vanadium**	**3.8 J**	**95 J**	**µg/L**	**SW12**	**17 / 117**	**1.9 - 500**	**95**	**18 n [8]**	**NA**	**[4]**	**Yes**	**ASL**
	7440-66-6	Zinc	0.97 J	352	µg/L	SW28	26 / 117	0.6 - 600	352	1100 n	26000	[4]	No	BSL

TABLE B-2.4a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water - All Areas (except Wetland Area of Area 9)

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

(4) Potential ARAR/TBC level source: Surface Water Quality Crietria for Toxic Substances. (Last updated 4/2011); http://www.nj.gov/dep/rules/rules/njac7_9b.pdf.

(5) Screening level for m-xylene is applied to m,p-xylenes.

(6) Screening level based on the fresh water criterion for human health (New Jersey Administrative Code 7:9B).

(7) Screening level for nickel soluble salts is applied to nickel.

(8) Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
µg/L = micrograms per liter

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.4b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water - Wetland Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Surface Water		**Volatile Organic Compounds**												
	67-66-3	**Chloroform**	**0.46 J**	**0.46 J**	**µg/L**	**A9-95**	**1 / 18**	**0.5 - 0.5**	**0.46**	**0.19 c**	**2100**	**[4]**	**Yes**	**ASL**
		Semi-volatile Organic Compounds												
	56-55-3	**Benzo(a)anthracene**	**0.053**	**0.053**	**µg/L**	**A9-89**	**1 / 17**	**0.05 - 0.05**	**0.053**	**0.029 c**	**0.18**	**[4]**	**Yes**	**ASL**
	117-81-7	Bis(2-Ethylhexyl)phthalate	0.51 J	0.51 J	µg/L	A9-93	1 / 17	1 - 1	0.51	4.8 c	2.2	[4]	No	BSL
	91-94-1	Dichlorobenzidine, 3,3`-	0.064	0.064	µg/L	A9-87	1 / 17	0.05 - 0.05	0.064	0.15 c	0.028	[4]	No	BSL
	87-86-5	**Pentachlorophenol**	**0.52 J**	**0.52 J**	**µg/L**	**A9-70**	**1 / 17**	**0.2 - 0.2**	**0.52**	**0.17 c**	**3**	**[4]**	**Yes**	**ASL**
		Inorganics												
	7429-90-5	Aluminum	85.8	2000	µg/L	A9-95	2 / 15	5.4 - 2000	2000	3700 n	NA	[4]	No	BSL
	7440-38-2	**Arsenic**	**0.44**	**2.1**	**µg/L**	**A9-95**	**2 / 15**	**0.052 - 100**	**2.1**	**0.045 c**	**0.061**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	14.8	22	µg/L	A9-95	2 / 15	3.2 - 2000	21.8	730 n	2000	[4]	No	BSL
	7440-41-7	Beryllium	0.52 J	0.52 J	µg/L	A9-95	1 / 15	0.21 - 50	0.52	7.3 n	42	[4]	No	BSL
	7440-43-9	Cadmium	0.45	0.45	µg/L	A9-95	1 / 15	0.13 - 50	0.45	1.8 n	16	[4]	No	BSL
	7440-70-2	Calcium	348 J	257000	µg/L	A9-70	14 / 15	173 - 50000	257000	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	2 J	2 J	µg/L	A9-95	1 / 15	0.65 - 100	2.0	NA	750	[4]	No	NTX
	7440-48-4	Cobalt	0.93 J	0.93 J	µg/L	A9-95	1 / 15	0.35 - 500	0.93	1.1 n	NA	[4]	No	BSL
	7440-50-8	Copper	1.1 J	1.1 J	µg/L	A9-95	1 / 15	0.7 - 250	1.1	150 n	1300	[4]	No	BSL
	7439-89-6	**Iron**	**501**	**21100 J**	**µg/L**	**A9-102**	**10 / 15**	**54 - 1000**	**21100**	**2600 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	**Lead**	**2.2**	**23.2**	**µg/L**	**A9-95**	**2 / 15**	**0.29 - 100**	**23**	**5 [5]**	**5**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	5000	741000	µg/L	A9-70	13 / 15	145 - 50000	741000	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**13**	**637**	**µg/L**	**A9-78**	**12 / 15**	**0.31 - 150**	**637**	**88 n**	**100**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.04 J	0.04 J	µg/L	A9-91	1 / 18	0.1 - 0.1	0.04	1.1 n [6]	0.051	[4]	No	BSL
	7440-02-0	Nickel	0.51 J	3.4	µg/L	A9-95	2 / 15	0.3 - 400	3.4	73 n [7]	1700	[4]	No	BSL
	7440-09-7	Potassium	2560	242000	µg/L	A9-70	9 / 15	177 - 50000	242000	NA	NA	[4]	No	NUT
	7440-23-5	Sodium	170 J	5780000	µg/L	A9-70	15 / 15	166 - 50000	5780000	NA	NA	[4]	No	NUT
	7440-62-2	Vanadium	5.5	5.5	µg/L	A9-95	1 / 15	1.9 - 500	5.5	18 n [8]	NA	[4]	No	BSL
	7440-66-6	Zinc	5.4	92	µg/L	A9-95	4 / 15	0.6 - 600	92	1100 n	26000	[4]	No	BSL

TABLE B-2.4b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water - Wetland Area of Area 9

(1) Maximum detected concentration used for screening.

(2) Screened against Regional Screening Levels, November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

(3) Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

(4) Potential ARAR/TBC level source: Surface Water Quality Crietria for Toxic Substances. (Last updated 4/2011); http://www.nj.gov/dep/rules/rules/njac7_9b.pdf.

(5) Screening level based on the fresh water criterion for human health (New Jersey Administrative Code 7:9B).

(6) Screening level for mercuric chloride is applied to mercury.

(7) Screening level for nickel soluble salts is applied to nickel.

(8) Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
µg/L = micrograms per liter

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.5a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Area 1

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening (1)	Screening Toxicity Value (n/c) (2)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion (3)
Sediment		**Volatile Organic Compounds**												
	67-64-1	Acetone	40	40	µg/kg	A68	1 / 9	9.9 - 21	40	6100000 n	NA	(4)	No	BSL
	75-15-0	Carbon disulfide	9.7 J	16	µg/kg	A68	2 / 9	0.79 - 11	16	82000 n	NA	(4)	No	BSL
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	15	15	µg/kg	A1-13	1 / 9	4.2 - 260	15	340000 n	NA	(4)	No	BSL
	98-86-2	Acetophenone	16 J	42 J	µg/kg	A60	4 / 9	210 - 260	42	780000 n	NA	(4)	No	BSL
	100-52-7	Benzaldehyde	33 J	140 J	µg/kg	A60	4 / 9	210 - 260	140	780000 n	NA	(4)	No	BSL
	56-55-3	Benzo(a)anthracene	3.4 J	16 J	µg/kg	A61	7 / 9	4.2 - 260	16	150 c	NA	(4)	No	BSL
	50-32-8	**Benzo(a)pyrene**	**4.6**	**16 J**	**µg/kg**	**A61**	**4 / 9**	**4.2 - 260**	**16**	**15 c**	**NA**	**(4)**	**Yes**	**ASL**
	205-99-2	Benzo(b)fluoranthene	6.9 J	14 J	µg/kg	A61	3 / 9	210 - 260	14	150 c	NA	(4)	No	BSL
	191-24-2	Benzo(g,h,i)perylene	7.7 J	7.7 J	µg/kg	A61	1 / 9	210 - 260	7.7	170000 n (5)	NA	(4)	No	BSL
	207-08-9	Benzo(k)fluoranthene	7.2 J	7.2 J	µg/kg	A61	1 / 9	210 - 260	7.2	1500 c	NA	(4)	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	12 J	99 J	µg/kg	A1-17	5 / 9	210 - 260	99	35000 c	NA	(4)	No	BSL
	218-01-9	Chrysene	4.3 J	12 J	µg/kg	A61	5 / 9	4.2 - 260	12	15000 c	NA	(4)	No	BSL
	84-66-2	Diethylphthalate	8.5 J	8.8 J	µg/kg	A60	2 / 9	210 - 260	8.8	4900000 n	NA	(4)	No	BSL
	84-74-2	Di-n-butylphthalate	8.3 J	12 J	µg/kg	A60	3 / 9	210 - 260	12	610000 n	NA	(4)	No	BSL
	206-44-0	Fluoranthene	10 J	29 J	µg/kg	A61	3 / 9	210 - 260	29	230000 n	NA	(4)	No	BSL
	86-73-7	Fluorene	8.8	8.8	µg/kg	A1-13	1 / 9	4.2 - 260	8.8	230000 n	NA	(4)	No	BSL
	91-57-6	Methylnaphthalene, 2-	9.9	9.9	µg/kg	A1-13	1 / 9	4.2 - 260	9.9	31000 n	NA	(4)	No	BSL
	106-44-5	Methylphenol, 4-	9.2 J	14 J	µg/kg	A68	2 / 9	210 - 260	14	31000 n	NA	(4)	No	BSL
	91-20-3	Naphthalene	9.8 J	9.8 J	µg/kg	A60	1 / 9	210 - 260	9.8	3600 c	NA	(4)	No	BSL
	85-01-8	Phenanthrene	6.6 J	22 J	µg/kg	A61	4 / 9	210 - 260	22	1700000 n (6)	NA	(4)	No	BSL
	108-95-2	Phenol	27 J	110 J	µg/kg	A60	4 / 9	210 - 260	110	1800000 n	NA	(4)	No	BSL
	129-00-0	Pyrene	8.7 J	25 J	µg/kg	A61	4 / 9	210 - 260	25	170000 n	NA	(4)	No	BSL
		PCBs/Pesticides												
	72-55-9	DDE, 4,4'-	0.16 J	0.17 J	µg/kg	A60	2 / 9	0.83 - 5	0.17	1400 c	NA	(4)	No	BSL
	50-29-3	DDT, 4,4'-	0.41 J	0.41 J	µg/kg	A146	1 / 9	0.83 - 5	0.41	1700 c	NA	(4)	No	BSL
	53494-70-5	Endrin ketone	0.054 J	0.054 J	µg/kg	A68	1 / 9	0.83 - 5	0.054	1800 n (7)	NA	(4)	No	BSL
	5103-74-2	Gamma-chlordane	0.23 J	0.23 J	µg/kg	A146	1 / 9	0.43 - 2.6	0.23	1600 c (8)	NA	(4)	No	BSL
	1024-57-3	Heptachlor epoxide	0.3 J	0.3 J	µg/kg	A61	1 / 9	0.43 - 2.6	0.30	53 c	NA	(4)	No	BSL
		Inorganics												
	7429-90-5	**Aluminum**	**276 J**	**9950**	**mg/kg**	**A68**	**73 / 73**	**17.9 - 34.6**	**9950**	**7700 n**	**NA**	**(4)**	**Yes**	**ASL**
	7440-36-0	Antimony	1.2 J	3.1	mg/kg	A64	17 / 73	1.1 - 8.3	3.1	3.1 n	NA	(4)	No	BSL
	7440-38-2	**Arsenic**	**0.92 J**	**40.2 J**	**mg/kg**	**A63**	**73 / 73**	**1 - 1.4**	**40.2**	**0.39 c**	**NA**	**(4)**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	1.4 J	17.3	mg/kg	A68	35 / 73	6.1 - 27.8	17.3	1500 n	NA	(4)	No	BSL
	7440-41-7	Beryllium	0.098 J	0.96	mg/kg	A156	36 / 73	0.28 - 1	0.96	16 n	NA	(4)	No	BSL
	7440-43-9	Cadmium	0.091 J	1	mg/kg	A1-12	36 / 73	0.31 - 1	1.0	7 n	NA	(4)	No	BSL
	7440-70-2	Calcium	141 J	31200	mg/kg	A1-22	70 / 73	448 - 865	31200	NA	NA	(4)	No	NUT

TABLE B-2.5a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Area 1

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Sediment		**Inorganics (continued)**												
	7440-47-3	Chromium	2.5	37	mg/kg	A156	73 / 73	1.2 - 2	36.5	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [9]	1.55	28	mg/kg	A1-14	25 / 25	1.2 - 2	28.44	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.39 J**	**1 J**	**mg/kg**	**A1-17**	**7 / 25**	**1.2 - 1.5**	**1.0**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.41 J**	**5.9 J**	**mg/kg**	**A68**	**57 / 73**	**1 - 6.9**	**5.9**	**2.3 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-50-8	Copper	2.9 J	35 J	mg/kg	A1-14	73 / 73	2.6 - 3.5	35	310 n	NA	[4]	No	BSL
	7439-89-6	**Iron**	**2000**	**36800 J**	**mg/kg**	**A101**	**73 / 73**	**9 - 17.3**	**36800**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	Lead	7.4	53	mg/kg	A64	73 / 73	1.1 - 1.4	52.9	400 n [10]	NA	[4]	No	BSL
	7439-95-4	Magnesium	286 J	4910	mg/kg	A68	70 / 73	448 - 865	4910	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**12.6**	**219**	**mg/kg**	**A68**	**70 / 70**	**1.6 - 2.1**	**219**	**180 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-97-6	Mercury	0.027 J	0.38	mg/kg	A1-14	71 / 73	0.034 - 0.14	0.38	2.3 n [11]	NA	[4]	No	BSL
	7440-02-0	Nickel	0.9 J	15	mg/kg	A68	61 / 73	1 - 5.6	14.9	150 n [12]	NA	[4]	No	BSL
	7440-09-7	Potassium	132 J	2390	mg/kg	A68	23 / 73	448 - 865	2390	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.094 J	7.0	mg/kg	A1-12	40 / 73	0.61 - 5	7	39 n	NA	[4]	No	BSL
	7440-22-4	Silver	0.3 J	0.42	mg/kg	A64	6 / 73	0.28 - 1.4	0.42	39 n	NA	[4]	No	BSL
	7440-23-5	Sodium	1190	6430 J	mg/kg	A68	73 / 73	448 - 865	6430	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	0.61 J	2.4 J	mg/kg	A1-12	5 / 73	0.56 - 3.5	2.4	NA	NA	[4]	No	NTX
	7440-62-2	**Vanadium**	**4.2 J**	**66**	**mg/kg**	**A65**	**73 / 73**	**1 - 6.9**	**66**	**39 n [13]**	**NA**	**[4]**	**Yes**	**ASL**
	7440-66-6	Zinc	13.4	100 J	mg/kg	A64	73 / 73	6.3 - 8.3	100	2300 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

[4] No Potential ARAR/TBC values are available.

[5] Screening level for pyrene is applied to benzo(g,h,i)perylene.

[6] Screening level for anthracene is applied to phenanthrene.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane
PCB = polychlorinated biphenyls

TABLE B-2.5a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Area 1

(7) Screening level for endrin is applied to endrin ketone.

(8) Screening level for chlordane is applied to gamma-chlordane.

(9) Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration. Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

(10) Lead screening value is from OSWER screening value for residential soil (400 mg/kg).

(11) Screening level for mercuric chloride is applied to mercury.

(12) Screening level for nickel soluble salts is applied to nickel.

(13) Screening level for vanadium and compounds is applied to vanadium.

*Includes the following data:

Historical Data:

EPA - September 2008

EPA - April 2009

EPA - June/July 2009

Pre-Remedial Investigation (2010):

Beach Sampling - May 2010

Area 2 - August 2010 - EPA-DESA

Remedial Investigation:

September/December 2010

January 2011

TABLE B-2.5b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Area 2

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Sediment		**Inorganics**												
	7429-90-5	Aluminum	3660	3660	mg/kg	A161	1 / 1	27.6 - 27.6	3660	7700 n	NA	[4]	No	BSL
	7440-38-2	**Arsenic**	**6.9 J**	**6.9 J**	**mg/kg**	**A161**	**1 / 1**	**1 - 1**	**6.9**	**0.39 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-41-7	Beryllium	0.36	0.36	mg/kg	A161	1 / 1	1 - 1	0.36	16 n	NA	[4]	No	BSL
	7440-70-2	Calcium	408 J	408 J	mg/kg	A161	1 / 1	690 - 690	408	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	12.3 J	12 J	mg/kg	A161	1 / 1	2 - 2	12.3	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III[5]	10.5	11	mg/kg	A161	1 / 1	NA - NA	10.5	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI[5]**	**1.8**	**1.8**	**mg/kg**	**A161**	**1 / 1**	**NA - NA**	**1.8**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL**
	7440-48-4	Cobalt	2	2	mg/kg	A161	1 / 1	1 - 1	2	2.3 n	NA	[4]	No	BSL
	7440-50-8	Copper	13.7 J	14 J	mg/kg	A161	1 / 1	2 - 2	13.7	310 n	NA	[4]	No	BSL
	7439-89-6	**Iron**	**9630**	**9630**	**mg/kg**	**A161**	**1 / 1**	**13.8 - 13.8**	**9630**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**
	7439-92-1	Lead	18.5	19	mg/kg	A161	1 / 1	1 - 1	18.5	400 n [6]	NA	[4]	No	BSL
	7439-95-4	Magnesium	1080	1080	mg/kg	A161	1 / 1	690 - 690	1080	NA	NA	[4]	No	NUT
	7439-96-5	Manganese	44.1	44	mg/kg	A161	1 / 1	1 - 1	44.1	180 n	NA	[4]	No	BSL
	7439-97-6	Mercury	0.19	0.19	mg/kg	A161	1 / 1	0.039 - 0.039	0.19	2.3 n [7]	NA	[4]	No	BSL
	7440-02-0	Nickel	5.5	5.5	mg/kg	A161	1 / 1	1 - 1	5.5	150 n [8]	NA	[4]	No	BSL
	7440-09-7	Potassium	698	698	mg/kg	A161	1 / 1	690 - 690	698	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.45 J	0.45 J	mg/kg	A161	1 / 1	5 - 5	0.45	39 n	NA	[4]	No	BSL
	7440-23-5	Sodium	2210	2210	mg/kg	A161	1 / 1	690 - 690	2210	NA	NA	[4]	No	NUT
	7440-62-2	Vanadium	16.7	17	mg/kg	A161	1 / 1	1 - 1	16.7	39 n [9]	NA	[4]	No	BSL
	7440-66-6	Zinc	35.3 J	35 J	mg/kg	A161	1 / 1	2 - 2	35.3	2300 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

[4] No Potential ARAR/TBC values are available.

[5] Chromium III and chromium VI concentration estimated using a chromium VI to chromium III concentration ratio of 1:6.

[6] Lead screening level is from OSWER screening value for residential soil (400 mg/kg).

[7] Screening level for mercuric chloride is applied to mercury.

[8] Screening level for nickel soluble salts is applied to nickel.

[9] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
mg/kg = milligrams per kilogram

*Includes the following data:

Historical Data:
EPA - September 2008
EPA - April 2009
EPA - June/July 2009

Pre-Remedial Investigation (2010):
Beach Sampling - May 2010
Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
September/December 2010
January 2011

TABLE B-2.5c

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Areas 5, 6, and Beach Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Sediment		**Volatile Organic Compounds**												
	67-64-1	Acetone	5.9 J	6.4 J	µg/kg	B11	2 / 5	8.3 - 14	6.4	6100000 n	NA	[4]	No	BSL
	78-93-3	Butanone, 2-	5.5 J	5.5 J	µg/kg	B31	1 / 5	8.3 - 14	5.5	2800000 n	NA	[4]	No	BSL
	75-15-0	Carbon disulfide	0.47 J	0.71 J	µg/kg	B11	2 / 5	0.67 - 6	0.71	82000 n	NA	[4]	No	BSL
		Semi-volatile Organic Compounds												
	98-86-2	Acetophenone	22 J	23 J	µg/kg	B11	2 / 5	210 - 230	23	780000 n	NA	[4]	No	BSL
	100-52-7	Benzaldehyde	44 J	220 J	µg/kg	A5-17	3 / 5	210 - 230	220	780000 n	NA	[4]	No	BSL
	56-55-3	Benzo(a)anthracene	7.7 J	16 J	µg/kg	B31	3 / 5	4 - 230	16	150 c	NA	[4]	No	BSL
	50-32-8	**Benzo(a)pyrene**	**3.4 J**	**18 J**	**µg/kg**	**B31**	**3 / 5**	**4 - 230**	**18**	**15 c**	**NA**	**[4]**	**Yes**	**ASL**
	205-99-2	Benzo(b)fluoranthene	18 J	18 J	µg/kg	B31	1 / 5	210 - 230	18	150 c	NA	[4]	No	BSL
	191-24-2	Benzo(g,h,i)perylene	11 J	11 J	µg/kg	B31	1 / 5	210 - 230	11	170000 n [5]	NA	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	8.5 J	8.5 J	µg/kg	B31	1 / 5	210 - 230	8.5	1500 c	NA	[4]	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	24 J	26 J	µg/kg	B31	2 / 5	210 - 230	26	35000 c	NA	[4]	No	BSL
	218-01-9	Chrysene	14 J	17 J	µg/kg	B31	2 / 5	4 - 230	17	15000 c	NA	[4]	No	BSL
	84-74-2	Di-n-butylphthalate	8.1 J	12 J	µg/kg	B31	2 / 5	210 - 230	12	610000 n	NA	[4]	No	BSL
	206-44-0	Fluoranthene	8.1 J	49 J	µg/kg	B31	2 / 5	210 - 230	49	230000 n	NA	[4]	No	BSL
	193-39-5	Indeno(1,2,3-cd)pyrene	11 J	11 J	µg/kg	B31	1 / 5	210 - 230	11	150 c	NA	[4]	No	BSL
	91-20-3	Naphthalene	9 J	9 J	µg/kg	B31	1 / 5	210 - 230	9	3600 c	NA	[4]	No	BSL
	85-01-8	Phenanthrene	49 J	49 J	µg/kg	B31	1 / 5	210 - 230	49	1700000 n [6]	NA	[4]	No	BSL
	108-95-2	Phenol	44 J	64 J	µg/kg	B11	2 / 5	210 - 230	64	1800000 n	NA	[4]	No	BSL
	129-00-0	Pyrene	10 J	45 J	µg/kg	B31	2 / 5	210 - 230	45	170000 n	NA	[4]	No	BSL
		PCBs/Pesticides												
	319-84-6	Alpha-BHC	0.042 J	0.042 J	µg/kg	B31	1 / 5	0.42 - 2.3	0.042	77 c	NA	[4]	No	BSL
	11097-69-1	Aroclor 1254	17 J	37 J	µg/kg	B11	2 / 5	8.1 - 44	37	110 n	NA	[4]	No	BSL
	319-85-7	Beta-BHC	0.052 J	0.052 J	µg/kg	B31	1 / 5	0.42 - 2.3	0.052	270 c	NA	[4]	No	BSL
	72-55-9	DDE, 4,4'-	1.3 J	1.3 J	µg/kg	B11	1 / 5	0.81 - 4.4	1.3	1400 c	NA	[4]	No	BSL
	53494-70-5	Endrin ketone	0.13 J	0.13 J	µg/kg	B11	1 / 5	0.81 - 4.4	0.13	1800 n [7]	NA	[4]	No	BSL
		Inorganics												
	7429-90-5	Aluminum	178	7080 J	mg/kg	B19	21 / 21	20 - 30.4	7080	7700 n	NA	[4]	No	BSL
	7440-36-0	**Antimony**	**0.63 J**	**11**	**mg/kg**	**A9-70**	**2 / 27**	**1 - 7.9**	**10.9**	**3.1 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**0.66 J**	**12 J**	**mg/kg**	**B19**	**27 / 27**	**1 - 1.3**	**12.3**	**0.39 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	1.4 J	18	mg/kg	B19	11 / 27	5 - 26.2	18.3	1500 n	NA	[4]	No	BSL
	7440-41-7	Beryllium	0.036 J	1.1	mg/kg	B19	14 / 27	0.25 - 0.66	1.1	16 n	NA	[4]	No	BSL
	7440-43-9	Cadmium	0.048 J	0.63	mg/kg	A9-70	8 / 27	0.25 - 0.66	0.63	7 n	NA	[4]	No	BSL
	7440-70-2	Calcium	179 J	3670	mg/kg	A5-18	17 / 22	500 - 760	3670	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	2.6	29 J	mg/kg	B19	27 / 27	1 - 1	29	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [8]	2.1	9.4	mg/kg	A9-70	6 / 6	1 - 1	9.4	12000 n	NA	[4]	No	BSL
	18540-29-9	**Chromium VI**	**0.38 J**	**0.55 J**	**mg/kg**	**A5-18**	**2 / 6**	**1 - 1.4**	**0.55**	**0.29 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.029 J**	**3.4**	**mg/kg**	**B19**	**22 / 27**	**0.64 - 6.6**	**3.4**	**2.3 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-50-8	Copper	1.1 J	99	mg/kg	A9-70	27 / 27	2.5 - 3.3	99.3	310 n	NA	[4]	No	BSL
	7439-89-6	**Iron**	**1940**	**27900 J**	**mg/kg**	**A1**	**21 / 22**	**10 - 15.2**	**27900**	**5500 n**	**NA**	**[4]**	**Yes**	**ASL**

TABLE B-2.5c

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Areas 5, 6, and Beach Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Sediment		**Inorganics (continued)**												
	7439-92-1	Lead	3.8	240	mg/kg	A9-70	26 / 27	1 - 1.3	240	400 n [9]	NA	[4]	No	BSL
	7439-95-4	Magnesium	151 J	1980	mg/kg	B19	19 / 22	500 - 760	1980	NA	NA	[4]	No	NUT
	7439-96-5	Manganese	11.8 J	130 J	mg/kg	SED206	25 / 25	1.5 - 2	130	180 n	NA	[4]	No	BSL
	7439-97-6	Mercury	0.023 J	0.25	mg/kg	B12	6 / 23	0.033 - 0.13	0.25	2.3 n [10]	NA	[4]	No	BSL
	7440-02-0	Nickel	0.67 J	17	mg/kg	A9-70	23 / 27	4 - 5.2	16.6	150 n [11]	NA	[4]	No	BSL
	7440-09-7	Potassium	108 J	1620	mg/kg	B19	6 / 22	500 - 760	1620	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.11 J	0.79	mg/kg	B24	9 / 27	0.5 - 4.6	0.79	39 n	NA	[4]	No	BSL
	7440-22-4	Silver	0.035 J	5.3 J	mg/kg	SED206	7 / 27	0.25 - 1.3	5.3	39 n	NA	[4]	No	BSL
	7440-23-5	Sodium	356 J	3430	mg/kg	B11	17 / 22	500 - 760	3430	NA	NA	[4]	No	NUT
	7440-62-2	**Vanadium**	**4 J**	**45 J**	**mg/kg**	**B19**	**27 / 27**	**5 - 6.6**	**45**	**39 n [12]**	**NA**	**[4]**	**Yes**	**ASL**
	7440-66-6	Zinc	7.6	52	mg/kg	A1	27 / 27	6 - 7.9	52	2300 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

[4] No Potential ARAR/TBC values are available.

[5] Screening level for pyrene is applied to benzo(g,h,i)perylene.

[6] Screening level for anthracene is applied to phenanthrene.

[7] Screening level for endrin is applied to endrin ketone.

[8] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration
Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium

[9] Lead screening value is from OSWER screening value for residential soil (400 mg/kg).

[10] Screening level for mercuric chloride is applied to mercury.

[11] Screening level for nickel soluble salts is applied to nickel.

[12] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
BHC = benzene hexachloride
DDE = p,p'-dichlorodiphenyldichloroethylene
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.5d

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Wetland Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Sediment		**Volatile Organic Compounds**												
	67-64-1	Acetone	15 J	180 J	µg/kg	A9-81/A9-99	9 / 38	8.5 - 69	180	6100000 n	NA	[4]	No	BSL
	78-93-3	Butanone, 2-	13 J	40	µg/kg	A9-99	3 / 38	8.5 - 69	40	2800000 n	NA	[4]	No	BSL
	75-15-0	Carbon disulfide	6.4	34	µg/kg	A9-75	9 / 38	0.68 - 5.5	34	82000 n	NA	[4]	No	BSL
	108-88-3	Toluene	31	31	µg/kg	A9-99	1 / 38	4.3 - 35	31	720000 ns	NA	[4]	No	IFD
		Semi-volatile Organic Compounds												
	83-32-9	Acenaphthene	3 J	64 J	µg/kg	A9-74	6 / 38	3.8 - 19	64	340000 n	NA	[4]	No	BSL
	208-96-8	Acenaphthylene	3.2 J	110 J	µg/kg	A9-88	18 / 38	3.8 - 19	110	340000 n [5]	NA	[4]	No	BSL
	98-86-2	Acetophenone	55 J	380 J	µg/kg	A9-93	6 / 38	190 - 1000	380	780000 n	NA	[4]	No	BSL
	120-12-7	Anthracene	82 J	95 J	µg/kg	A9-85	2 / 38	97 - 500	95	1700000 n	NA	[4]	No	BSL
	56-55-3	**Benzo(a)anthracene**	**5.4 J**	**550 J**	**µg/kg**	**A9-85**	**35 / 38**	**3.8 - 19**	**550**	**150 c**	**NA**	**[4]**	**Yes**	**ASL**
	50-32-8	**Benzo(a)pyrene**	**5.9**	**570 J**	**µg/kg**	**A9-85**	**35 / 38**	**3.8 - 19**	**570**	**15 c**	**NA**	**[4]**	**Yes**	**ASL**
	205-99-2	**Benzo(b)fluoranthene**	**100 J**	**1000**	**µg/kg**	**A9-85**	**13 / 38**	**190 - 1000**	**1000**	**150 c**	**NA**	**[4]**	**Yes**	**ASL**
	191-24-2	Benzo(g,h,i)perylene	74 J	480	µg/kg	A9-85	6 / 38	190 - 1000	480	170000 n [6]	NA	[4]	No	BSL
	207-08-9	Benzo(k)fluoranthene	84 J	480	µg/kg	A9-85	7 / 38	190 - 1000	480	1500 c	NA	[4]	No	BSL
	117-81-7	Bis(2-ethylhexyl)phthalate	98 J	12000	µg/kg	A9-104	10 / 38	190 - 1000	12000	35000 c	NA	[4]	No	BSL
	85-68-7	Butylbenzylphthalate	120 J	240 J	µg/kg	A9-83	3 / 38	190 - 1000	240	260000 c	NA	[4]	No	BSL
	86-74-8	Carbazole	73 J	73 J	µg/kg	A9-85	1 / 38	190 - 1000	73	NA	NA	[4]	No	IFD
	218-01-9	Chrysene	5.7 J	610 J	µg/kg	A9-85	35 / 38	3.8 - 19	610	15000 c	NA	[4]	No	BSL
	53-70-3	**Dibenzo(a,h)anthracene**	**4 J**	**76**	**µg/kg**	**A9-85**	**17 / 38**	**3.8 - 19**	**76**	**15 c**	**NA**	**[4]**	**Yes**	**ASL**
	206-44-0	Fluoranthene	72 J	1700	µg/kg	A9-85	16 / 38	190 - 1000	1700	230000 n	NA	[4]	No	BSL
	86-73-7	Fluorene	2.5 J	24 J	µg/kg	A9-88	8 / 38	3.8 - 19	24	230000 n	NA	[4]	No	BSL
	193-39-5	**Indeno(1,2,3-cd)pyrene**	**68 J**	**430**	**µg/kg**	**A9-85**	**6 / 38**	**190 - 1000**	**430**	**150 c**	**NA**	**[4]**	**Yes**	**ASL**
	91-57-6	Methylnaphthalene, 2-	4.1 J	45	µg/kg	A9-84	6 / 38	3.8 - 19	45	31000 n	NA	[4]	No	BSL
	91-20-3	Naphthalene	320 J	320 J	µg/kg	A9-84	1 / 38	190 - 1000	320	3600 c	NA	[4]	No	IFD
	85-01-8	Phenanthrene	51 J	490	µg/kg	A9-85	4 / 38	190 - 1000	490	1700000 n [7]	NA	[4]	No	BSL
	129-00-0	Pyrene	60 J	1100	µg/kg	A9-85	16 / 38	190 - 1000	1100	170000 n	NA	[4]	No	BSL
		PCBs/Pesticides												
	5103-71-9	Alpha-Chlordane	0.76 JN	9.2 J	µg/kg	A9-85	2 / 38	0.4 - 1.8	9.2	1600 c [8]	NA	[4]	No	BSL
	11097-69-1	Aroclor 1254	7 J	19	µg/kg	A9-84	2 / 38	7.8 - 34	19	110 n	NA	[4]	No	BSL
	60-57-1	Dieldrin	2	2	µg/kg	A9-85	1 / 38	0.78 - 3.4	2	30 c	NA	[4]	No	IFD
	5103-74-2	Gamma-Chlordane	5.7 JN	5.7 JN	µg/kg	A9-85	1 / 38	0.4 - 1.8	5.7	1600 c [8]	NA	[4]	No	IFD
	72-43-5	Methoxychlor	5 J	5 J	µg/kg	A9-106	1 / 38	4 - 18	5	31000 n	NA	[4]	No	IFD
		Inorganics												
	7429-90-5	**Aluminum**	**936**	**20900**	**mg/kg**	**SED67**	**40 / 40**	**19.5 - 78.7**	**20900**	**7700 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-36-0	**Antimony**	**0.72 J**	**11**	**mg/kg**	**A9-70**	**3 / 40**	**5.9 - 23.6**	**10.9**	**3.1 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-38-2	**Arsenic**	**3.7**	**89**	**mg/kg**	**A9-97**	**40 / 40**	**0.98 - 3.9**	**88.9**	**0.39 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	13.5 J	138	mg/kg	A9-104	32 / 40	19.5 - 78.7	138	1500 n	NA	[4]	No	BSL
	7440-41-7	Beryllium	0.19 J	1.5 J	mg/kg	A9-97	24 / 40	0.49 - 2	1.5	16 n	NA	[4]	No	BSL
	7440-43-9	Cadmium	0.34 J	3.8	mg/kg	A9-97	20 / 40	0.49 - 2	3.8	7 n	NA	[4]	No	BSL
	7440-70-2	Calcium	271 J	7210	mg/kg	A9-97	37 / 40	488 - 1970	7210	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	8.3	60	mg/kg	A9-104	40 / 40	0.98 - 3.9	59.7	NA	NA	[4]	No	NTX
	16065-83-1	Chromium III [9]	7.55	60	mg/kg	A9-104	38 / 38	0.98 - 3.9	59.7	12000 n	NA	[4]	No	BSL

TABLE B-2.5d

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Wetland Area of Area 9

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Sediment		**Inorganics (continued)**												
	18540-29-9	**Chromium VI**	**0.8 J**	**1.8**	**mg/kg**	**A9-112**	**5 / 38**	**1 - 4.2**	**1.8**	**0.29 c**	**NA**	[4]	**Yes**	**ASL/TOX**
	7440-48-4	**Cobalt**	**0.15 J**	**13 J**	**mg/kg**	**A9-74**	**18 / 40**	**4.9 - 19.7**	**12.7**	**2.3 n**	**NA**	[4]	**Yes**	**ASL**
	7440-50-8	**Copper**	**3 J**	**1790**	**mg/kg**	**A9-97**	**40 / 40**	**2.4 - 9.8**	**1790**	**310 n**	**NA**	[4]	**Yes**	**ASL**
	7439-89-6	**Iron**	**9940 J**	**89700**	**mg/kg**	**A9-106**	**40 / 40**	**9.8 - 39.4**	**89700**	**5500 n**	**NA**	[4]	**Yes**	**ASL**
	7439-92-1	**Lead**	**2.9**	**564**	**mg/kg**	**A9-97**	**40 / 40**	**0.98 - 3.9**	**564**	**400 n** [10]	**NA**	[4]	**Yes**	**ASL**
	7439-95-4	Magnesium	270 J	6500	mg/kg	A9-104	39 / 40	488 - 1970	6500	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**16.9**	**218 J**	**mg/kg**	**A9-74**	**40 / 40**	**1.5 - 5.9**	**218**	**180 n**	**NA**	[4]	**Yes**	**ASL**
	7439-97-6	**Mercury**	**0.018 J**	**2.6**	**mg/kg**	**A9-90**	**38 / 38**	**0.098 - 0.39**	**2.6**	**2.3 n** [11]	**NA**	[4]	**Yes**	**ASL**
	7440-02-0	Nickel	1.9 J	61.3	mg/kg	A9-97	39 / 40	3.9 - 15.7	61.3	150 n [12]	NA	[4]	No	BSL
	7440-09-7	Potassium	425 J	2390	mg/kg	A9-96	37 / 40	488 - 1970	2390	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	1.2 J	6.2	mg/kg	A9-75	3 / 40	3.4 - 13.8	6.2	39 n	NA	[4]	No	BSL
	7440-22-4	Silver	0.27 J	1.7 J	mg/kg	A9-97	3 / 40	0.98 - 3.9	1.7	39 n	NA	[4]	No	BSL
	7440-23-5	Sodium	356 J	12400	mg/kg	A9-90	35 / 40	488 - 1970	12400	NA	NA	[4]	No	NUT
	7440-28-0	Thallium	2.2 J	2.2 J	mg/kg	A9-75	1 / 40	2.4 - 9.8	2.2	NA	NA	[4]	No	IFD
	7440-62-2	**Vanadium**	**10.5**	**106**	**mg/kg**	**A9-104**	**40 / 40**	**4.9 - 19.7**	**106**	**39 n** [13]	**NA**	[4]	**Yes**	**ASL**
	7440-66-6	Zinc	11.4	300	mg/kg	A9-104	40 / 40	5.9 - 23.6	300	2300 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of the previous version of RSL (November 2010) results in more conservative screening levels.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient
NTX = no toxicity information available

[4] No Potential ARAR/TBC values are available.

[5] Screening level for acenaphthene is applied to acenaphthalene.

[6] Screening level for pyrene is applied to benzo(g,h,i)perylene.

[7] Screening level for anthracene is applied to phenanthrene.

[8] Screening level for chlordane is applied to alpha- and gamma-chlordane.

[9] Chromium III concentrations are derived from subtracting chromium concentration from chromium VI concentration. Chromium III is assumed to be not detected in the case where chromium VI concentration is greater than chromium.

[10] Lead screening level is from OSWER screening value for residential soil (400 mg/kg).

[11] Screening level for mercuric chloride is applied to mercury.

[12] Screening level for nickel soluble salts is applied to nickel.

[13] Screening level for vanadium and compounds is applied to vanadium.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration exceeds saturation concentration
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyls

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.6a

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Fish		**Inorganics**												
	7429-90-5	Aluminum	0.54 J	0.54 J	mg/kg wet wt.	FT-1	1 / 6	3.2 - 5	0.54	140 n	NA	[4]	No	BSL
	7440-38-2	**Arsenic**	**0.079 J**	**0.68**	**mg/kg wet wt.**	**FT-1**	**6 / 6**	**0.16 - 0.25**	**0.68**	**0.0021 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-70-2	Calcium	8.9 J	240	mg/kg wet wt.	FT-3	6 / 6	81 - 130	240	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.032 J	0.042 J	mg/kg wet wt.	FT-3	5 / 6	0.16 - 0.25	0.042	200 n [5]	NA	[4]	No	BSL
	7439-92-1	Lead	0.038 J	0.046 J	mg/kg wet wt.	FT-1	2 / 6	0.16 - 0.25	0.046	0.10 n [6]	NA	[4]	No	BSL
	7439-96-5	Manganese	0.35	0.35	mg/kg wet wt.	FT-4	1 / 6	0.24 - 0.38	0.35	19 n	NA	[4]	No	BSL
	7439-97-6	**Mercury**	**0.0046 J**	**0.053**	**mg/kg wet wt.**	**FT-5**	**6 / 6**	**0.02 - 0.03**	**0.053**	**0.014 n [7]**	**NA**	**[4]**	**Yes**	**ASL**
	7440-23-5	Sodium	15 J	170	mg/kg wet wt.	FT-3	6 / 6	81 - 130	170	NA	NA	[4]	No	NUT
	7440-66-6	Zinc	1.5	1.7	mg/kg wet wt.	FT-1	3 / 6	0.97 - 1.5	1.7	41 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
NUT = essential nutrient

[4] No Potential ARAR/TBC values are available.

[5] Chromium screened as chromium III. ERT indicated that based on the high organic content in the Raritan Bay sediments, the predominant form of chromium would be trivalent.

[6] The screening level for lead was developed by the EPA Region 2.

[7] Screening level for methylmercury is applied to mercury.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
mg/kg wet wt. = milligrams per kilogram wet weight

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.6b

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Hard Clam

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Hard Clam		**Inorganics**												
	7429-90-5	Aluminum	1.5 J	1.8 J	mg/kg wet wt.	ML-2A	2 / 5	3.3 - 5.8	1.8	140 n	NA	[4]	No	BSL
	7440-38-2	**Arsenic**	**0.18**	**1.6**	**mg/kg wet wt.**	**MER-3**	**4 / 5**	**0.083 - 0.17**	**1.6**	**0.0021 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	0.11 J+	0.11 J+	mg/kg wet wt.	MER-1	3 / 5	0.016 - 3.3	0.11	27 n	NA	[4]	No	BSL
	7440-43-9	**Cadmium**	**0.14**	**0.17**	**mg/kg wet wt.**	**MER-2**	**3 / 5**	**0.016 - 0.083**	**0.17**	**0.14 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-70-2	Calcium	290 J	530 J	mg/kg wet wt.	ML-2A	2 / 2	83 - 83	530	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.19	0.31	mg/kg wet wt.	MER-1	3 / 5	0.05 - 0.17	0.31	200 n [5]	NA	[4]	No	BSL
	7440-48-4	**Cobalt**	**0.056**	**0.13**	**mg/kg wet wt.**	**MER-3**	**3 / 5**	**0.016 - 0.83**	**0.13**	**0.041 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-50-8	Copper	0.52	2.4	mg/kg wet wt.	MER-1	5 / 5	0.016 - 0.42	2.4	5.4 n	NA	[4]	No	BSL
	7439-89-6	Iron	13 J	15 J	mg/kg wet wt.	ML-2A	2 / 2	1.7 - 1.7	15	95 n	NA	[4]	No	BSL
	7439-92-1	**Lead**	**0.29**	**3.8**	**mg/kg wet wt.**	**ML-2A**	**5 / 5**	**0.016 - 0.17**	**3.8**	**0.10 n [6]**	**NA**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	91 J	100 J	mg/kg wet wt.	ML-1A	2 / 2	83 - 83	100	NA	NA	[4]	No	NUT
	7439-96-5	**Manganese**	**8.8**	**34**	**mg/kg wet wt.**	**MER-2**	**5 / 5**	**0.016 - 0.25**	**34**	**19 n**	**NA**	**[4]**	**Yes**	**ASL**
	7440-02-0	Nickel	0.16 J+	0.26 J+	mg/kg wet wt.	MER-3	3 / 5	0.016 - 0.67	0.26	2.7 n [7]	NA	[4]	No	BSL
	7440-09-7	Potassium	330 J	380 J	mg/kg wet wt.	ML-2A	2 / 2	83 - 83	380	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.16	0.22	mg/kg wet wt.	MER-2	3 / 5	0.083 - 0.58	0.22	0.68 n	NA	[4]	No	BSL
	7440-22-4	Silver	0.032	0.34	mg/kg wet wt.	MER-3	3 / 5	0.016 - 0.17	0.34	0.68 n	NA	[4]	No	BSL
	7440-23-5	Sodium	530 J	650 J	mg/kg wet wt.	ML-1A	2 / 2	83 - 83	650	NA	NA	[4]	No	NUT
	7440-62-2	Vanadium	0.088	0.088	mg/kg wet wt.	MER-3	1 / 5	0.083 - 0.83	0.088	0.68 n [8]	NA	[4]	No	BSL
	7440-66-6	Zinc	4.6	19	mg/kg wet wt.	MER-3	5 / 5	0.16 - 1	19	41 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
IFD = detection frequency less than 5%
NUT = essential nutrient

[4] No Potential ARAR/TBC values are available.

[5] Chromium screened as chromium III. ERT indicated that based on the high organic content in the Raritan Bay sediments, the predominant form of chromium would be trivalent.

[6] The screening level for lead was developed by the EPA Region 2.

[7] Screening level for nickel soluble salts is applied to nickel.

[8] Screening level for vanadium and compounds is applied to vanadium.

Definitions: NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
J+=estimated value, biased high
mg/kg wet wt. = milligrams per kilogram wet weight

*Includes the following data:

Historical Data:	EPA - September 2008
	EPA - April 2009
	EPA - June/July 2009
Pre-Remedial Investigation (2010):	Beach Sampling - May 2010
	Area 2 - August 2010 - EPA-DESA
Remedial Investigation:	September/December 2010
	January 2011

TABLE B-2.6c

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Ribbed Mussel

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Ribbed Mussel		**Inorganics**												
	7429-90-5	Aluminum	0.89 J	6.2 J	mg/kg wet wt.	RM-3	5 / 10	2 - 5.8	6.2	140 n	NA	[4]	No	BSL
	7440-36-0	Antimony	0.022	0.03	mg/kg wet wt.	RM-3	3 / 10	0.018 - 0.59	0.03	0.054 n	NA	[4]	No	BSL
	7440-38-2	**Arsenic**	**0.66**	**0.89**	**mg/kg wet wt.**	**RM-6**	**6 / 10**	**0.09 - 0.1**	**0.89**	**0.0021 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-39-3	Barium	0.041 J+	0.06 J+	mg/kg wet wt.	RM-3	6 / 10	0.018 - 2	0.06	27 n	NA	[4]	No	BSL
	7440-43-9	Cadmium	0.038	0.085	mg/kg wet wt.	RM-2	6 / 10	0.018 - 0.049	0.085	0.14 n	NA	[4]	No	BSL
	7440-70-2	Calcium	23 J	38 J	mg/kg wet wt.	ML-3A	4 / 4	49 - 49	38	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.13	0.23	mg/kg wet wt.	RM-3	6 / 10	0.055 - 0.098	0.23	200 n [5]	NA	[4]	No	BSL
	7440-48-4	Cobalt	0.024	0.029	mg/kg wet wt.	RM-3	6 / 10	0.018 - 0.49	0.029	0.041 n	NA	[4]	No	BSL
	7440-50-8	Copper	0.16 J	1.4 J+	mg/kg wet wt.	RM-2	10 / 10	0.018 - 0.24	1.4	5.4 n	NA	[4]	No	BSL
	7439-89-6	Iron	3.3 J	4.2 J	mg/kg wet wt.	ML-3A	4 / 4	0.98 - 0.98	4.2	95 n	NA	[4]	No	BSL
	7439-92-1	**Lead**	**0.14**	**0.81**	**mg/kg wet wt.**	**RM-6**	**10 / 10**	**0.018 - 0.098**	**0.81**	**0.10 n [6]**	**NA**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	37 J	40 J	mg/kg wet wt.	ML-4A	4 / 4	49 - 49	40	NA	NA	[4]	No	NUT
	7439-96-5	Manganese	0.27 J	0.67 J+	mg/kg wet wt.	RM-6	10 / 10	0.018 - 0.15	0.67	19 n	NA	[4]	No	BSL
	7440-02-0	Nickel	0.045 J+	0.074 J+	mg/kg wet wt.	RM-3	6 / 10	0.018 - 0.39	0.074	2.7 n [7]	NA	[4]	No	BSL
	7440-09-7	Potassium	130 J	140 J	mg/kg wet wt.	ML-4A	4 / 4	49 - 49	140	NA	NA	[4]	No	NUT
	7782-49-2	Selenium	0.18	0.25	mg/kg wet wt.	RM-5	6 / 10	0.09 - 0.34	0.25	0.68 n	NA	[4]	No	BSL
	7440-22-4	Silver	0.036	0.066	mg/kg wet wt.	RM-1	6 / 10	0.018 - 0.098	0.066	0.68 n	NA	[4]	No	BSL
	7440-23-5	Sodium	250 J	270 J	mg/kg wet wt.	ML-4A	4 / 4	49 - 49	270	NA	NA	[4]	No	NUT
	7440-62-2	Vanadium	0.1	0.16	mg/kg wet wt.	RM-2	3 / 10	0.09 - 0.49	0.16	0.68 n [8]	NA	[4]	No	BSL
	7440-66-6	Zinc	0.88	5.8	mg/kg wet wt.	RM-2	10 / 10	0.18 - 0.59	5.8	41 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
NUT = essential nutrient

[4] No Potential ARAR/TBC values are available.

[5] Chromium screened as chromium III. ERT indicated that based on the high organic content in the Raritan Bay sediments, the predominant form of chromium would be trivalent.

[6] The screening level for lead was developed by the EPA Region 2.

[7] Screening level for nickel soluble salts is applied to nickel.

[8] Screening level for vanadium and compounds is applied to vanadium.

Definitions: NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
J+=estimated value, biased high
mg/kg wet wt. = milligrams per kilogram wet weight

*Includes the following data:

Historical Data:	EPA - September 2008
	EPA - April 2009
	EPA - June/July 2009
Pre-Remedial Investigation (2010):	Beach Sampling - May 2010
	Area 2 - August 2010 - EPA-DESA
Remedial Investigation:	September/December 2010
	January 2011

TABLE B-2.6d

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Blue Crab (Muscle)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [1]	Screening Toxicity Value (n/c) [2]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [3]
Blue Crab Muscle		**Inorganics**												
	7429-90-5	Aluminum	2.9	6.3	mg/kg wet wt.	BC-1	5 / 5	2.7 - 3.7	6.3	140 n	NA	[4]	No	BSL
	7440-38-2	**Arsenic**	**0.13 J**	**0.28**	**mg/kg wet wt.**	**BC-5**	**5 / 5**	**0.13 - 0.19**	**0.28**	**0.0021 c**	**NA**	**[4]**	**Yes**	**ASL/TOX**
	7440-41-7	Beryllium	0.0046 J	0.0046 J	mg/kg wet wt.	BC-3	1 / 5	0.067 - 0.094	0.0046	0.27 n	NA	[4]	No	BSL
	7440-70-2	Calcium	160	380 J	mg/kg wet wt.	BC-1	5 / 5	67 - 94	380	NA	NA	[4]	No	NUT
	7440-47-3	Chromium	0.03 J	0.039 J	mg/kg wet wt.	BC-2	3 / 5	0.13 - 0.19	0.039	200 n [5]	NA	[4]	No	BSL
	7440-50-8	Copper	1.9	4	mg/kg wet wt.	BC-4	5 / 5	0.34 - 0.47	4	5.4 n	NA	[4]	No	BSL
	7439-89-6	Iron	10	21 J	mg/kg wet wt.	BC-1	5 / 5	1.3 - 1.9	21	95 n	NA	[4]	No	BSL
	7439-92-1	**Lead**	**0.039 J**	**0.20**	**mg/kg wet wt.**	**BC-1**	**4 / 5**	**0.13 - 0.19**	**0.2**	**0.10 n [6]**	**NA**	**[4]**	**Yes**	**ASL**
	7439-95-4	Magnesium	76 J	89	mg/kg wet wt.	BC-4	3 / 5	67 - 94	89	NA	NA	[4]	No	NUT
	7439-96-5	Manganese	0.51	1.9	mg/kg wet wt.	BC-2	5 / 5	0.2 - 0.28	1.9	19 n	NA	[4]	No	BSL
	7439-97-6	Mercury	0.0056	0.011	mg/kg wet wt.	BC-5	4 / 5	0.013 - 0.019	0.011	0.014 n [7]	NA	[4]	No	BSL
	7440-02-0	Nickel	0.043 J	0.043 J	mg/kg wet wt.	BC-3	1 / 5	0.54 - 0.75	0.043	2.7 n [8]	NA	[4]	No	BSL
	7440-09-7	Potassium	430 J	430 J	mg/kg wet wt.	BC-1	1 / 5	67 - 94	430	NA	NA	[4]	No	NUT
	7440-22-4	Silver	0.063 J	0.1 J	mg/kg wet wt.	BC-2	5 / 5	0.13 - 0.19	0.1	0.68 n	NA	[4]	No	BSL
	7440-23-5	Sodium	490	690	mg/kg wet wt.	BC-4	5 / 5	67 - 94	690	NA	NA	[4]	No	NUT
	7440-66-6	Zinc	2.4	7	mg/kg wet wt.	BC-5	5 / 5	0.8 - 1.1	7	41 n	NA	[4]	No	BSL

[1] Maximum detected concentration used for screening.

[2] Screened against Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.

[3] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen

Deletion Reason: BSL = below screening level
NUT = essential nutrient

[4] No Potential ARAR/TBC values are available.

[5] Chromium screened as chromium III. ERT indicated that based on the high organic content in the Raritan Bay sediments, the predominant form of chromium would be trivalent.

[6] The screening level for lead was developed by the EPA Region 2.

[7] Screening level for methylmercury is applied to mercury.

[8] Screening level for nickel soluble salts is applied to nickel.

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
J = estimated value
mg/kg wet wt. = milligrams per kilogram wet weight

*Includes the following data:

Historical Data:
- EPA - September 2008
- EPA - April 2009
- EPA - June/July 2009

Pre-Remedial Investigation (2010):
- Beach Sampling - May 2010
- Area 2 - August 2010 - EPA-DESA

Remedial Investigation:
- September/December 2010
- January 2011

TABLE B-2.6e
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Blue Crab (Muscle plus Hepatopancreas)

Exposure Point	CAS No.	Chemical	Minimum Concentration (Qualifier) [1]	Maximum Concentration (Qualifier) [1]	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit	Concentration Used for Screening [2]	Screening Toxicity Value (n/c) [3]	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Yes/No)	Rationale for Selection or Deletion [4]
Blue Crab		**Inorganics**												
(Muscle and	7429-90-5	Aluminum	2.4	5.1	mg/kg wet wt.	BC-1	5 / 5	2.9 - 4	5.10	140 n	NA	[5]	No	BSL
Hepatopancreas)	**7440-38-2**	**Arsenic**	**0.17**	**0.35**	**mg/kg wet wt.**	**BC-4**	**5 / 5**	**0.14 - 0.2**	**0.35**	**0.0021 c**	**NA**	**[5]**	**Yes**	**ASL/TOX**
	7440-41-7	Beryllium	0.013	0.013	mg/kg wet wt.	BC-3	1 / 5	0.071 - 0.1	0.01	0.27 n	NA	[5]	No	BSL
	7440-43-9	**Cadmium**	**0.064**	**0.16**	**mg/kg wet wt.**	**BC-5**	**4 / 5**	**0.071 - 0.1**	**0.16**	**0.14 n**	**NA**	**[5]**	**Yes**	**ASL**
	7440-70-2	Calcium	240	600	mg/kg wet wt.	BC-5	5 / 5	71 - 100	600	NA	NA	[5]	No	NUT
	7440-47-3	Chromium	0.033	0.091	mg/kg wet wt.	BC-5	4 / 5	0.14 - 0.2	0.09	200 n [6]	NA	[5]	No	BSL
	7440-48-4	**Cobalt**	**0.26**	**0.36**	**mg/kg wet wt.**	**BC-5**	**3 / 5**	**0.71 - 1**	**0.36**	**0.041 n**	**NA**	**[5]**	**Yes**	**ASL**
	7440-50-8	**Copper**	**4.3**	**8.3**	**mg/kg wet wt.**	**BC-5**	**5 / 5**	**0.36 - 0.5**	**8.30**	**5.4 n**	**NA**	**[5]**	**Yes**	**ASL**
	7439-89-6	Iron	9	18	mg/kg wet wt.	BC-1	5 / 5	1.4 - 2	18.00	95 n	NA	[5]	No	BSL
	7439-92-1	**Lead**	**0.054**	**0.18**	**mg/kg wet wt.**	**BC-1**	**4 / 5**	**0.14 - 0.2**	**0.18**	**0.10 n [7]**	**NA**	**[5]**	**Yes**	**ASL**
	7439-95-4	Magnesium	46	110	mg/kg wet wt.	BC-4	5 / 5	71 - 100	110	NA	NA	[5]	No	NUT
	7439-96-5	Manganese	0.47	1.7	mg/kg wet wt.	BC-2	5 / 5	0.21 - 0.3	1.70	19 n	NA	[5]	No	BSL
	7439-97-6	Mercury	0.0054	0.011	mg/kg wet wt.	BC-5	4 / 5	0.014 - 0.02	0.01	0.014 n [8]	NA	[5]	No	BSL
	7440-02-0	Nickel	0.11	0.28	mg/kg wet wt.	BC-4	2 / 5	0.57 - 0.8	0.28	2.7 n [9]	NA	[5]	No	BSL
	7440-09-7	Potassium	410	410	mg/kg wet wt.	BC-1	1 / 5	71 - 100	410	NA	NA	[5]	No	NUT
	7440-22-4	Silver	0.16	0.29	mg/kg wet wt.	BC-5	5 / 5	0.14 - 0.2	0.29	0.68 n	NA	[5]	No	BSL
	7440-23-5	Sodium	590	790	mg/kg wet wt.	BC-4	5 / 5	71 - 100	790	NA	NA	[5]	No	NUT
	7440-62-2	Vanadium	0.37	0.37	mg/kg wet wt.	BC-5	1 / 5	0.71 - 1	0.37	0.68 n [10]	NA	[5]	No	BSL
	7440-66-6	Zinc	3.1	7.3	mg/kg wet wt.	BC-5	5 / 5	0.85 - 1.2	7.30	41 n	NA	[5]	No	BSL

[1] Data from hepatopancreas composite samples are mathematically combined with data from composite samples of tissue to form composite samples of combined tissue plus hepatopancreas.
Weighted average combined tissue plus hepatopancreas crab concentrations are calculated using the following formula:

$$C = C_{hp} \times \frac{WT_{hp}}{WT} + C_t \times \frac{WT_t}{WT}$$

where:

C = Chemical concentration in combined tissue plus hepatopancreas, mg/kg
C_{hp} = Chemical concentration in hepatopancreas, mg/kg
WT_{hp} = Weight of hepatopancreas, gram
WT = Weight of tissue plus hepatopancreas, gram
C_t = Chemical concentration in tissue, mg/kg
WT_t = Weight of tissue, gram

[2] Maximum detected concentration used for screening.
[3] Screened against Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.
[4] Rationale Codes:

Selection Reason: ASL = above screening level
TOX = group A carcinogen
Deletion Reason: BSL = below screening level
NUT = essential nutrient

Definitions:
NA = not available
NC = not calculated
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
COPC = chemical of potential concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement /To Be Considered
mg/kg wet wt. = milligrams per kilogram wet weight

*Includes the following data:
Historical Data:
EPA - September 2008
EPA - April 2009
EPA - June/July 2009
Pre-Remedial Investigation (2010):
Beach Sampling - May 2010
Area 2 - August 2010 - EPA-DESA
Remedial Investigation:
September/December 2010
January 2011

[5] No Potential ARAR/TBC values are available.
[6] Chromium screened as chromium III. ERT indicated that based on the high organic content in the Raritan Bay sediments, the predominant form of chromium would be trivalent.
[7] The screening level for lead was developed by the EPA Region 2.
[8] Screening level for methylmercury is applied to mercury.
[9] Screening level for nickel soluble salts is applied to nickel.
[10] Screening level for vanadium and compounds is applied to vanadium.

TABLE B-3.1a
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 1

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration (1)	Detection Frequency	Upper Confidence Limit (1)	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value(2)	Unit	Statistic (3)	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	91	25 / 31	132	600	132	µg/kg	UCL-G	95% Approximate Gamma UCL
	50-32-8	Benzo(a)pyrene	µg/kg	101	22 / 31	182	530	182	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	112	24 / 31	158	580	158	µg/kg	UCL-G	95% Approximate Gamma UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	81	16 / 31	150	110	110	µg/kg	Max	UCL > Max
	193-39-5	Indeno(1,2,3-cd)pyrene	µg/kg	96	18 / 31	145	290	145	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	316	12 / 31	892	3100	892	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	2205	220 / 228	2626	8710	2626	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	37	118 / 244	99	2390	99	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	18	227 / 242	35	760	35	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	1.7	14 / 18	4.4	8.3	4.4	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	mg/kg	2.1	196 / 230	2.2	9.2	2.2	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-50-8	Copper	mg/kg	44	232 / 243	91	1730	91	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	22079	229 / 229	27519	96800	27519	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	557	222 / 241	1553	47700	557	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	60	231 / 242	75	355	75	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	26	229 / 230	32	118	32	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls

J = estimated value

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
(1) The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values.
One-half of the reporting limit is used for non-detect values.
(2) The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
(3) Statistics: UCL-G = upper confidence limit of mean of gamma distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
Max = maximum detected concentration

TABLE B-3.1b
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Area 2

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	50-32-8	Benzo(a)pyrene	µg/kg	NC	1 / 13	NC	16 J	16	µg/kg	Max	<4 detected values
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	NC	2 / 13	NC	480	480	µg/kg	Max	<4 detected values
		Inorganics									
	7440-36-0	Antimony	mg/kg	24	83 / 94	41	190	41	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	18	94 / 94	29	150	29	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.18	5 / 21	0.58	2	0.58	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	mg/kg	1.4	56 / 94	1.8	4 J	1.8	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-50-8	Copper	mg/kg	31	94 / 94	54	330	54	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	12658	93 / 93	17904	74800 J	17904	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	485	94 / 94	594	3000	485	mg/kg	UCL-G	Mean
	7440-62-2	Vanadium	mg/kg	16	94 / 94	17	53.9	17	mg/kg	UCL-N	95% Student's-t UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
NC = not calculated

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values.
One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics:
UCL-N = upper confidence limit of mean of normal distribution
UCL-G = upper confidence limit of mean of gamma distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
Max = maximum detected concentration

TABLE B-3.1c
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 3 and 4

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration (1)	Detection Frequency	Upper Confidence Limit (1)	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value(2)	Unit	Statistic (3)	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	148	25 / 50	198	290	198	µg/kg	UCL-G	95% Approximate Gamma UCL
	50-32-8	Benzo(a)pyrene	µg/kg	146	24 / 50	196	240	196	µg/kg	UCL-G	95% Approximate Gamma UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	149	32 / 50	196	340	196	µg/kg	UCL-G	95% Approximate Gamma UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	3747	91 / 91	4346	27600 J	4346	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-36-0	Antimony	mg/kg	2.6	50 / 91	4.0	5.5 J	4.0	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	6.3	87 / 91	13	144	13	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.70	23 / 30	1.01	2.4 J	1.01	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	mg/kg	2.4	38 / 91	3.7	11.3	3.7	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	13772	91 / 91	15522	62800 J	15522	mg/kg	UCL-G	95% Approximate Gamma UCL
	7439-96-5	Manganese	mg/kg	122	91 / 91	186	940 J	186	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	19	81 / 91	22	112 J	22	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-66-6	Zinc	mg/kg	92	91 / 91	337	5160 J	337	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
(1) The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
(2) The EPCs are the lower of the maximum concentration and the UCL.
(3) Statistics: UCL-G = upper confidence limit of mean of gamma distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.1d
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 5, 6, and Beach Area of Area 9

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration (1)	Detection Frequency	Upper Confidence Limit (1)	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value(2)	Unit	Statistic (3)	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	50-32-8	Benzo(a)pyrene	µg/kg	40	6 / 11	91	40 J	40	µg/kg	Max	UCL > Max
		Inorganics									
	7429-90-5	Aluminum	mg/kg	1298	309 / 310	1561	11600	1561	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	4.4	110 / 458	6.8	210	6.8	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	5.7	453 / 465	6.9	54	6.9	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.61	10 / 28	0.66	1.1 J	0.66	mg/kg	UCL-N	95% Student's-t UCL
	7440-48-4	Cobalt	mg/kg	1.8	189 / 352	2.1	11.1	2.1	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	13381	310 / 310	16037	77000 J	16037	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	68	447 / 465	97	1090	68	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	52	352 / 355	96	3470 J	96	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	18	346 / 352	21	125	21	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
J = estimated value

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
(1) The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
(2) The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
(3) Statistics: UCL-N = upper confidence limit of mean of normal distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
Max = maximum detected concentration

TABLE B-3.1e
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Upland Area of Area 9

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	66	87 / 128	176	3000 J	176	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	50-32-8	Benzo(a)pyrene	µg/kg	50	78 / 128	132	2200 J	132	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	73	95 / 128	164	2100 J	164	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	11	41 / 128	30	520 J	30	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	193-39-5	Indeno(1,2,3-cd)pyrene	µg/kg	28	68 / 128	72	1200 J	72	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	714	23 / 128	2947	62000	2947	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	3297	135 / 135	4265	13500	4265	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	22	62 / 135	94	2200	94	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	13	130 / 135	35	594	35	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-43-9	Cadmium	mg/kg	0.26	114 / 135	0.68	12.5	0.68	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.67	58 / 130	0.74	3.4 J-	0.74	mg/kg	UCL-N	95% Student's-t UCL
	7440-48-4	Cobalt	mg/kg	1.7	107 / 135	2.4	12.7	2.4	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-50-8	Copper	mg/kg	43	127 / 135	97	1170	97	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	19851	135 / 135	21696	70300	21696	mg/kg	UCL-G	95% Approximate Gamma UCL
	7439-92-1	Lead	mg/kg	251	125 / 135	676	10200 J	251	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	62	135 / 135	104	1020	104	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	19	134 / 135	27	202	27	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls

J = estimated value
J-=estimated value, biased low

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics:
UCL-N = upper confidence limit of mean of normal distribution
UCL-G = upper confidence limit of mean of gamma distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.1f
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 2, 8, and 11)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	84	146 / 224	152	3000 J	152	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	50-32-8	Benzo(a)pyrene	µg/kg	77	130 / 224	130	2200 J	130	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	94	159 / 224	152	2100 J	152	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	54	64 / 224	83	520 J	83	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	193-39-5	Indeno(1,2,3-cd)pyrene	µg/kg	65	109 / 224	101	1200 J	101	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	461	38 / 224	1740	62000	1740	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	2180	777 / 792	2520	27600 J	2520	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	15	342 / 948	33	2390	33	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	9.7	911 / 953	15	760 J	15	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-43-9	Cadmium	mg/kg	0.32	428 / 828	0.42	12.5	0.42	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.75	114 / 218	1.0	8.3 J	1.0	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	mg/kg	1.9	539 / 828	2.2	12.7	2.2	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-50-8	Copper	mg/kg	22	916 / 954	36	1730	36	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	16875	793 / 793	19083	96800	19083	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	208	905 / 952	461	47700 J	208	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	63	816 / 836	85	3470 J	85	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	20	809 / 828	23	202	23	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-66-6	Zinc	mg/kg	41	810 / 847	69	5160 J	69	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls

J = estimated value

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.1g
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Soil
Exposure Medium:	Surface Soil - All Areas (except Areas 8 and 11)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration (1)	Detection Frequency	Upper Confidence Limit (1)	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value(2)	Unit	Statistic (3)	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	83	147 / 237	147	3000 J	147	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	50-32-8	Benzo(a)pyrene	µg/kg	76	131 / 237	126	2200 J	126	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	92	160 / 237	147	2100 J	147	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	54	64 / 237	82	520 J	82	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	193-39-5	Indeno(1,2,3-cd)pyrene	µg/kg	66	109 / 237	99	1200 J	99	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	439	40 / 237	1648	62000	1648	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	2114	870 / 885	2423	27600 J	2423	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	16	425 / 1042	33	2390	33	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	11	1005 / 1047	16	760 J	16	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-43-9	Cadmium	mg/kg	0.31	459 / 922	0.40	12.5	0.40	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.69	119 / 239	0.95	8.3 J	0.95	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	mg/kg	1.9	595 / 922	2.1	12.7	2.1	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-50-8	Copper	mg/kg	23	1009 / 1047	36	1730	36	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	16433	886 / 886	18492	96800	18492	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	234	999 / 1046	466	47700 J	234	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	61	909 / 929	80	3470 J	80	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	20	903 / 922	22	202	22	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-66-6	Zinc	mg/kg	41	904 / 941	66	5160 J	66	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
(1) The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
(2) The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
(3) Statistics: UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.1h
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface Soil - Areas 8 and 11

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	243	24 / 26	411	1900 J	411	µg/kg	UCL-G	95% Approximate Gamma UCL
	50-32-8	Benzo(a)pyrene	µg/kg	199	24 / 26	333	1400 J	333	µg/kg	UCL-G	95% Approximate Gamma UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	285	18 / 26	416	1900	416	µg/kg	UCL-G	95% Approximate Gamma UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	45	18 / 26	74	260	74	µg/kg	UCL-G	95% Approximate Gamma UCL
	193-39-5	Indeno(1,2,3-cd)pyrene	µg/kg	152	16 / 26	209	840	209	µg/kg	UCL-G	95% Approximate Gamma UCL
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	74	8 / 25	222	720	222	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	2784	182 / 182	3470	13500 J	3470	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	80	60 / 186	211	3270	211	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	63	184 / 184	155	2470 J	155	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-43-9	Cadmium	mg/kg	0.64	102 / 186	1.3	22.1	1.3	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.60	29 / 56	0.66	2.2 J	0.66	mg/kg	UCL-N	95% Student's-t UCL
	7440-48-4	Cobalt	mg/kg	3.1	155 / 186	4.3	24.1	4.3	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-50-8	Copper	mg/kg	134	184 / 184	283	4630	283	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	20490	182 / 182	27912	183000 J	27912	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	2651	182 / 184	8172	198000	2651	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	103	184 / 184	172	1710	172	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-02-0	Nickel	mg/kg	19	184 / 186	55	1500	55	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	24	186 / 186	26	75.1	26	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-66-6	Zinc	mg/kg	140	184 / 184	240	2700 J	240	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls
J = estimated value
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics:
UCL-N = upper confidence limit of mean of normal distribution
UCL-T = upper confidence limit of mean of lognormal distribution
UCL-G = upper confidence limit of mean of gamma distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Surface/Subsurface Soil - All Upland Areas

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface/ Subsurface Soil		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	75	241 / 423	124	3000 J	124	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	50-32-8	Benzo(a)pyrene	µg/kg	67	222 / 423	108	2300 J	108	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	82	265 / 423	132	3100 J	132	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	39	111 / 423	58	520 J	58	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	193-39-5	Indeno(1,2,3-cd)pyrene	µg/kg	52	186 / 423	78	1200 J	78	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		PCBs/Pesticides									
	11097-69-1	Aroclor 1254	µg/kg	262	58 / 422	942	62000	942	µg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	2647	771 / 771	3076	30400 J	3076	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	mg/kg	18	385 / 858	42	3270	42	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	17	829 / 858	34	2100 J	34	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-43-9	Cadmium	mg/kg	0.31	463 / 780	0.45	12.5	0.45	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	18540-29-9	Chromium VI	mg/kg	0.84	257 / 496	1.3	46 J	1.3	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	mg/kg	1.8	493 / 780	2.1	24.8	2.1	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-50-8	Copper	mg/kg	44	833 / 858	79.81	4950 J	80	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	16545	771 / 771	18544	154000	18544	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	mg/kg	408	837 / 860	807	40000	408	mg/kg	UCL-NP	Mean
	7439-96-5	Manganese	mg/kg	59	782 / 780	74	1250	74	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	18	768 / 780	20	202	20	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-66-6	Zinc	mg/kg	42	752 / 780	74	5160 J	74	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL

UCL = upper confidence limit of mean
PCB = polychlorinated biphenyls

J = estimated value

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.3a
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater (<10 feet bgs)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Shallow Groundwater		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/L	NC	1 / 7	NC	0.17	0.17	µg/L	Max	<10 samples
	132-64-9	Dibenzofuran	µg/L	NC	1 / 7	NC	11	11	µg/L	Max	<10 samples
	91-20-3	Naphthalene	µg/L	NC	1 / 7	NC	16	16	µg/L	Max	<10 samples
		Inorganics									
	7429-90-5	Aluminum	µg/L	NC	7 / 7	NC	34800 J	34800	µg/L	Max	<10 samples
	7440-36-0	Antimony	µg/L	NC	2 / 7	NC	2.1 J	2.1	µg/L	Max	<10 samples
	7440-38-2	Arsenic	µg/L	NC	7 / 7	NC	6.8 J	6.8	µg/L	Max	<10 samples
	7440-43-9	Cadmium	µg/L	NC	4 / 7	NC	4.7	4.7	µg/L	Max	<10 samples
	7440-48-4	Cobalt	µg/L	NC	7 / 7	NC	40.1 J	40.1	µg/L	Max	<10 samples
	7439-89-6	Iron	µg/L	NC	7 / 7	NC	372000	372000	µg/L	Max	<10 samples
	7439-92-1	Lead	µg/L	6.33	6 / 7	NC	20.4	6.33	µg/L	NA	Mean
	7439-96-5	Manganese	µg/L	NC	7 / 7	NC	1840 J	1840	µg/L	Max	<10 samples

UCL = upper confidence limit of mean
NC = not calculated
J = estimated value
NA = not applicable
µg/L = micrograms per liter
bgs = below ground surface

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: Max = maximum detected concentration

TABLE B-3.3b
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Groundwater (All Wells)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Groundwater		**Volatile Organic Compounds**									
	127-18-4	Tetrachloroethene	µg/L	0.71	5 / 20	2.0	5.0	2.0	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
		Inorganics									
	7429-90-5	Aluminum	µg/L	4541	20 / 20	8172	34800 J	8172	µg/L	UCL-G	95% Approximate Gamma UCL
	7440-36-0	Antimony	µg/L	0.90	13 / 20	1.5	5.4	1.5	µg/L	UCL-G	95% Approximate Gamma UCL
	7440-38-2	Arsenic	µg/L	2.0	20 / 20	2.8	6.8 J	2.8	µg/L	UCL-G	95% Approximate Gamma UCL
	7440-43-9	Cadmium	µg/L	0.76	15 / 20	1.9	4.7	1.9	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	µg/L	14	20 / 20	23	40.1 J	23	µg/L	UCL-G	95% Approximate Gamma UCL
	7440-50-8	Copper	µg/L	23	20 / 20	81	271	81	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	µg/L	32287	20 / 20	79894	372000	79894	µg/L	UCL-G	95% Approximate Gamma UCL
	7439-92-1	Lead	µg/L	11	19 / 20	33	107	11	µg/L	UCL-NP	Mean
	7439-96-5	Manganese	µg/L	784	20 / 20	1308	2060	1308	µg/L	UCL-G	95% Approximate Gamma UCL

UCL = upper confidence limit of mean J = estimated value µg/L = micrograms per liter

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: UCL-NP = upper confidence limit of mean of non-parametric distribution
UCL-G = upper confidence limit of mean of gamma distribution
Max = maximum detected concentration

TABLE B-3.4a
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water - All Areas (except Wetland Area of Area 9)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface Water		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/L	NC	1 / 7	NC	0.055	0.055	µg/L	Max	<10 samples
	205-99-2	Benzo(b)fluoranthene	µg/L	NC	1 / 7	NC	0.063	0.063	µg/L	Max	<10 samples
		Inorganics									
	7429-90-5	Aluminum	µg/L	1470	35 / 117	2162	12600 J	2162	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-36-0	Antimony	µg/L	13	19 / 139	19	53.2 J	19	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	µg/L	32	31 / 139	40	70.9	40	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-48-4	Cobalt	µg/L	173	15 / 117	218	17 J	17	µg/L	Max	UCL > Max
	7440-50-8	Copper	µg/L	77	38 / 139	98	154 J	98	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	µg/L	3156	49 / 117	6600	74400	6600	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-92-1	Lead	µg/L	106	40 / 139	253	1580 J	106	µg/L	UCL-NP	Mean
	7439-96-5	Manganese	µg/L	170	43 / 117	305	2620 J	305	µg/L	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	µg/L	177	17 / 117	220	94.9 J	95	µg/L	Max	UCL > Max

UCL = upper confidence limit of mean
NC = not calculated
J = estimated value
µg/L = micrograms per liter

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: UCL-NP = upper confidence limit of mean of non-parametric distribution
Max = maximum detected concentration

TABLE B-3.4b
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Surface Water
Exposure Medium:	Surface Water - Wetland Area of Area 9

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Surface Water		**Volatile Organic Compounds**									
	67-66-3	Chloroform	µg/L	NC	1 / 18	NC	0.46 J	0.46	µg/L	Max	<4 detected values
		Semi-volatile Organic Compounds									
	56-55-3	Benzo(a)anthracene	µg/L	NC	1 / 17	NC	0.053	0.053	µg/L	Max	<4 detected values
	87-86-5	Pentachlorophenol	µg/L	NC	1 / 17	NC	0.52 J	0.52	µg/L	Max	<4 detected values
		Inorganics									
	7440-38-2	Arsenic	µg/L	NC	2 / 15	NC	2.1	2.1	µg/L	Max	<4 detected values
	7439-89-6	Iron	µg/L	3922	10 / 15	8342	21100 J	8342	µg/L	UCL-G	95% Approximate Gamma UCL
	7439-96-5	Manganese	µg/L	188	12 / 15	402	637	402	µg/L	UCL-G	95% Approximate Gamma UCL

UCL = upper confidence limit of mean
NC = not calculated
J = estimated value
µg/L = micrograms per liter

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL.
[3] Statistics: UCL-G = upper confidence limit of mean of gamma distribution
Max = maximum detected concentration

TABLE B-3.5a
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Area 1

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Sediment		**Semi-volatile Organic Compounds**									
	50-32-8	Benzo(a)pyrene	µg/kg	NC	4 / 9	NC	16 J	16	µg/kg	Max	<10 samples
		Inorganics									
	7429-90-5	Aluminum	mg/kg	1648	73 / 73	1922	9950	1922	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-38-2	Arsenic	mg/kg	7.5	73 / 73	8.8	40.2 J	8.8	mg/kg	UCL-G	95% Approximate Gamma UCL
	18540-29-9	Chromium VI	mg/kg	0.66	7 / 25	0.71	1.0 J	0.71	mg/kg	UCL-N	95% Student's-t UCL
	7440-48-4	Cobalt	mg/kg	2.1	57 / 73	2.6	5.9 J	2.6	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	10363	73 / 73	11815	36800 J	11815	mg/kg	UCL-G	95% Approximate Gamma UCL
	7439-96-5	Manganese	mg/kg	49	70 / 70	68	219	68	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	19	73 / 73	21	66	21	mg/kg	UCL-G	95% Approximate Gamma UCL

UCL = upper confidence limit of mean
J = estimated value

NC = not calculated

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values.
One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL.
[3] Statistics:
UCL-N = upper confidence limit of mean of normal distribution
UCL-G = upper confidence limit of mean of gamma distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
Max = maximum detected concentration

TABLE B-3.5b
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Area 2

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Sediment		**Inorganics**									
	7440-38-2	Arsenic	mg/kg	NC	1 / 1	NC	6.9 J	6.9	mg/kg	Max	<10 samples
	18540-29-9	Chromium VI	mg/kg	NC	1 / 1	NC	1.8	1.8	mg/kg	Max	<10 samples
	7439-89-6	Iron	mg/kg	NC	1 / 1	NC	9630	9630	mg/kg	Max	<10 samples

UCL = upper confidence limit of mean
NC = not calculated
mg/kg = milligrams per kilogram
J = estimated value

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values.
One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL.
[3] Statistics: Max = maximum detected concentration

TABLE B-3.5c
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Areas 5, 6, and Beach Area of Area 9

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Sediment		**Semi-volatile Organic Compounds**									
	50-32-8	Benzo(a)pyrene	µg/kg	NC	3 / 5	NC	18 J	18	µg/kg	Max	<10 samples
		Inorganics									
	7440-36-0	Antimony	mg/kg	1.9	2 / 27	3.8	10.9	3.8	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-38-2	Arsenic	mg/kg	4.2	27 / 27	5.6	12.3 J	5.6	mg/kg	UCL-G	95% Approximate Gamma UCL
	18540-29-9	Chromium VI	mg/kg	NC	2 / 6	NC	0.55 J	0.55	mg/kg	Max	<10 samples
	7440-48-4	Cobalt	mg/kg	1.2	22 / 27	1.6	3.4	1.6	mg/kg	UCL-G	95% Approximate Gamma UCL
	7439-89-6	Iron	mg/kg	9710	21 / 22	17768	27900 J	17768	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7440-62-2	Vanadium	mg/kg	14	27 / 27	17	45 J	17	mg/kg	UCL-G	95% Approximate Gamma UCL

UCL = upper confidence limit of mean
J = estimated value
NC = not calculated
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL.
[3] Statistics: UCL-G = upper confidence limit of mean of gamma distribution
Max = maximum detected concentration
UCL-NP = upper confidence limit of mean of non-parametric distribution

TABLE B-3.5d
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment - Wetland Area of Area 9

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Sediment		**Semi-volatile Organic Compounds**									
	56-55-3	Benzo(a)anthracene	µg/kg	82	35 / 38	117	550 J	117	µg/kg	UCL-G	95% Approximate Gamma UCL
	50-32-8	Benzo(a)pyrene	µg/kg	74	35 / 38	105	570 J	105	µg/kg	UCL-G	95% Approximate Gamma UCL
	205-99-2	Benzo(b)fluoranthene	µg/kg	243	13 / 38	284	1000	284	µg/kg	UCL-T	95% H-UCL
	53-70-3	Dibenzo(a,h)anthracene	µg/kg	13	17 / 38	26	76	26	µg/kg	UCL-G	95% Approximate Gamma UCL
	193-39-5	Indeno(1,2,3-Cd)Pyrene	µg/kg	211	6 / 38	242	430	242	µg/kg	UCL-G	95% Approximate Gamma UCL
		Inorganics									
	7429-90-5	Aluminum	mg/kg	7320	40 / 40	8322	20900	8322	mg/kg	UCL-N	95% Student's-t UCL
	7440-36-0	Antimony	mg/kg	NC	3 / 40	NC	10.9	10.9	mg/kg	Max	<4 detected values
	7440-38-2	Arsenic	mg/kg	17	40 / 40	20	88.9	20	mg/kg	UCL-G	95% Approximate Gamma UCL
	18540-29-9	Chromium VI	mg/kg	1.0	5 / 38	1.2	1.8	1.2	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-48-4	Cobalt	mg/kg	4.9	18 / 40	5.6	12.7 J	5.6	mg/kg	UCL-N	95% Student's-t UCL
	7440-50-8	Copper	mg/kg	115	40 / 40	320	1790	320	mg/kg	UCL-NP	95% Chebyshev (Mean, Sd) UCL
	7439-89-6	Iron	mg/kg	29226	40 / 40	33675	89700	33675	mg/kg	UCL-G	95% Approximate Gamma UCL
	7439-92-1	Lead	mg/kg	117	40 / 40	154	564	117	mg/kg	UCL-G	Mean
	7439-96-5	Manganese	mg/kg	80	40 / 40	96	218 J	96	mg/kg	UCL-G	95% Approximate Gamma UCL
	7439-97-6	Mercury	mg/kg	0.26	38 / 38	0.35	2.6	0.35	mg/kg	UCL-G	95% Approximate Gamma UCL
	7440-62-2	Vanadium	mg/kg	44	40 / 40	50	106	50	mg/kg	UCL-G	95% Approximate Gamma UCL

UCL = upper confidence limit of mean
J = estimated value

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics:
UCL-G = upper confidence limit of mean of gamma distribution
UCL-N = upper confidence limit of mean of normal distribution
UCL-NP = upper confidence limit of mean of non-parametric distribution
Max = maximum detected concentration

TABLE B-3.6a
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

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

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration (1)	Detection Frequency	Upper Confidence Limit (1)	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value(2)	Unit	Statistic (3)	Rationale
Fish		**Inorganics**									
	7440-38-2	Arsenic	mg/kg wet wt.	0.26	6 / 6	NC	0.68	0.26	mg/kg wet wt.	Max	<10 samples
	7439-97-6	Mercury	mg/kg wet wt.	0.022	6 / 6	NC	0.053	0.022	mg/kg wet wt.	Max	<10 samples

UCL = upper confidence limit of mean NC = not calculated mg/kg wet wt. = milligrams per kilogram wet weight
J = estimated value

Note:
(1) The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values.
One-half of the reporting limit is used for non-detect values.
(2) The EPCs are the lower of the maximum concentration and the UCL.
(3) Statistics: Max = maximum detected concentration

TABLE B-3.6b
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Hard Clam

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Hard Clam		**Inorganics**									
	7440-38-2	Arsenic	mg/kg wet wt.	0.75	4 / 5	NC	1.6	1.6	mg/kg wet wt.	Max	<10 samples
	7440-43-9	Cadmium	mg/kg wet wt.	0.11	3 / 5	NC	0.17	0.17	mg/kg wet wt.	Max	<10 samples
	7440-48-4	Cobalt	mg/kg wet wt.	0.21	3 / 5	NC	0.13	0.13	mg/kg wet wt.	Max	<10 samples
	7439-92-1	Lead	mg/kg wet wt.	1.7	5 / 5	NC	3.8	1.7	mg/kg wet wt.	NA	Mean
	7439-96-5	Manganese	mg/kg wet wt.	17	5 / 5	NC	34	34	mg/kg wet wt.	Max	<10 samples

UCL = upper confidence limit of mean
J = estimated value
NC = not calculated
NA = not applicable
mg/kg wet wt. = milligrams per kilogram wet weight

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: Max = maximum detected concentration

TABLE B-3.6c
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Ribbed Mussel

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Ribbed Mussel		**Inorganics**									
	7440-38-2	Arsenic	mg/kg wet wt.	0.47	6 / 10	0.97	0.89	0.89	mg/kg wet wt.	Max	UCL > Max
	7439-92-1	Lead	mg/kg wet wt.	0.36	10 / 10	0.49	0.81 J	0.36	mg/kg wet wt.	UCL-N	Mean

UCL = upper confidence limit of mean J = estimated value NC = not calculated mg/kg wet wt. = milligrams per kilogram wet weight

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values.
One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: UCL-N = upper confidence limit of mean of normal distribution
Max = maximum detected concentration

TABLE B-3.6d
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Blue Crab (Muscle)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration (1)	Detection Frequency	Upper Confidence Limit (2)	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value	Unit	Statistic (3)	Rationale
Blue Crab (Muscle)		**Inorganics**									
	7440-38-2	Arsenic	mg/kg wet wt.	0.23	5 / 5	NC	0.28	0.28	mg/kg wet wt.	Max	<10 samples
	7439-92-1	Lead	mg/kg wet wt.	0.11	4 / 5	NC	0.2	0.11	mg/kg wet wt.	NA	Mean

UCL = upper confidence limit of mean
J = estimated value
NC = not calculated
NA = not applicable
mg/kg wet wt. = milligrams per kilogram wet weight

Note:
(1) The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
(2) The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
(3) Statistics: Max = maximum detected concentration

TABLE B-3.6e
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Medium:	Biota
Exposure Medium:	Blue Crab (Muscle plus Hepatopancreas)

Exposure Point	CAS No.	Chemical of Potential Concern	Unit	Mean Concentration [1]	Detection Frequency	Upper Confidence Limit [1]	Maximum Concentration (Qualifier)	Exposure Point Concentrations			
								Value[2]	Unit	Statistic [3]	Rationale
Blue Crab (Muscle and Hepatopancreas)		**Inorganics**									
	7440-38-2	Arsenic	mg/kg wet wt.	0.27	5 / 5	NC	0.35	0.35	mg/kg wet wt.	Max	<10 samples
	7440-43-9	Cadmium	mg/kg wet wt.	0.079	4 / 5	NC	0.16	0.16	mg/kg wet wt.	Max	<10 samples
	7440-48-4	Cobalt	mg/kg wet wt.	0.30	3 / 5	NC	0.36	0.36	mg/kg wet wt.	Max	<10 samples
	7440-50-8	Copper	mg/kg wet wt.	6.2	5 / 5	NC	8.3	8.3	mg/kg wet wt.	Max	<10 samples
	7439-92-1	Lead	mg/kg wet wt.	0.11	4 / 5	NC	0.18	0.11	mg/kg wet wt.	NA	Mean

UCL = upper confidence limit of mean
NA = not applicable
NC = not calculated
mg/kg wet wt. = milligrams per kilogram wet weight

Note:
[1] The mean concentrations and UCLs were calculated using the ProUCL 4.1.00 program for chemicals with at least 10 samples in a dataset and 4 detected values. One-half of the reporting limit is used for non-detect values.
[2] The EPCs are the lower of the maximum concentration and the UCL. For lead, the EPC is based on the mean concentration.
[3] Statistics: Max = maximum detected concentration

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Adult	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
			Area 1	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1a	Table B-3.1a	Table B-3.1a	Table B-3.1a	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	182	(2)	91	(1)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
			Upland Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1e	Table B-3.1e	Table B-3.1e	Table B-3.1e	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Adolescent (6-18 yrs)	Area 1	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1a	Table B-3.1a	Table B-3.1a	Table B-3.1a	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2008[3]	50	EPA 2008[3]	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2008[3]	50	EPA 2008[3]	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	20	[5]	10	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
			Upland Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1e	Table B-3.1e	Table B-3.1e	Table B-3.1e	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2008[3]	50	EPA 2008[3]	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
		Child (0-6 yrs)	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	200	EPA 2002	100	EPA 2008	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Child (0-6 yrs)	Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	200	EPA 2002	100	EPA 2008	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	182	(2)	91	(1)	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
	Pedestrian	Adult	Current Scenario: All Areas (except Areas 2, 8, and 11) Furrent Scenario: All Areas (except Areas 8 and 11)	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	350	EPA 1991	175	(1)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
		Adolescent (6-18 yrs)	Current Scenario: All Areas (except Areas 2, 8, and 11) Furrent Scenario: All Areas (except Areas 8 and 11)	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2008(3)	50	EPA 2008(3)	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	350	EPA 1991	175	(1)	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008(4)	53	EPA 2008(4)	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
	Trespasser	Adult	Areas 2, 8, and 11	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	52	(6)	26	(1)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	

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TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Trespasser	Adolescent (6-18 yrs)	Areas 2, 8, and 11	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2008[3]	50	EPA 2008[3]	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	52	[6]	26	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
	Outdoor Worker	Adult	Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Soil	mg/day	100	EPA 2002	50	EPA 1997	
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2	Table 3-2	Table 3-2	
				EF	Exposure Frequency	days/year	225	EPA 2002	219	EPA 2004	
				ED	Exposure Duration	years	25	EPA 2002	9	EPA 2004	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	9,125	EPA 1989	3,285	EPA 1989	
	Construction/ Utility Worker	Adult	All Upland Areas	CS	Chemical Concentration in Soil	mg/kg	Table B-3.2	Table B-3.2	Not Evaluated		Daily Intake (mg/kg-day) = CS x CF x IR-S x RBA x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--			
				IR-S	Ingestion Rate of Soil	mg/day	330	EPA 2002			
				RBA	Relative Bioavailability for Arsenic and Lead	unitless	Table 3-2	Table 3-2			
				EF	Exposure Frequency	days/year	250	[7]			
				ED	Exposure Duration	years	1	[7]			
				BW	Body Weight	kg	70	EPA 2002			
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989			
				AT-N	Averaging Time (Noncancer)	days	365	EPA 1989			
Dermal Contact	Recreational User	Adult	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	18,000	EPA 2004[8]	6,900	EPA 2004[9]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2004	0.01	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Recreational User	Adult	Area 1	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1a	Table B-3.1a	Table B-3.1a	Table B-3.1a	Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	6,900	EPA 2004[9]	6,900	EPA 2004[9]	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2004	0.01	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	5,700	EPA 2004[10]	5,700	EPA 2004[10]	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2004	0.01	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	182	[2]	91	[1]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
			Upland Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1e	Table B-3.1e	Table B-3.1e	Table B-3.1e	Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	5,700	EPA 2004[10]	5,700	EPA 2004[10]	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2004	0.01	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	

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TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Recreational User	Adolescent (6-18 yrs)	Area 1	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1a	Table B-3.1a	Table B-3.1a	Table B-3.1a	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	6,100	EPA 2008[11]	6,100	EPA 2008[11]	
				AF	Adherence Factor	mg/cm^2	0.09	EPA 2008[12]	0.05	EPA 2008[12]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	5,000	EPA 2008[13]	5,000	EPA 2008[13]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2008[14]	0.04	EPA 2008[14]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	20	[5]	10	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
			Upland Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1e	Table B-3.1e	Table B-3.1e	Table B-3.1e	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	5,000	EPA 2008[13]	5,000	EPA 2008[13]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2008[14]	0.04	EPA 2008[14]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	

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TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Recreational User	Child (0-6 yrs)	Areas 2, 5, 6 and Beach Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	6,600	EPA 2004	6,600	EPA 2004	
				AF	Adherence Factor	mg/cm^2	0.1	EPA 2008[15]	0.06	EPA 2008[15]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[1]	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	2,300	EPA 2008[16]	2,300	EPA 2008[16]	
				AF	Adherence Factor	mg/cm^2	0.13	EPA 2008[17]	0.07	EPA 2008[17]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	182	[5]	91	[1]	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
	Pedestrian	Adult	Current Scenario: All Areas (except Areas 2, 8, and 11) Furrent Scenario: All Areas (except Areas 8 and 11)	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	5,700	EPA 2004[10]	5,700	EPA 2004[10]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2004	0.01	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	350	EPA 1991	175	[1]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Pedestrian	Adolescent (6-18 yrs)	Current Scenario: All Areas (except Areas 2, 8, and 11) Furrent Scenario: All Areas (except Areas 8 and 11)	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	5,000	EPA 2008[13]	5,000	EPA 2008[13]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2008[14]	0.04	EPA 2008[14]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	350	EPA 1991	175	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
	Trespasser	Adult	Areas 2, 8, and 11	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	5,700	EPA 2004[10]	5,700	EPA 2004[10]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2004	0.01	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	52	[6]	26	[1]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
		Adolescent (6-18 yrs)	Areas 2, 8, and 11	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	5,000	EPA 2008[13]	5,000	EPA 2008[13]	
				AF	Adherence Factor	mg/cm^2	0.07	EPA 2008[14]	0.04	EPA 2008[14]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	52	[6]	26	[1]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[4]	53	EPA 2008[4]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Outdoor Worker	Adult	Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	3,300	EPA 2004	3,300	EPA 2004	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.2	EPA 2004	0.02	EPA 2004	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	225	EPA 2002	219	EPA 2004	
				ED	Exposure Duration	years	25	EPA 2002	9	EPA 2004	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	9,125	EPA 1989	3,285	EPA 1989	
	Construction/ Utility Worker	Adult	All Upland Areas	CS	Chemical Concentration in Soil	mg/kg	Table B-3.2	Table B-3.2	Not Evaluated		Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--			CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	3,300	EPA 2004			EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.3	EPA 2004			
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6			
				EF	Exposure Frequency	days/year	250	(7)			
				ED	Exposure Duration	years	1	(7)			
				BW	Body Weight	kg	70	EPA 2002			
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989			
				AT-N	Averaging Time (Noncancer)	days	365	EPA 1989			
Inhalation	Recreational User	Adult	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Exposure Concentration
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	EC (mg/m^3) =
				ET	Exposure Time	hrs/day	2	EPA 2009	1	EPA 2009	CA x ET x EF x ED x 1/AT
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	where:
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	CA = CS/PEF
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	210,240	EPA 1989	78,840	EPA 1989	
			Area 1	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1a	Table B-3.1a	Table B-3.1a	Table B-3.1a	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure Time	hrs/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	78,840	EPA 1989	

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TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Inhalation	Recreational User	Adult	Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure Time	hrs/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	182	(2)	91	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	78,840	EPA 1989	
			Upland Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1e	Table B-3.1e	Table B-3.1e	Table B-3.1e	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure Time	hrs/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	78,840	EPA 1989	
		Adolescent (6-18 yrs)	Area 1	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1a	Table B-3.1a	Table B-3.1a	Table B-3.1a	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure time	hr/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	105,120	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure time	hr/day	4	(5)	2	(1)	where:
				EF	Exposure Frequency	days/year	20	(5)	10	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	105,120	EPA 1989	

TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Inhalation	Recreational User	Adolescent (6-18 yrs)	Upland Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1e	Table B-3.1e	Table B-3.1e	Table B-3.1e	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure time	hr/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	105,120	EPA 1989	
		Child (0-6 yrs)	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	Tables B-3.1b and 3.1d	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure time	hr/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(1)	CA = CS/PEF
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	52,560	EPA 1989	52,560	EPA 1989	
			Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure time	hr/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	182	(2)	91	(1)	CA = CS/PEF
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	52,560	EPA 1989	52,560	EPA 1989	
	Pedestrian	Adult	Current Scenario: All Areas (except Areas 2, 8, and 11) Furrent Scenario: All Areas (except Areas 8 and 11)	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure Time	hrs/day	2	EPA 2009	1	EPA 2009	where:
				EF	Exposure Frequency	days/year	350	EPA 1991	175	(1)	CA = CS/PEF
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	78,840	EPA 1989	

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TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Inhalation	Pedestrian	Adolescent	Current Scenario:	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	Tables B-3.1f and 3.1g	EC (mg/m^3) =
		(6-18 yrs)	All Areas	CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
			(except Areas	ET	Exposure time	hr/day	2	EPA 2009	1	EPA 2009	where:
			2, 8, and 11)	EF	Exposure Frequency	days/year	350	EPA 1991	175	(1)	CA = CS/PEF
			Furrent Scenario:	ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
			All Areas	PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
			(except Areas	AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
			8 and 11)	AT-N	Averaging Time (Noncancer)	hrs	105,120	EPA 1989	105,120	EPA 1989	
	Trespasser	Adult	Areas 2, 8, and	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	For Cancer =
			11	CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	EC (mg/m^3) =
				ET	Exposure Time	hrs/day	2	EPA 2009	1	EPA 2009	CA x ET x EF x ED x 1/AT
				EF	Exposure Frequency	days/year	52	(6)	26	(1)	For non Cancer =
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	EC (mg/m^3) = CA
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	where:
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	CA = CS/PEF
		Adolescent	Areas 2, 8, and	CS	Chemical Concentration in Soil	mg/kg	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	Tables B-3.1b and 3.1h	For Cancer =
		(6-18 yrs)	11	CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	EC (mg/m^3) =
				ET	Exposure time	hr/day	2	EPA 2009	1	EPA 2009	CA x ET x EF x ED x 1/AT
				EF	Exposure Frequency	days/year	52	(6)	26	(1)	For non Cancer =
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	EC (mg/m^3) = CA
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	where:
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	CA = CS/PEF
	Outdoor Worker	Adult	Areas 3 and 4	CS	Chemical Concentration in Soil	mg/kg	Table B-3.1c	Table B-3.1c	Table B-3.1c	Table B-3.1c	EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated	calculated	calculated	CA x ET x EF x ED x 1/AT
				ET	Exposure Time	hrs/day	8	EPA 2002	4	(1)	where:
				EF	Exposure Frequency	days/year	225	EPA 2002	219	EPA 2004	CA = CS/PEF
				ED	Exposure Duration	years	25	EPA 2002	9	EPA 2004	
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7	area specific	Table B-4.7	
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N	Averaging Time (Noncancer)	hrs	219,000	EPA 1989	78,840	EPA 1989	

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TABLE B-4.1

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Inhalation	Construction/ Utility Worker	Adult	All Upland Areas	CS	Chemical Concentration in Soil	mg/kg	Table B-3.2	Table B-3.2	Not Evaluated		EC (mg/m^3) =
				CA	Chemical Concentration in Air	mg/m^3	calculated	calculated			CA x ET x EF x ED x 1/AT
				ET	Exposure Time	hrs/day	8	EPA 2009			where:
				EF	Exposure Frequency	days/year	250	(7)			CA = CS/PEF
				ED	Exposure Duration	years	1	(7)			
				PEF	Particulate Emission Factor	m^3/kg	area specific	Table B-4.7			
				AT-C	Averaging Time (Cancer)	hrs	613,200	EPA 1989			
				AT-N	Averaging Time (Noncancer)	hrs	8,760	EPA 1989			

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

(1) assumes one-half RME exposure frequency

(2) assumes 3 days/week in the spring and fall and 5 days/week in the summer, with 13 weeks per season

(3) based on the central tendency soil/dust ingestion rate for children 6 to <21 years in age. CTE is assumed to be one half the RME value.

(4) based on the weighted average weight for children 6 to <21 years in age

(5) based on site-specific data, the Old Bridge Township Recreation Center holds summer camp at the Recreational Center building for children aged 6 to 13 years in July from 9 am to 1 pm (4 hours per day for 5 days per week)

(6) assumes one day a week in the spring and fall and two days a week in the summer, with 13 weeks per season

(7) assumes 250 work days per year for one year

(8) based on the total surface area for adults

(9) based on the weighted average surface area for head, hands, forearms, lower legs, and feet for adult

(10) based on the weighted average surface area for head, hands, forearms, and lower legs for adult

(11) based on the weighted average surface area for head, hands, forearms, lower legs, and feet for children ages 6 to <21 years

(12) based on the weighted adherence factors on soil activity under RME scenario and daycare for CTE scenario for head, hands, forearms, lower legs, and feet for children ages 6 to <21 years

(13) based on the weighted average surface area for head, hands, forearms, and lower legs for children ages 6 to <21 years

(14) based on the weighted adherence factors on soil activity under RME scenario and daycare for CTE scenario for head, hands, forearms, and lower legs for children ages 6 to <21 years

(15) based on the weighted adherence factors on soil activity under RME scenario and daycare for CTE scenario for head, hands, arms, legs, and feet for children ages 0 to <6 years

(16) based on the weighted average surface area for head, hands, forearms, and lower legs for children ages 0 to <6 years

(17) based on the weighted adherence factors on soil activity under RME scenario and daycare for CTE scenario for head, hands, forearms, and lower legs for children ages 0 to <6 years

Sources:

EPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03

EPA 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

EPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. EPA/540/R/99/005

EPA 2008: Child-Specific Exposure Factors Handbook. EPA/600/R-06/096F

EPA 2009: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment. EPA-540-R-070-002

TABLE B-4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Construction/ Utility Worker	Adult	All Upland Areas	CW	Chemical Concentration in Water	µg/L	Table B-3.3a	Table B-3.3a	Not Evaluated		Daily Intake (mg/kg-day) = CW x CF1 x IR-W x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--			
				IR-W	Ingestion Rate of Water	L/day	0.002	EPA 2008 (1)			
				EF	Exposure Frequency	days/year	250	(2)			
				ED	Exposure Duration	years	1	(2)			
				BW	Body Weight	kg	70	EPA 1991			
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989			
				AT-N	Averaging Time (Noncancer)	days	365	EPA 1989			
	Resident	Adult/Child	Tap Water	CW	Chemical Concentration in Water	µg/L	Table B-3.3b	Table B-3.3b	Table B-3.3b	Table B-3.3b	Daily Intake (mg/kg-day) = CW x CF1 x {(IR-W_a x ED_a x 1/BW_a + IR-W_c x ED_c x 1/BW_c)} x EF x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W_a	Ingestion Rate of Water, adult	L/day	2	EPA 1991	1.4	EPA 1997	
				IR-W_c	Ingestion Rate of Water, child	L/day	1	EPA 2008	0.34	EPA 2008	
				BW_a	Body Weight, adult	kg	70	EPA 1991	70	EPA 1991	
				BW_c	Body Weight, child	kg	15	EPA 1991	15	EPA 1991	
				ED_a	Exposure Duration, adult	years	24	EPA 1991	9	EPA 1997	
				ED_c	Exposure Duration, child	years	6	EPA 1991	6	EPA 1991	
				EF	Exposure Frequency	days/year	350	EPA 1991	350	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N_a	Averaging Time (Noncancer) - adult	days	8,760	EPA 1989	3,285	EPA 1989	
				AT-N_c	Averaging Time (Noncancer) - child	days	2,190	EPA 1989	2,190	EPA 1989	
Dermal Contact	Construction/ Utility Worker	Adult	All Upland Areas	CW	Chemical Concentration in Water	µg/L	Table B-3.3a	Table B-3.3a	Not Evaluated		Daily Intake (mg/kg-day) = CW x CF1 x SA x K_p x CF2 x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--			
				SA	Skin Surface Area Available for Contact	cm^2	5,700	EPA 2004(3)			
				K_p	Dermal Permeability Coefficient	cm/hr	Table B-4.6	Table B-4.6			
				CF2	Conversion Factor 2	L/cm^3	0.001	--			
				ET	Exposure Time	hr/day	4	(4)			
				EF	Exposure Frequency	days/year	250	(2)			
				ED	Exposure Duration	years	1	(2)			
				BW_a	Body Weight	kg	70	EPA 1991			
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989			
				AT-N	Averaging Time (Noncancer)	days	365	EPA 1989			

TABLE B-4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS FOR GROUNDWATER EXPOSURE PATHWAYS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Intake Equation/ Model Name
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Resident	Adult/Child	Tap Water (Showering and Bathing)	CW	Chemical Concentration in Water	µg/L	Table B-3.3b	Table B-3.3b	Table B-3.3b	Table B-3.3b	Daily Intake (mg/kg-day) = CW x CF1 x {(SA_a x K_p x ET_a x ED_a x 1/BW_a) + (SA_c x K_p x ET_c x ED_c x 1/BW_c)} x CF2 x EF x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA_a	Skin Surface Area Available for Contact - adult	cm^2	18,000	EPA 2004	18,000	EPA 2004	
				SA_c	Skin Surface Area Available for Contact - child	cm^2	6,600	EPA 2008	6,600	EPA 2008	
				K_p	Dermal Permeability Coefficient	cm/hr	Table B-4.6	Table B-4.6	Table B-4.6	Table B-4.6	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET_a	Exposure Time - adult	hr/day	0.25	EPA 2001	0.1	EPA 2001	
				ET_c	Exposure Time - child	hr/day	0.45	EPA 2001	0.14	EPA 2001	
				EF	Exposure Frequency	days/year	350	EPA 1991	350	EPA 1991	
				ED_a	Exposure Duration - adult	years	24	EPA 1991	9	EPA 1997	
				ED_c	Exposure Duration - child	years	6	EPA 1991	6	EPA 1991	
				BW_a	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				BW_c	Body Weight - child	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N_a	Averaging Time (Noncancer) - adult	days	8,760	EPA 1989	3,285	EPA 1989	
				AT-N_c	Averaging Time (Noncancer) - child	days	2,190	EPA 1989	2,190	EPA 1989	
Inhalation	Resident	Adult/Child	Tap Water (Showering and Bathing)	CW	Chemical concentration in groundwater	µg/L	Table B-3.3b	Table B-3.3b	Table B-3.3b	Table B-3.3b	Exposure Concentration (mg/m^3) = CA x {(ET_a x ED_a)+(ET_c x ED_c)} x EF x 1/AT
				CA	Chemical concentration in air	mg/m^3	Tables D-3 and D-4	Tables D-3 and D-4	Tables D-3 and D-4	Tables D-3 and D-4	
				CF	Conversion factor	mg/µg	0.001	-	0.001	-	
				ET_a	Exposure time - adult	hr/day	0.58	EPA 2001	0.25	EPA 2001	
				ET_c	Exposure time - child	hr/day	1	EPA 2001	0.33	EPA 2001	
				EF	Exposure frequency	days/yr	350	EPA 1991	350	EPA 1991	
				ED_a	Exposure Duration, adult	years	24	EPA 1991	9	EPA 1991	
				ED_c	Exposure duration, child	years	6	EPA 1991	6	EPA 1991	
				AT-C	Averaging time (Cancer)	hrs	613,200	EPA 1989	613,200	EPA 1989	
				AT-N_a	Averaging time (Noncancer) - adult	hrs	210,240	EPA 1989	78,840	EPA 1989	
				AT-N_c	Averaging time (Noncancer) - child	hrs	52,560	EPA 1989	52,560	EPA 1989	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

(1) assumes one tenth of the recommended mean water ingestion rate for children ages 18 to 21 years while swimming

(2) assumes 250 work days per year for one year

(3) based on the weighted average surface area for head, hands, forearms, and lower legs for adult

(4) construction workers are assumed to come into contact with groundwater for 4 hours per day

Sources:

EPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03

EPA 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure .Draft.

EPA 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA 2001: Personal communication with M. Olsen of EPA Region 2, July 13, 2001. Based on EPA Region 2 and the Andelman model as modified by Schaum et al.

EPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

EPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. EPA/540/R/99/005

EPA 2008: Child-Specific Exposure Factors Handbook. EPA/600/R-06/096F

TABLE B-4.3

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Adult	Area 1	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) =
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	CW x CF1 x IR-W x ET x EF x ED x
				IR-W	Ingestion Rate of Water	L/hr	0.02	EPA 2008[1]	0.02	EPA 2008[1]	1/BW x 1/AT
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
			Areas 2, 5, 6, and Beach Area of Area 9	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) =
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	CW x CF1 x IR-W x ET x EF x ED x
				IR-W	Ingestion Rate of Water	L/hr	0.02	EPA 2008[1]	0.02	EPA 2008[1]	1/BW x 1/AT
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
			Wetland Area of Area 9	CW	Chemical Concentration in Water	µg/L	Table B-3.4b	Table B-3.4b	Table B-3.4b	Table B-3.4b	Daily Intake (mg/kg-day) =
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	CW x CF1 x IR-W x ET x EF x ED x
				IR-W	Ingestion Rate of Water	L/hr	0.002	EPA 2008[4]	0.002	EPA 2008[4]	1/BW x 1/AT
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
		Adolescent (6-18 yrs)	Area 1	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) =
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	CW x CF1 x IR-W x ET x EF x ED x
				IR-W	Ingestion Rate of Water	L/hr	0.05	EPA 2008[5]	0.05	EPA 2008[5]	1/BW x 1/AT
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[6]	53	EPA 2008[6]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	

TABLE B-4.3

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Adolescent (6-18 yrs)	Wetland Area of Area 9	CW	Chemical Concentration in Water	µg/L	Table B-3.4b	Table B-3.4b	Table B-3.4b	Table B-3.4b	Daily Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hr	0.005	EPA 2008[4]	0.005	EPA 2008[4]	
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[6]	53	EPA 2008[6]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
		Child (0-6 yrs)	Areas 2, 5, 6, and Beach Area of Area 9	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) = CW x CF1 x IR-W x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				IR-W	Ingestion Rate of Water	L/hr	0.05	EPA 2008[5]	0.05	EPA 2008[5]	
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
Dermal Contact	Recreational User	Adult	Area 1	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) = CW x CF1 x SA x K_p x CF2 x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm^2	18,000	EPA 2004	18,000	EPA 2004	
				K_p	Permeability Coefficient	cm/hr	chemical specific	Table B-4.5	chemical specific	Table B-4.5	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	

TABLE B-4.3

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Recreational User	Adult	Areas 2, 5, 6, and Beach Area of Area 9	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) = CW x CF1 x SA x K_p x CF2 x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm^2	18,000	EPA 2004	18,000	EPA 2004	
				K_p	Permeability Coefficient	cm/hr	chemical specific	Table B-4.5	chemical specific	Table B-4.5	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1	EPA 2008(2)	0.5	EPA 2008(2)	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(3)	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
			Wetland Area of Area 9	CW	Chemical Concentration in Water	µg/L	Table B-3.4b	Table B-3.4b	Table B-3.4b	Table B-3.4b	Daily Intake (mg/kg-day) = CW x CF1 x SA x K_p x CF2 x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm^2	6,900	EPA 2004	6,900	EPA 2004	
				K_p	Permeability Coefficient	cm/hr	chemical specific	Table B-4.5	chemical specific	Table B-4.5	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1	EPA 2008(2)	0.5	EPA 2008(2)	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(3)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 2002	70	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
		Adolescent (6-18 yrs)	Area 1	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) = CW x CF1 x SA x K_p x CF2 x ET x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	
				SA	Skin Surface Area Available for Contact	cm^2	15,000	EPA 2008(7)	15,000	EPA 2008(7)	
				K_p	Permeability Coefficient	cm/hr	chemical specific	Table B-4.5	chemical specific	Table B-4.5	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1	EPA 2008(2)	0.5	EPA 2008(2)	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(3)	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008(6)	53	EPA 2008(6)	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	

TABLE B-4.3

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal	Recreational	Adolescent	Wetland Area of	CW	Chemical Concentration in Water	µg/L	Table B-3.4b	Table B-3.4b	Table B-3.4b	Table B-3.4b	Daily Intake (mg/kg-day) =
Contact	User	(6-18 yrs)	Area 9	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	CW x CF1 x SA x K_p x CF2 x ET x EF x ED x
				SA	Skin Surface Area Available for Contact	cm^2	6,100	EPA 2008[6]	6,100	EPA 2008[6]	1/BW x 1/AT
				K_p	Permeability Coefficient	cm/hr	chemical specific	Table B-4.5	chemical specific	Table B-4.5	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[6]	53	EPA 2008[6]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
		Child	Areas 2, 5, 6,	CW	Chemical Concentration in Water	µg/L	Table B-3.4a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) =
		(0-6 yrs)	and Beach	CF1	Conversion Factor 1	mg/µg	0.001	--	0.001	--	CW x CF1 x SA x K_p x CF2 x ET x EF x ED x
			Area of Area 9	SA	Skin Surface Area Available for Contact	cm^2	6,600	EPA 2008[8]	6,600	EPA 2008[8]	1/BW x 1/AT
				K_p	Permeability Coefficient	cm/hr	chemical specific	Table B-4.5	chemical specific	Table B-4.5	
				CF2	Conversion Factor 2	L/cm^3	0.001	--	0.001	--	
				ET	Exposure Time	hrs/day	1	EPA 2008[2]	0.5	EPA 2008[2]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[3]	
				ED	Exposure Duration	years	6	EPA 1991	6	EPA 1997	
				BW	Body Weight	kg	15	EPA 2002	15	EPA 2002	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

[1] based on the recommended mean water ingestion rate for children ages 18 to 21 years while swimming

[2] assumes 1 hour per day under RME scenario and 0.5 hour per day under CTE scenario

[3] assumes one-half RME exposure frequency

[4] assumes one-tenth of the recommended mean water ingestion rate for swimming

[5] based on the recommended mean water ingestion rate for children ages 6 to 15 years while swimming

[6] based on weighted average weight for children 6 to <21 years in age

[7] based on the weighted total surface area for children between 6 to <21 years of age

[8] based on the weighted total surface area for children between 0 to <6 years of age

Sources:

EPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03

EPA 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

EPA 2008: Child-Specific Exposure Factors Handbook. EPA/600/R-06/096F

EPA 2009: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment. EPA-540-R-070-002

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TABLE B-4.4

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Adult	Area 1	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5a	Table B-3.4a	Table B-3.4a	Table B-3.4a	Daily Intake (mg/kg-day) =
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	10	(1)	5	(1)	1/BW x 1/AT
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(2)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
			Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Daily Intake (mg/kg-day) =
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	10	(1)	5	(1)	1/BW x 1/AT
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(2)	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
			Wetland Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5d	Table B-3.5d	Table B-3.5d	Table B-3.5d	Daily Intake (mg/kg-day) =
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	100	(3)	50	(1)	1/BW x 1/AT
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(2)	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
		Adolescent (6-18 yrs)	Area 1	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5a	Table B-3.5a	Table B-3.5a	Table B-3.5a	Daily Intake (mg/kg-day) =
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF x IR-S x EF x ED x
				IR-S	Ingestion Rate of Sediment	mg/day	10	EPA 2008(4)	5	EPA 2008(4)	1/BW x 1/AT
				EF	Exposure Frequency	days/year	100	EPA 2009	50	(2)	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008(5)	53	EPA 2008(5)	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	

TABLE B-4.4

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Recreational User	Adolescent (6-18 yrs)	Wetland Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5d	Table B-3.5d	Table B-3.5d	Table B-3.5d	Daily Intake (mg/kg-day) = CS x CF x IR-S x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Sediment	mg/day	100	EPA 2008[3]	50	EPA 2008[3]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[5]	53	EPA 2008[5]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
		Child (0-6 yrs)	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Daily Intake (mg/kg-day) = CS x CF x IR-S x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	
				IR-S	Ingestion Rate of Sediment	mg/day	20	EPA 2008[6]	10	EPA 2008[6]	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
Dermal Contact	Recreational User	Adult	Area 1	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5a	Table B-3.5a	Table B-3.5a	Table B-3.5a	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	6,900	EPA 2004	6,900	EPA 2004	
				AF	Adherence Factor	mg/cm^2	0.3	EPA 2004[7]	0.07	EPA 2004[7]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1991	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	

TABLE B-4.4

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Recreational User	Adult	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	6,900	EPA 2004	6,900	EPA 2004	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.3	EPA 2004[7]	0.07	EPA 2004[7]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1991	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
			Wetland Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5d	Table B-3.5d	Table B-3.5d	Table B-3.5d	Daily Intake (mg/kg-day) =
				CF	Conversion Factor	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	6,900	EPA 2004	6,900	EPA 2004	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.3	EPA 2004[7]	0.07	EPA 2004[7]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	12	EPA 1991	9	EPA 1991	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	3,285	EPA 1989	
		Adolescent (6-18 yrs)	Area 1	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5a	Table B-3.5a	Table B-3.5a	Table B-3.5a	Daily Intake (mg/kg-day) =
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	CS x CF x SA x AF x ABS x
				SA	Skin Surface Area Available for Contact	cm^2	6,100	EPA 2008[8]	6,100	EPA 2008[8]	EF x ED x 1/BW x 1/AT
				AF	Adherence Factor	mg/cm^2	0.3	EPA 2004[7]	0.07	EPA 2004[7]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[5]	53	EPA 2008[5]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	

TABLE B-4.4

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Dermal Contact	Recreational User	Adolescent (6-18 yrs)	Wetland Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Table B-3.5d	Table B-3.5d	Table B-3.5d	Table B-3.5d	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	6,100	EPA 2008[8]	6,100	EPA 2008[8]	
				AF	Adherence Factor	mg/cm^2	0.3	EPA 2004[7]	0.07	EPA 2004[7]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	12	EPA 1989	12	EPA 1989	
				BW	Body Weight	kg	53	EPA 2008[5]	53	EPA 2008[5]	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	4,380	EPA 1989	4,380	EPA 1989	
		Child (0-6 yrs)	Areas 2, 5, 6, and Beach Area of Area 9	CS	Chemical Concentration in Sediment	mg/kg	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Tables B-3.5b and 3.5c	Daily Intake (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
				CF	Conversion Factor 1	kg/mg	1E-06	--	1E-06	--	
				SA	Skin Surface Area Available for Contact	cm^2	4,200	EPA 2008[9]	4,200	EPA 2008[9]	
				AF	Adherence Factor	mg/cm^2	0.2	EPA 2004[10]	0.2	EPA 2004[10]	
				ABS	Absorption Factor	unitless	chemical specific	Table B-4.6	chemical specific	Table B-4.6	
				EF	Exposure Frequency	days/year	100	EPA 2009	50	[2]	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

(1) potential ingestion is limited to sediments that have been re-suspended in the water column while swimming. One tenth of the recommended soil ingestion rate for residential adults is used.

(2) assumes one-half RME exposure frequency

(3) based on soil ingestion rate for residential adults

(4) potential ingestion is limited to sediments that have been re-suspended in the water column while swimming. One tenth of the recommended soil ingestion rate for children 6 to <21 years in age is used.

(5) based on weighted average weight for children 6 to <21 years in age

(6) potential ingestion is limited to sediments that have been re-suspended in the water column while swimming. One tenth of the recommended soil ingestion rate for children <6 years old is used.

(7) RME value is based on the geometric mean soil adherence factor for reed gatherers and CTE value is based on the geometric meansoil adherence factor for gardeners

(8) based on the weighted average surface area for head, hands, forearms, lower legs, and feet for children ages 6 to <21 years

(9) based on the weighted average surface area for head, hands, arms, legs, and feet for children ages 0 to <6 years

(10) based on geometric mean soil adherence factor of children playing in wet soil

Sources:

EPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002

EPA 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03

EPA 1997: Exposure Factors Handbook. Vol. 1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment Final. EPA/540/R/99/005

EPA 2008: Child-Specific Exposure Factors Handbook. EPA/600/R-06/096F

EPA 2009: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment. EPA-540-R-070-002

TABLE B-4.5

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion of Fish	Angler	Adult	All Areas (except Areas 3 and 4)	CS	Chemical Concentration in Fish	mg/kg	Tables B-3.6a	Tables B-3.6a	Tables B-3.6a	Tables B-3.6a	Daily Intake (mg/kg-day) = CS x CF1 x IR-F x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	kg/g	1E-03	--	1E-03	--	
				IR-F	Ingestion Rate of Fish	g/day	33	(1)	22	(1)	
				EF	Exposure Frequency	days/year	365	EPA 1997	365	EPA 1997	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	
		Child (0-6 yrs)	All Areas (except Areas 3 and 4)	CS	Chemical Concentration in Fish	mg/kg	Tables B-3.6a	Tables B-3.6a	Tables B-3.6a	Tables B-3.6a	Daily Intake (mg/kg-day) = CS x CF1 x IR-F x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	kg/g	1E-03	--	1E-03	--	
				IR-F	Ingestion Rate of Fish	g/day	11	EPA 2011(2)	7.3	EPA 2011(2)	
				EF	Exposure Frequency	days/year	365	EPA 1997	365	EPA 1997	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	
Ingestion of Shellfish	Angler	Adult	All Areas (except Areas 3 and 4)	CS	Chemical Concentration in Fish	mg/kg	Tables B-3.6b to 3.6e	Tables B-3.6b to 3.6e	Tables B-3.6b to 3.6e	Tables B-3.6b to 3.6e	Daily Intake (mg/kg-day) = CS x CF1 x IR-F x EF x ED x 1/BW x 1/AT
				CF1	Conversion Factor 1	kg/g	1E-03	--	1E-03	--	
				IR-F	Ingestion Rate of Shellfish	g/day	16	(3)	6.6	EPA 1997(4)	
				EF	Exposure Frequency	days/year	365	EPA 1997	365	EPA 1997	
				ED	Exposure Duration	years	24	EPA 1991	9	EPA 1997	
				BW	Body Weight	kg	70	EPA 1991	70	EPA 1991	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	8,760	EPA 1989	3,285	EPA 1989	

TABLE B-4.5

VALUES AND EQUATIONS USED FOR DAILY INTAKE CALCULATIONS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

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

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Unit	RME		CTE		Chronic Daily Intake (CDI)
							Value	Rationale/ Reference	Value	Rationale/ Reference	
Ingestion	Angler	Child	All Areas	CS	Chemical Concentration in Fish	mg/kg	Tables B-3.3b	Tables B-3.3b	Tables B-3.3b	Tables B-3.3b	Daily Intake (mg/kg-day) =
of Shellfish		(0-6 yrs)	(except Areas	CF	Conversion Factor	kg/g	1E-03	--	1E-03	--	CS x CF1 x IR-F x EF x ED x
			3 and 4)	IR-F	Ingestion Rate of Shellfish	g/day	5.3	EPA 2011[(2)]	2.2	EPA 2011[(2)]	1/BW x 1/AT
				EF	Exposure Frequency	days/year	365	EPA 1997	365	EPA 1997	
				ED	Exposure Duration	years	6	EPA 1989	6	EPA 1989	
				BW	Body Weight	kg	15	EPA 2008	15	EPA 2008	
				AT-C	Averaging Time (Cancer)	days	25,550	EPA 1989	25,550	EPA 1989	
				AT-N	Averaging Time (Noncancer)	days	2,190	EPA 1989	2,190	EPA 1989	

RME = Reasonable Maximum Exposure; CTE = Central Tendency Exposure

(1) RME value is based on average of fish ingestion rates for Raritan Bay (May and Burger 1996) and Newark Bay Complex (Burger 2002). CTE value is based on the mean fish ingestion rate for Raritan Bay (Burger 2002).

(2) per EPA recommendation, the fish and shellfish ingestion rates for children are assumed to be 1/3 of adult ingestion rates

(3) based on the mean crab ingestion rate for the Newark Bay Complex (Burger 2002)

(4) based on the recommended fish (finfish and shellfish) ingestion rate for freshwater/estuarine fish

Sources:

Burger, J. 2002. Consumption Patterns and Why People Fish. Environmental Research Section A, 90, 125-135.

EPA 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

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TABLE B-4.6
CHEMICAL-SPECIFIC INFORMATION USED FOR DAILY INTAKE CALCULATIONS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical	Permeability Coefficient [1] (cm/hr)	Dermal Absorption Fraction [1] Unitless	Henry's Law Constant[2] ($atm\text{-}m^3/mole$)	Diffusivity in Air[2] (cm^2/s)	Diffusivity in Water[2] (cm^2/s)	Fraction Volatilized[3] Unitless
Volatile Organic Compounds						
Chloroform	6.8E-03	NA	3.7E-03	7.7E-02	1.1E-05	5.5E-01
Tetrachloroethene	3.3E-02	NA	1.8E-02	5.0E-02	9.5E-06	5.0E-01
Semi-volatile Organic Compounds						
Benzo(a)anthracene	4.7E-01	1.3E-01	1.2E-05	5.1E-02	5.9E-06	NA
Benzo(a)pyrene	7.0E-01	1.3E-01	4.6E-07	4.8E-02	5.6E-06	NA
Benzo(b)fluoranthene	7.0E-01	1.3E-01	6.6E-07	4.8E-02	5.6E-06	NA
Dibenzo(a,h)anthracene	1.5E+00	1.3E-01	1.4E-07	4.5E-02	5.2E-06	NA
Dibenzofuran[4]	9.8E-02	NA	2.1E-04	4.1E-02	7.4E-06	4.2E-01
Indeno(1,2,3-cd)pyrene	1.0E+00	1.3E-01	3.5E-07	4.5E-02	5.2E-06	NA
Naphthalene[4]	4.7E-02	1.3E-01	4.4E-04	6.0E-02	8.4E-06	4.6E-01
Pentachlorophenol	3.9E-01	2.5E-01	2.5E-08	3.0E-02	8.0E-06	NA
PCBs/Pesticides						
Aroclor 1254	7.5E-01	1.4E-01	2.8E-04	4.0E-02	4.7E-06	NA
Inorganics						
Aluminum	1.0E-03	NA	NA	NA	NA	NA
Antimony	1.0E-03	NA	NA	NA	NA	NA
Arsenic	1.0E-03	3.0E-02	NA	NA	NA	NA
Cadmium	1.0E-03	1.0E-03	NA	NA	NA	NA
Chromium VI	2.0E-03	NA	NA	NA	NA	NA
Cobalt	4.0E-04	NA	NA	NA	NA	NA
Copper	1.0E-03	NA	NA	NA	NA	NA
Iron	1.0E-03	NA	NA	NA	NA	NA
Lead	1.0E-04	NA	NA	NA	NA	NA
Manganese	1.0E-03	NA	NA	NA	NA	NA
Mercury	1.0E-03	NA	1.1E-02	3.1E-02	6.3E-06	3.8E-01
Nickel	2.0E-04	NA	NA	NA	NA	NA
Vanadium	1.0E-03	NA	NA	NA	NA	NA
Zinc	6.0E-04	NA	NA	NA	NA	NA

NA - Not applicable
Notes:
[1] Source: EPA 2004. Risk Assessment Guidance for Superfund. Part E.
[2] Source: EPA November 2010. Regional Screening Levels for Chemical Contaminanats at Superfund Sites.
[3] Estimated for volatile chemicals using Eqn. 5 from Schaum et al (1994) (p. 308), with radon as the reference chemical (j):

$$f_i = f_j \times \frac{(2.5/D_w^{0.67} + RT/D_a^{0.67}H)_i}{(2.5/D_w^{0.67} + RT/D_a^{0.67}H)_j}$$

Where:
f_i = volatilization fraction for chemical i
f_j = volatilization fraction for chemical j = Radon
D_a = diffusion coefficient in air, m^2/s
D_w = diffusion coefficient in water, m^2/s
D_a for Radon = 2.0×10^{-5}
D_w for Radon = 1.4×10^{-9}

R = gas constant, $atm\text{-}m^3/mol\text{-}K = 8.21 \times 10^{-5}$
H = Henry's law constant, $atm\text{-}m^3/mol$
T = temperature, K = 293

[4] Source: Risk Assessment Information System. Accessed June 2011. http://rais.ornl.gov

TABLE B-4.7
PARTICULATE EMISSION FACTOR
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

$$Q/C = A \times \exp \frac{(\ln A_{site} - B)^2}{C}$$

A,B,C constant based on Zone 8, Philadephia, PA[1]

A = 14.0111 (unitless)
B = 19.6154 (unitless)
C = 225.3397 (unitless)

$$PEF = Q/C \times \frac{3{,}600\ s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

			Reference
U_m =	4.47	m/s	based on the mean annual wind speed from 1930 to 1996 for Newark, New Jersey, the closest station to the site
U_t =	11.32	m/s	EPA 2002
F(x) =	0.194	(unitless)	EPA 2002

	Area 1	Area 2	Areas 3 and 4	Areas 5, 6, and Beach Area of Area 9	Upland Area of Area 9	All Areas (except Areas 2, 8, and 11)	All Areas (except Areas 8 and 11)	Areas 8 and 11	All Upland Areas
A_{site} (acres)	17.97	5.97	8.81	58.31	21.69	107.93	113.90	38.35	59.92
Q/C_{wind} (g/m^2 -s per kg/m^3)	48.49	57.42	54.03	40.97	47.17	37.70	37.43	43.44	40.82
V =	0.05	0.05	0.8	0.05	0.8	0.5	0.5	0.5	0.5
PEF (m^3/kg)	**4.27E+08**	**5.06E+08**	**2.26E+09**	**3.61E+08**	**1.97E+09**	**6.31E+08**	**6.27E+08**	**7.27E+08**	**6.83E+08**

EPA 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Exhibit D-2.

TABLE B-5.1
NONCANCER TOXICITY DATA - ORAL/DERMAL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal [1]	Absorbed RfD for Dermal [1]		Primary Target Organ	Combined Uncertainty/ Modifying Factor	Source	Date [2] (MM/DD/YYYY)
		Value	Unit		Value	Unit				
Volatile Organic Compounds										
Chloroform	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	100	IRIS	7/19/2011
Tetrachloroethene	Chronic	1.0E-02	mg/kg-day	1	1.0E-02	mg/kg-day	Liver	1000	IRIS	7/19/2011
Semi-volatile Organic Compounds										
Benzo(a)anthracene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Dibenzofuran	Chronic	1.0E-03	mg/kg-day	1	1.0E-03	mg/kg-day	Developmental/Organ Weight	10000	S-PPRTV	6/11/2007
Indeno(1,2,3-cd)pyrene	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	2.0E-02	mg/kg-day	1	2.0E-02	mg/kg-day	Body Weight	3000	IRIS	7/19/2011
Pentachlorophenol	Chronic	5.0E-03	mg/kg-day	1	5.0E-03	mg/kg-day	Liver	300	IRIS	7/19/2011
PCBs/Pesticides										
Aroclor 1254	Chronic	2.0E-05	mg/kg-day	1	2.0E-05	mg/kg-day	Eyes/Fingernails/Immune System	300	IRIS	5/23/2011
Inorganics										
Aluminum	Chronic	1.0E+00	mg/kg-day	1	1.0E+00	mg/kg-day	Neurological	100	PPRTV	10/23/2006
Antimony	Chronic	4.0E-04	mg/kg-day	0.15	6.0E-05	mg/kg-day	Longevity/Blood	1000	IRIS	5/23/2011
Arsenic	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Skin	3	IRIS	5/23/2011
Cadmium[3]	Chronic	1.0E-03	mg/kg-day	0.025	2.5E-05	mg/kg-day	Kidney	10	IRIS	5/23/2011
Chromium VI	Chronic	3.0E-03	mg/kg-day	0.025	7.5E-05	mg/kg-day	NA	900	IRIS	5/23/2011
Cobalt	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Thyroid Gland	3000	PPRTV	8/25/2008
Copper	Chronic	4.0E-02	mg/kg-day	1	4.0E-02	mg/kg-day	GI Tract	NA	HEAST	7/1/1997
Iron	Chronic	7.0E-01	mg/kg-day	1	7.0E-01	mg/kg-day	GI Tract	1.5	PPRTV	9/11/2006
Lead	Chronic	NA	NA	1	NA	NA	NA	NA	NA	NA
Manganese[4]	Chronic	1.4E-01	mg/kg-day	1	1.4E-01	mg/kg-day	CNS	1	IRIS	5/23/2011
Mercury[5]	Chronic	3.0E-04	mg/kg-day	1	3.0E-04	mg/kg-day	Immune System	1000	IRIS	5/23/2011
Nickel	Chronic	2.0E-02	mg/kg-day	0.04	8.0E-04	mg/kg-day	Body Weight/Organ Weight	300	IRIS	7/19/2011
Vanadium	Chronic	5.0E-03	mg/kg-day	1	5.0E-03	mg/kg-day	Kidney	3000	PPRTV	9/30/2009
Zinc	Chronic	3.0E-01	mg/kg-day	1	3.0E-01	mg/kg-day	Fetus	3	IRIS	5/23/2011

[1] Adjusted RfD for Dermal = Oral RfD x Oral Absorption Efficiency for Dermal. From Regional Screening Levels (RSL), November 2010, http://www.epa.gov/region09/waste/sfund/prg/index.html

[2] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.

[3] Based on RfD for cadmium (diet)
Cadmium (water) RfD is $5x10^{-4}$ mg/kg-day with an oral absorption efficiency for dermal of 5%.

[4] Based on RfD for manganese (diet)

[5] Based on RfD for mercuric chloride
For fish/shellfish, the RfD of $1x10^{-4}$ mg/kg-day is based on methyl mercury.

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
CNS = central nervous system
GI = gastrointestinal
HEAST = Health Effect Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
S-PPRTV = Screening Provisional Peer Reviewed Toxicity Value
RfD = reference dose
RSL = Regional Screening Level

TABLE B-5.2a
NONCANCER TOXICITY DATA - INHALATION (CHRONIC)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source [1]	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	9.8E-02	mg/m^3	Liver	100	ATSDR	12/10/2010
Tetrachloroethene	2.7E-01	mg/m^3	CNS	100	ATSDR	12/10/2010
Semi-volatile Organic Compounds						
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Naphthalene	3.0E-03	mg/m^3	Respiratory	3000	IRIS	7/19/2011
Pentachlorophenol	NA	NA	NA	NA	NA	NA
PCBs/Pesticides						
Aroclor 1254	NA	NA	NA	NA	NA	NA
Inorganics						
Aluminum	5.0E-03	mg/m^3	Neurological	300	PPRTV	10/23/2006
Antimony	NA	NA	NA	NA	NA	NA
Arsenic	1.5E-05	mg/m^3	Developmental/Cardiovascular System/CNS	30	Cal/EPA	12/18/2008
Cadmium	1.0E-05	mg/m^3	Kidney	9	ATSDR	12/10/2010
Chromium VI	1.0E-04	mg/m^3	Lungs	300	IRIS	5/23/2011
Cobalt	6.0E-06	mg/m^3	Respiratory System	300	PPRTV	8/25/2008
Copper	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	5.0E-05	mg/m^3	CNS	1000	IRIS	5/23/2011
Mercury	3.0E-04	mg/m^3	Motor Coordination/CNS	30	IRIS	5/23/2011
Nickel	9.0E-05	mg/m3	Respiratory System	30	ATSDR	12/10/2010
Vanadium	1.0E-04	mg/m^3	Respiratory System	30	ATSDR	12/10/2010
Zinc	NA	NA	NA	NA	NA	NA

[1] ATSDR chronic inhalation minimal risk level (MRL)
MRL is converted from units in ppmv to mg/m^3 using the following equation:
MRL (mg/m^3) = (ppmv)(1 kg/1000 g)(P/RT)(molecular weight)
where:
P = ambient air pressure, 1 atmosphere (atm)
R = ideal gas constant, 8.2×10^{-5} atm-m^3/mol-^{0}K
T = absolute temperature, 298.15 Kelvin (^{0}K)
[2] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris
Date shown for other sources is the publication date.

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
RfC = reference concentration

TABLE B-5.2b
NONCANCER TOXICITY DATA - INHALATION (SUBCHRONIC)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source [1]	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	2.4E-01	mg/m^3	Liver	300	ATSDR	12/10/2010
Tetrachloroethene	NA	NA	NA	NA	NA	NA
Semi-volatile Organic Compounds						
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
PCBs/Pesticides						
Aroclor 1254	NA	NA	NA	NA	NA	NA
Inorganics						
Aluminum	NA	NA	NA	NA	NA	NA
Antimony[3]	2.0E-04	mg/m^3	NA	100	PPRTV	8/5/2008
Arsenic	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Chromium VI	3.0E-04	mg/m^3	Respiratory System	30	ATSDR	12/10/2010
Cobalt	2.0E-05	mg/m^3	Respiratory System	100	PPRTV	8/25/2008
Copper	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA
Nickel	2.0E-04	mg/m^3	Respiratory System	30	ATSDR	12/10/2010
Vanadium [4]	1.0E-04	mg/m^3	Lung	1000	PPRTV	4/30/2008
Zinc	NA	NA	NA	NA	NA	NA

[1] ATSDR chronic inhalation minimal risk level (MRL)
MRL is converted from units in ppmv to mg/m^3 using the following equation:
$MRL\ (mg/m^3) = (ppmv)(1\ kg/1000\ g)(P/RT)(molecular\ weight)$
where:
P = ambient air pressure, 1 atmosphere (atm)
R = ideal gas constant, 8.2×10^{-5} atm-m^3/mol-^{0}K
T = absolute temperature, 298.15 Kelvin (^{0}K)
[2] Date shown is the publication date.
[3] Based on antimony trioxide
[4] Based on vanadium pentoxide

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value
RfC = reference concentration

TABLE B-5.2c
NONCANCER TOXICITY DATA - INHALATION (ACUTE)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation RfC		Primary Target Organ	Combined Uncertainty/ Modifying Factor	RfC Target Organ	
	Value	Unit			Source [1]	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	4.9E-01	mg/m^3	Liver	30	ATSDR	12/10/2010
Tetrachloroethene	2.0E+01	mg/m^3	CNS/Respiratory System	60	Cal/EPA	12/18/2008
Semi-volatile Organic Compounds						
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Pentachlorophenol	NA	NA	NA	NA	NA	NA
PCBs/Pesticides						
Aroclor 1254	NA	NA	NA	NA	NA	NA
Inorganics						
Aluminum	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA
Arsenic	2.0E-04	mg/m^3	Developmental/Cardiovascular System/CNS	1,000	Cal/EPA	12/18/2008
Cadmium	3.0E-05	mg/m^3	Respiratory System	300	ATSDR	12/10/2010
Chromium VI	NA	NA	NA	NA	NA	NA
Cobalt	NA	NA	NA	NA	NA	NA
Copper	1.0E-01	mg/m^3	Respiratory System	10	Cal/EPA	12/18/2008
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	1.7E-04	mg/m^3	CNS	300	Cal/EPA	12/18/2008
Mercury	6.0E-04	mg/m^3	CNS	3,000	Cal/EPA	12/18/2008
Nickel	6.00E-03	mg/m^3	Respiratory System/Immune System	6	Cal/EPA	12/18/2008
Vanadium [3]	3.0E-02	mg/m^3	Respiratory System/Eyes	10	Cal/EPA	12/18/2008
Zinc	NA	NA	NA	NA	NA	NA

[1] ATSDR chronic inhalation minimal risk level (MRL)
MRL is converted from units in ppmv to mg/m^3 using the following equation:

$$MRL\ (mg/m^3) = (ppmv)(1\ kg/1000\ g)(P/RT)(molecular\ weight)$$

where:

P = ambient air pressure, 1 atmosphere (atm)
R = ideal gas constant, 8.2×10^{-5} atm-m^3/mol-^{0}K
T = absolute temperature, 298.15 Kelvin (^{0}K)

[2] Date shown is the publication date.
[3] Based on vanadium pentoxide

Definition:
ATSDR = Agency for Toxic Substances and Disease Registry
Cal/EPA = California Environmental Protection Agency
CNS = central nervous system
IRIS = Integrated Risk Information System
NA = not available
RfC = reference concentration

TABLE B-6.1
CANCER TOXICITY DATA - ORAL/DERMAL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Oral Slope Factor		Oral Absorption Efficiency for Dermal [1]	Absorbed Slope Factor for Dermal [1]		Mutagen [2]	Weight of Evidence/ Cancer Guideline Description	Source	Date [3]
	Value	Unit		Value	Unit				(MM/DD/YYYY)
Volatile Organic Compounds									
Chloroform	3.1E-02	(mg/kg-day)-1	1	3.1E-02	(mg/kg-day)-1	--	B2 / 2B	Cal/EPA	12/18/2008
Tetrachloroethene	5.4E-01	(mg/kg-day)-1	1	5.4E-01	(mg/kg-day)-1	--	2B	Cal/EPA	12/18/2008
Semi-volatile Organic Compounds									
Benzo(a)anthracene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Benzo(a)pyrene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	M	B2	IRIS	5/23/2011
Benzo(b)fluoranthene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Dibenzo(a,h)anthracene	7.3E+00	$(mg/kg\text{-}day)^{-1}$	1	7.3E+00	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Dibenzofuran	NA	NA	1	NA	NA	--	D	IRIS	7/19/2011
Indeno(1,2,3-cd)pyrene	7.3E-01	$(mg/kg\text{-}day)^{-1}$	1	7.3E-01	$(mg/kg\text{-}day)^{-1}$	M	B2	EPA	7/1/1993
Naphthalene	NA	NA	1	NA	NA	--	C	IRIS	7/19/2011
Pentachlorophenol	4.0E-01	(mg/kg-day)-1	1	4.0E-01	(mg/kg-day)-1	--	Likely to be carcinogenic to humans	IRIS	7/19/2011
PCBs/Pesticides									
Aroclor 1254[4]	2.0E+00	$(mg/kg\text{-}day)^{-1}$	1	2.0E+00	$(mg/kg\text{-}day)^{-1}$	--	B2	IRIS	5/23/2011
Inorganics									
Aluminum	NA	NA	1	NA	NA	--	NA	NA	NA
Antimony[5]	NA	NA	0.15	NA	NA	--	inadequate information to assess the carcinogenic potential	PPRTV	8/5/2008
Arsenic	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1	1.5E+00	$(mg/kg\text{-}day)^{-1}$	--	A	IRIS	5/23/2011
Cadmium	NA	NA	0.025	NA	NA	--	NA	NA	NA
Chromium VI	5.0E-01	$(mg/kg\text{-}day)^{-1}$	0.025	1.3E-02	$(mg/kg\text{-}day)^{-1}$	M	Likely to be carcinogenic to humans	NJDEP	5/23/2011
Cobalt	NA	NA	1	NA	NA	--	NA	NA	NA
Copper	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Iron	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Lead	NA	NA	NA	NA	NA	--	NA	NA	NA
Manganese	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Mercury	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011
Nickel	NA	NA	0.04	NA	NA	--	NA	NA	NA
Vanadium	NA	NA	1	NA	NA	--	NA	NA	NA
Zinc	NA	NA	1	NA	NA	--	D	IRIS	5/23/2011

[1] Adjusted oral cancer slope factor (CSF) for Dermal = Oral CSF x Oral Absorption Efficiency for Dermal
[2] Idenitified as a mutagen on the Regional Screening Level (RSL) Table, November 2010
http://www.epa.gov/region09/waste/sfund/prg/index.html
[3] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/
Date shown for other sources is the publication date.
[4] Based on oral slope factor for polychlorinated biphenyls (PCBs)
[5] Based on antimony trioxide

EPA Weight of Evidence (EPA 1986, EPA 1996):
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

Definition:
Cal/EPA = California Environmental Protection Agency
EPA = EPA Provisional Guidance for Quantitative Assessment of Polycyclic Aromatic Hydrocarbons
IRIS = Integrated Risk Information System
M = mutagen
NA = not available
NJDEP = New Jersey Department of
Environmental Protection

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE B-6.2
CANCER TOXICITY DATA - INHALATION
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical of Potential Concern	Inhalation Unit Risk		Mutagen [1]	Weight of Evidence/ Cancer Guideline Description	Inhalation Unit Risk	
	Value	Unit			Source	Date [2] (MM/DD/YYYY)
Volatile Organic Compounds						
Chloroform	2.3E-05	$(\mu g/m^3)^{-1}$	--	B2	IRIS	7/19/2011
Tetrachloroethene	5.9E-06	$(\mu g/m^3)^{-1}$	--	2A	Cal/EPA	12/18/2008
Semi-volatile Organic Compounds						
Benzo(a)anthracene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Benzo(a)pyrene	1.1E-03	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Benzo(b)fluoranthene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Dibenzo(a,h)anthracene	1.2E-03	$(\mu g/m^3)^{-1}$	M	NA	Cal/EPA	12/18/2008
Dibenzofuran	NA	NA	--	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1E-04	$(\mu g/m^3)^{-1}$	M	B2	Cal/EPA	12/18/2008
Naphthalene	3.4E-05	$(\mu g/m^3)^{-1}$	--	2B	Cal/EPA	12/18/2008
Pentachlorophenol	5.1E-06	$(\mu g/m^3)^{-1}$		Likely to be carcinogenic to humans	Cal/EPA	12/18/2008
PCBs/Pesticides						
Aroclor 1254	5.7E-04	$(\mu g/m^3)^{-1}$	--	B2	IRIS	5/23/2011
Heptachlor Epoxide	2.6E-03	$(\mu g/m^3)^{-1}$	--	B2	IRIS	7/19/2011
Inorganics						
Aluminum	NA	NA	--	NA	NA	NA
Antimony[3]	NA	NA	--	Suggestive evidence of the carcinogenic potential	PPRTV	8/5/2008
Arsenic	4.3E-03	$(\mu g/m^3)^{-1}$	--	A	IRIS	5/23/2011
Cadmium	1.8E-03	$(\mu g/m^3)^{-1}$	--	B1	IRIS	5/23/2011
Chromium VI	1.2E-02	$(\mu g/m^3)^{-1}$	M	A	IRIS	5/23/2011
Cobalt	9.0E-03	$(\mu g/m^3)^{-1}$	--	Likely to be carcinogenic to humans	PPRTV	8/25/2008
Copper	NA	NA	--	D	IRIS	5/23/2011
Iron	NA	NA	--	NA	NA	NA
Lead	NA	NA	--	NA	NA	NA
Manganese	NA	NA	--	D	IRIS	5/23/2011
Mercury	NA	NA	--	D	IRIS	5/23/2011
Nickel	2.6E-04	$(\mu g/m^3)^{-1}$	--	A	Cal/EPA	12/18/2008
Silver	NA	NA	--	D	IRIS	5/23/2011
Vanadium[4]	8.0E-03	$(\mu g/m^3)^{-1}$	--	Suggestive evidence of carcinogenic potential	PPRTV	4/30/2008
Zinc	NA	NA	--	D	IRIS	5/23/2011

[1] Idenitified as a mutagen on the Regional Screening Level (RSL) Table, November 2010, http://www.epa.gov/region09/waste/sfund/prg/index.html
[2] Date shown for IRIS is the date IRIS was searched. http://www.epa.gov/iris/ Date shown for other sources is the publication date.
[3] Based on antimony trioxide
[4] Based on vanadium pentoxide

Definition:
Cal/EPA = California Environmental Protection Agency
IRIS = Integrated Risk Information System
M = mutagen
NA = not available
PPRTV = Provisional Peer Reviewed Toxicity Value

EPA Weight of Evidence (EPA 1986, EPA 1996):
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

EPA Weight of Evidence Narrative (EPA 2005):
Carcinogenic to human
Likely to be carcinogenic to humans
Suggestive evidence of carcinogenic potential
Inadequate information to assess carcinogenic potential
Not likely to be carcinogenic to humans

TABLE B-7.1a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 1 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.32E-01	mg/kg	8.88E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	6.48E-09	5.18E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.82E-01	mg/kg	1.22E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	8.91E-08	7.12E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.58E-01	mg/kg	1.06E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	7.75E-09	6.19E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	1.10E-01	mg/kg	7.38E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	5.39E-08	4.31E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.45E-01	mg/kg	9.74E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	7.11E-09	5.68E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	8.92E-01	mg/kg	5.98E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1.20E-07	3.49E-07	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.75E-02
			Inorganics												
			Aluminum	2.63E+03	mg/kg	1.76E-04	mg/kg-day	NA	NA	NA	1.03E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.03E-03
			Antimony	9.90E+01	mg/kg	6.65E-06	mg/kg-day	NA	NA	NA	3.88E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	9.69E-02
			Arsenic	3.46E+01	mg/kg	1.39E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.09E-06	8.13E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.71E-02
			Chromium VI	4.42E+00	mg/kg	2.97E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	1.48E-07	1.73E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	5.77E-04
			Cobalt	2.22E+00	mg/kg	1.49E-07	mg/kg-day	NA	NA	NA	8.69E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.90E-03
			Copper	9.09E+01	mg/kg	6.10E-06	mg/kg-day	NA	NA	NA	3.56E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	8.89E-04
			Iron	2.75E+04	mg/kg	1.85E-03	mg/kg-day	NA	NA	NA	1.08E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	1.54E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.52E+01	mg/kg	5.05E-06	mg/kg-day	NA	NA	NA	2.94E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.10E-04
			Vanadium	3.19E+01	mg/kg	2.14E-06	mg/kg-day	NA	NA	NA	1.25E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	2.50E-03
		Exp. Route Total								2.52E-06					1.65E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.32E-01	mg/kg	5.58E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.07E-09	3.25E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.82E-01	mg/kg	7.66E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	5.59E-08	4.47E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.58E-01	mg/kg	6.66E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.87E-09	3.89E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	1.10E-01	mg/kg	4.63E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.38E-08	2.70E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.45E-01	mg/kg	6.12E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.47E-09	3.57E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	8.92E-01	mg/kg	4.05E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	8.09E-08	2.36E-07	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.18E-02
			Inorganics												
			Aluminum	2.63E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	9.90E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	3.46E+01	mg/kg	3.36E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	5.05E-07	1.96E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	6.54E-03
			Chromium VI	4.42E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.22E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	9.09E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	2.75E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.52E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	3.19E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								6.89E-07					1.83E-02

TABLE B-7.1a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 1 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.32E-01	mg/kg	1.21E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.33E-13	7.07E-12	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.82E-01	mg/kg	1.67E-09	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	1.83E-12	9.72E-12	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.58E-01	mg/kg	1.45E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.59E-13	8.45E-12	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	1.10E-01	mg/kg	1.01E-09	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	1.21E-12	5.88E-12	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.45E-01	mg/kg	1.33E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.46E-13	7.76E-12	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	8.92E-01	mg/kg	8.17E-09	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	4.66E-12	4.77E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	2.63E+03	mg/kg	2.41E-05	µg/m^3	NA	NA	NA	1.40E-07	mg/m^3	5.00E-03	mg/m^3	2.81E-05
			Antimony	9.90E+01	mg/kg	9.07E-07	µg/m^3	NA	NA	NA	5.29E-09	mg/m^3	NA	NA	NA
			Arsenic	3.46E+01	mg/kg	3.17E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	1.36E-09	1.85E-09	mg/m^3	1.50E-05	mg/m^3	1.23E-04
			Chromium VI	4.42E+00	mg/kg	4.05E-08	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	4.86E-10	2.36E-10	mg/m^3	1.00E-04	mg/m^3	2.36E-06
			Cobalt	2.22E+00	mg/kg	2.03E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	1.83E-10	1.19E-10	mg/m^3	6.00E-06	mg/m^3	1.98E-05
			Copper	9.09E+01	mg/kg	8.33E-07	µg/m^3	NA	NA	NA	4.86E-09	mg/m^3	NA	NA	NA
			Iron	2.75E+04	mg/kg	2.52E-04	µg/m^3	NA	NA	NA	1.47E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.52E+01	mg/kg	6.89E-07	µg/m^3	NA	NA	NA	4.02E-09	mg/m^3	5.00E-05	mg/m^3	8.04E-05
			Vanadium	3.19E+01	mg/kg	2.92E-07	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	2.34E-09	1.71E-09	mg/m^3	1.00E-04	mg/m^3	1.71E-05
		Exp. Route Total								4.38E-09					2.71E-04
	Exposure Point Total									3.22E-06					1.84E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.1a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 1 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	7.38E-10	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	5.39E-10	4.31E-09	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	8.45E-10	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	6.17E-10	4.93E-09	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	2.90E-05	mg/kg-day	NA	NA	NA	1.69E-04	mg/kg-day	1.00E+00	mg/kg-day	1.69E-04
			Antimony	1.93E+01	µg/L	2.59E-07	mg/kg-day	NA	NA	NA	1.51E-06	mg/kg-day	4.00E-04	mg/kg-day	3.78E-03
			Arsenic	4.02E+01	µg/L	5.40E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	8.10E-07	3.15E-06	mg/kg-day	3.00E-04	mg/kg-day	1.05E-02
			Cobalt	1.70E+01	µg/L	2.28E-07	mg/kg-day	NA	NA	NA	1.33E-06	mg/kg-day	3.00E-04	mg/kg-day	4.44E-03
			Copper	9.77E+01	µg/L	1.31E-06	mg/kg-day	NA	NA	NA	7.65E-06	mg/kg-day	4.00E-02	mg/kg-day	1.91E-04
			Iron	6.60E+03	µg/L	8.86E-05	mg/kg-day	NA	NA	NA	5.17E-04	mg/kg-day	7.00E-01	mg/kg-day	7.38E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	4.09E-06	mg/kg-day	NA	NA	NA	2.39E-05	mg/kg-day	1.40E-01	mg/kg-day	1.70E-04
			Vanadium	9.49E+01	µg/L	1.27E-06	mg/kg-day	NA	NA	NA	7.43E-06	mg/kg-day	5.00E-03	mg/kg-day	1.49E-03
		Exp. Route Total								8.11E-07					2.15E-02
Surface Water	Surface Water	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	3.12E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	2.28E-07	1.82E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	5.33E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.89E-07	3.11E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	2.61E-05	mg/kg-day	NA	NA	NA	1.52E-04	mg/kg-day	1.00E+00	mg/kg-day	1.52E-04
			Antimony	1.93E+01	µg/L	2.33E-07	mg/kg-day	NA	NA	NA	1.36E-06	mg/kg-day	6.00E-05	mg/kg-day	2.27E-02
			Arsenic	4.02E+01	µg/L	4.86E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	7.29E-07	2.83E-06	mg/kg-day	3.00E-04	mg/kg-day	9.45E-03
			Cobalt	1.70E+01	µg/L	8.21E-08	mg/kg-day	NA	NA	NA	4.79E-07	mg/kg-day	3.00E-04	mg/kg-day	1.60E-03
			Copper	9.77E+01	µg/L	1.18E-06	mg/kg-day	NA	NA	NA	6.88E-06	mg/kg-day	4.00E-02	mg/kg-day	1.72E-04
			Iron	6.60E+03	µg/L	7.97E-05	mg/kg-day	NA	NA	NA	4.65E-04	mg/kg-day	7.00E-01	mg/kg-day	6.64E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	3.68E-06	mg/kg-day	NA	NA	NA	2.15E-05	mg/kg-day	1.40E-01	mg/kg-day	1.53E-04
			Vanadium	9.49E+01	µg/L	1.15E-06	mg/kg-day	NA	NA	NA	6.69E-06	mg/kg-day	5.00E-03	mg/kg-day	1.34E-03
		Exp. Route Total								1.35E-06					3.62E-02
	Exposure Point Total									2.16E-06					5.77E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.1a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 1 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	1.07E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	7.84E-10	6.26E-10	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.92E+03	mg/kg	1.29E-05	mg/kg-day	NA	NA	NA	7.52E-05	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	7.52E-05
			Arsenic	8.84E+00	mg/kg	5.93E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	8.89E-08	3.46E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.15E-03
			Chromium VI	7.07E-01	mg/kg	4.74E-09	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	2.37E-09	2.77E-08	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	9.22E-06
			Cobalt	2.65E+00	mg/kg	1.78E-08	mg/kg-day	NA	NA	NA	1.04E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	3.45E-04
			Iron	1.18E+04	mg/kg	7.93E-05	mg/kg-day	NA	NA	NA	4.62E-04	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	6.61E-04
			Manganese	6.82E+01	mg/kg	4.57E-07	mg/kg-day	NA	NA	NA	2.67E-06	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	1.91E-05
			Vanadium	2.14E+01	mg/kg	1.43E-07	mg/kg-day	NA	NA	NA	8.36E-07	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	1.67E-04
		Exp. Route Total								9.21E-08					2.43E-03
Sediment	Sediment	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	2.89E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.11E-08	1.69E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.92E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	8.84E+00	mg/kg	3.68E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	5.52E-07	2.15E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	7.16E-03
			Chromium VI	7.07E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	2.65E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.18E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Manganese	6.82E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.14E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								5.73E-07					7.16E-03
	Exposure Point Total									6.65E-07					9.59E-03

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.1b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Area 1 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface	Ingestion	**Semi-volatile Organic Compounds**												
	Soil		Benzo(a)anthracene	1.32E-01	mg/kg	1.17E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	8.56E-09	6.84E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.82E-01	mg/kg	1.61E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.18E-07	9.40E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.58E-01	mg/kg	1.40E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.02E-08	8.18E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	1.10E-01	mg/kg	9.75E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	7.12E-08	5.69E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.45E-01	mg/kg	1.29E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	9.39E-09	7.51E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	8.92E-01	mg/kg	7.90E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1.58E-07	4.61E-07	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	2.31E-02
			Inorganics												
			Aluminum	2.63E+03	mg/kg	2.33E-04	mg/kg-day	NA	NA	NA	1.36E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.36E-03
			Antimony	9.90E+01	mg/kg	8.78E-06	mg/kg-day	NA	NA	NA	5.12E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.28E-01
			Arsenic	3.46E+01	mg/kg	1.84E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.76E-06	1.07E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.58E-02
			Chromium VI	4.42E+00	mg/kg	3.92E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	1.96E-07	2.29E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	7.62E-04
			Cobalt	2.22E+00	mg/kg	1.97E-07	mg/kg-day	NA	NA	NA	1.15E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.83E-03
			Copper	9.09E+01	mg/kg	8.06E-06	mg/kg-day	NA	NA	NA	4.70E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.17E-03
			Iron	2.75E+04	mg/kg	2.44E-03	mg/kg-day	NA	NA	NA	1.42E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.03E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.52E+01	mg/kg	6.66E-06	mg/kg-day	NA	NA	NA	3.89E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.78E-04
			Vanadium	3.19E+01	mg/kg	2.83E-06	mg/kg-day	NA	NA	NA	1.65E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	3.30E-03
		Exp. Route Total								3.33E-06					2.18E-01
Soil	Surface	Dermal	**Semi-volatile Organic Compounds**												
	Soil	Contact	Benzo(a)anthracene	1.32E-01	mg/kg	8.37E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	6.11E-09	4.88E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.82E-01	mg/kg	1.15E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	8.40E-08	6.71E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.58E-01	mg/kg	1.00E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	7.30E-09	5.84E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	1.10E-01	mg/kg	6.96E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	5.08E-08	4.06E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.45E-01	mg/kg	9.18E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	6.70E-09	5.36E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	8.92E-01	mg/kg	6.07E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1.21E-07	3.54E-07	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.77E-02
			Inorganics												
			Aluminum	2.63E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	9.90E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	3.46E+01	mg/kg	5.05E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	7.58E-07	2.95E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	9.82E-03
			Chromium VI	4.42E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.22E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	9.09E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	2.75E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.52E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	3.19E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.03E-06					2.75E-02

TABLE B-7.1b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Area 1 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.32E-01	mg/kg	1.21E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	1.33E-13	7.07E-12	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.82E-01	mg/kg	1.67E-09	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	1.83E-12	9.72E-12	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.58E-01	mg/kg	1.45E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	1.59E-13	8.45E-12	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	1.10E-01	mg/kg	1.01E-09	$\mu g/m^3$	1.20E-03	$(\mu g/m^3)^{-1}$	1.21E-12	5.88E-12	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.45E-01	mg/kg	1.33E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	1.46E-13	7.76E-12	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	8.92E-01	mg/kg	8.17E-09	$\mu g/m^3$	5.70E-04	$(\mu g/m^3)^{-1}$	4.66E-12	4.77E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	2.63E+03	mg/kg	2.41E-05	$\mu g/m^3$	NA	NA	NA	1.40E-07	mg/m^3	5.00E-03	mg/m^3	2.81E-05
			Antimony	9.90E+01	mg/kg	9.07E-07	$\mu g/m^3$	NA	NA	NA	5.29E-09	mg/m^3	NA	NA	NA
			Arsenic	3.46E+01	mg/kg	3.17E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	1.36E-09	1.85E-09	mg/m^3	1.50E-05	mg/m^3	1.23E-04
			Chromium VI	4.42E+00	mg/kg	4.05E-08	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	4.86E-10	2.36E-10	mg/m^3	1.00E-04	mg/m^3	2.36E-06
			Cobalt	2.22E+00	mg/kg	2.03E-08	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	1.83E-10	1.19E-10	mg/m^3	6.00E-06	mg/m^3	1.98E-05
			Copper	9.09E+01	mg/kg	8.33E-07	$\mu g/m^3$	NA	NA	NA	4.86E-09	mg/m^3	NA	NA	NA
			Iron	2.75E+04	mg/kg	2.52E-04	$\mu g/m^3$	NA	NA	NA	1.47E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.52E+01	mg/kg	6.89E-07	$\mu g/m^3$	NA	NA	NA	4.02E-09	mg/m^3	5.00E-05	mg/m^3	8.04E-05
			Vanadium	3.19E+01	mg/kg	2.92E-07	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	2.34E-09	1.71E-09	mg/m^3	1.00E-04	mg/m^3	1.71E-05
		Exp. Route Total								4.38E-09					2.71E-04
	Exposure Point Total									4.37E-06					2.46E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.1b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Area 1 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface	Surface	Ingestion	**Semi-volatile Organic Compounds**												
Water	Water		Benzo(a)anthracene	5.50E-02	µg/L	2.44E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.78E-09	1.42E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	2.79E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.04E-09	1.63E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	9.58E-05	mg/kg-day	NA	NA	NA	5.59E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	5.59E-04
			Antimony	1.93E+01	µg/L	8.56E-07	mg/kg-day	NA	NA	NA	4.99E-06	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.25E-02
			Arsenic	4.02E+01	µg/L	1.78E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.67E-06	1.04E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.47E-02
			Cobalt	1.70E+01	µg/L	7.53E-07	mg/kg-day	NA	NA	NA	4.39E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.46E-02
			Copper	9.77E+01	µg/L	4.33E-06	mg/kg-day	NA	NA	NA	2.52E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	6.31E-04
			Iron	6.60E+03	µg/L	2.92E-04	mg/kg-day	NA	NA	NA	1.71E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.44E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	1.35E-05	mg/kg-day	NA	NA	NA	7.88E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	5.63E-04
			Vanadium	9.49E+01	µg/L	4.20E-06	mg/kg-day	NA	NA	NA	2.45E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	4.91E-03
		Exp. Route Total								2.68E-06					7.09E-02
Surface	Surface	Dermal	**Semi-volatile Organic Compounds**												
Water	Water	Contact	Benzo(a)anthracene	5.50E-02	µg/L	3.44E-07	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.51E-07	2.00E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	5.86E-07	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.28E-07	3.42E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	2.87E-05	mg/kg-day	NA	NA	NA	1.68E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.68E-04
			Antimony	1.93E+01	µg/L	2.57E-07	mg/kg-day	NA	NA	NA	1.50E-06	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	2.50E-02
			Arsenic	4.02E+01	µg/L	5.35E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	8.02E-07	3.12E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.04E-02
			Cobalt	1.70E+01	µg/L	9.04E-08	mg/kg-day	NA	NA	NA	5.27E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.76E-03
			Copper	9.77E+01	µg/L	1.30E-06	mg/kg-day	NA	NA	NA	7.57E-06	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.89E-04
			Iron	6.60E+03	µg/L	8.77E-05	mg/kg-day	NA	NA	NA	5.12E-04	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	7.31E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	4.05E-06	mg/kg-day	NA	NA	NA	2.36E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.69E-04
			Vanadium	9.49E+01	µg/L	1.26E-06	mg/kg-day	NA	NA	NA	7.36E-06	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	1.47E-03
		Exp. Route Total								1.48E-06					3.98E-02
	Exposure Point Total									4.16E-06					1.11E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/L = microgram per liter

TABLE B-7.1b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Area 1 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	1.42E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.04E-09	8.27E-10	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.92E+03	mg/kg	1.70E-05	mg/kg-day	NA	NA	NA	9.94E-05	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	9.94E-05
			Arsenic	8.84E+00	mg/kg	7.83E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.17E-07	4.57E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.52E-03
			Chromium VI	7.07E-01	mg/kg	6.27E-09	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	3.13E-09	3.65E-08	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	1.22E-05
			Cobalt	2.65E+00	mg/kg	2.34E-08	mg/kg-day	NA	NA	NA	1.37E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.56E-04
			Iron	1.18E+04	mg/kg	1.05E-04	mg/kg-day	NA	NA	NA	6.11E-04	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	8.73E-04
			Manganese	6.82E+01	mg/kg	6.04E-07	mg/kg-day	NA	NA	NA	3.52E-06	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	2.52E-05
			Vanadium	2.14E+01	mg/kg	1.89E-07	mg/kg-day	NA	NA	NA	1.10E-06	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	2.21E-04
		Exp. Route Total								1.22E-07					3.21E-03
Sediment	Sediment	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	3.37E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.46E-08	1.97E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.92E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	8.84E+00	mg/kg	4.30E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	6.45E-07	2.51E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	8.36E-03
			Chromium VI	7.07E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	2.65E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.18E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Manganese	6.82E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.14E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								6.69E-07					8.36E-03
	Exposure Point Total									7.91E-07					1.16E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.2a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 2 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	2.15E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.57E-08	6.26E-09	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	6.44E-08	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.29E-07	1.88E-07	mg/kg-day	2.00E-05	$(mg/kg\text{-}day)^{-1}$	9.39E-03
			Inorganics												
			Antimony	4.08E+01	mg/kg	5.48E-06	mg/kg-day	NA	NA	NA	1.60E-05	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	4.00E-02
			Arsenic	2.94E+01	mg/kg	2.36E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.55E-06	6.90E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.30E-02
			Chromium VI	5.80E-01	mg/kg	7.78E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	3.89E-08	2.27E-07	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	7.57E-05
			Cobalt	1.77E+00	mg/kg	2.37E-07	mg/kg-day	NA	NA	NA	6.92E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.31E-03
			Copper	5.43E+01	mg/kg	7.28E-06	mg/kg-day	NA	NA	NA	2.12E-05	mg/kg-day	4.00E-02	$(mg/kg\text{-}day)^{-1}$	5.31E-04
			Iron	1.79E+04	mg/kg	2.40E-03	mg/kg-day	NA	NA	NA	7.01E-03	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	1.00E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	2.31E-06	mg/kg-day	NA	NA	NA	6.75E-06	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	1.35E-03
		Exp. Route Total								3.73E-06					8.66E-02
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	3.52E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.57E-08	1.03E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.14E-07	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	2.27E-07	3.31E-07	mg/kg-day	2.00E-05	$(mg/kg\text{-}day)^{-1}$	1.66E-02
			Inorganics												
			Antimony	4.08E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	2.94E+01	mg/kg	1.49E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.23E-06	4.35E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.45E-02
			Chromium VI	5.80E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	1.77E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Copper	5.43E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.79E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								2.49E-06					3.11E-02
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	2.48E-10	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	2.72E-13	7.22E-13	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	7.43E-09	$\mu g/m^3$	5.70E-04	$(\mu g/m^3)^{-1}$	4.23E-12	2.17E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Antimony	4.08E+01	mg/kg	6.32E-07	$\mu g/m^3$	NA	NA	NA	1.84E-09	mg/m^3	NA	NA	NA
			Arsenic	2.94E+01	mg/kg	4.54E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	1.95E-09	1.33E-09	mg/m^3	1.50E-05	mg/m^3	8.83E-05
			Chromium VI	5.80E-01	mg/kg	8.97E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	1.08E-10	2.62E-11	mg/m^3	1.00E-04	mg/m^3	2.62E-07
			Cobalt	1.77E+00	mg/kg	2.74E-08	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	2.46E-10	7.98E-11	mg/m^3	6.00E-06	mg/m^3	1.33E-05
			Copper	5.43E+01	mg/kg	8.40E-07	$\mu g/m^3$	NA	NA	NA	2.45E-09	mg/m^3	NA	NA	NA
			Iron	1.79E+04	mg/kg	2.77E-04	$\mu g/m^3$	NA	NA	NA	8.08E-07	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	2.67E-07	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	2.13E-09	7.78E-10	mg/m^3	1.00E-04	mg/m^3	7.78E-06
		Exp. Route Total								4.45E-09					1.10E-04
	Exposure Point Total									6.22E-06					1.18E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.2a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 2 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	1.48E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.08E-09	4.31E-09	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	1.69E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.23E-09	4.93E-09	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	5.80E-05	mg/kg-day	NA	NA	NA	1.69E-04	mg/kg-day	1.00E+00	mg/kg-day	1.69E-04
			Antimony	1.93E+01	µg/L	5.18E-07	mg/kg-day	NA	NA	NA	1.51E-06	mg/kg-day	4.00E-04	mg/kg-day	3.78E-03
			Arsenic	4.02E+01	µg/L	1.08E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.62E-06	3.15E-06	mg/kg-day	3.00E-04	mg/kg-day	1.05E-02
			Cobalt	1.70E+01	µg/L	4.56E-07	mg/kg-day	NA	NA	NA	1.33E-06	mg/kg-day	3.00E-04	mg/kg-day	4.44E-03
			Copper	9.77E+01	µg/L	2.62E-06	mg/kg-day	NA	NA	NA	7.65E-06	mg/kg-day	4.00E-02	mg/kg-day	1.91E-04
			Iron	6.60E+03	µg/L	1.77E-04	mg/kg-day	NA	NA	NA	5.17E-04	mg/kg-day	7.00E-01	mg/kg-day	7.38E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	8.18E-06	mg/kg-day	NA	NA	NA	2.39E-05	mg/kg-day	1.40E-01	mg/kg-day	1.70E-04
			Vanadium	9.49E+01	µg/L	2.55E-06	mg/kg-day	NA	NA	NA	7.43E-06	mg/kg-day	5.00E-03	mg/kg-day	1.49E-03
		Exp. Route Total								1.62E-06					2.15E-02
Surface Water	Surface Water	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	6.24E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	4.56E-07	1.82E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	1.07E-06	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	7.78E-07	3.11E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	5.22E-05	mg/kg-day	NA	NA	NA	1.52E-04	mg/kg-day	1.00E+00	mg/kg-day	1.52E-04
			Antimony	1.93E+01	µg/L	4.66E-07	mg/kg-day	NA	NA	NA	1.36E-06	mg/kg-day	6.00E-05	mg/kg-day	2.27E-02
			Arsenic	4.02E+01	µg/L	9.72E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.46E-06	2.83E-06	mg/kg-day	3.00E-04	mg/kg-day	9.45E-03
			Cobalt	1.70E+01	µg/L	1.64E-07	mg/kg-day	NA	NA	NA	4.79E-07	mg/kg-day	3.00E-04	mg/kg-day	1.60E-03
			Copper	9.77E+01	µg/L	2.36E-06	mg/kg-day	NA	NA	NA	6.88E-06	mg/kg-day	4.00E-02	mg/kg-day	1.72E-04
			Iron	6.60E+03	µg/L	1.59E-04	mg/kg-day	NA	NA	NA	4.65E-04	mg/kg-day	7.00E-01	mg/kg-day	6.64E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	7.36E-06	mg/kg-day	NA	NA	NA	2.15E-05	mg/kg-day	1.40E-01	mg/kg-day	1.53E-04
			Vanadium	9.49E+01	µg/L	2.29E-06	mg/kg-day	NA	NA	NA	6.69E-06	mg/kg-day	5.00E-03	mg/kg-day	1.34E-03
		Exp. Route Total								2.69E-06					3.62E-02
	Exposure Point Total									4.31E-06					5.77E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.2a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Area 2 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Inorganics**												
			Arsenic	6.90E+00	mg/kg	9.26E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.39E-07	2.70E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	9.00E-04
			Chromium VI	1.76E+00	mg/kg	2.36E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.18E-08	6.88E-08	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	2.29E-05
			Iron	9.63E+03	mg/kg	1.29E-04	mg/kg-day	NA	NA	NA	3.77E-04	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	5.38E-04
		Exp. Route Total								1.51E-07					1.46E-03
Sediment	Sediment	Dermal Contact	**Inorganics**												
			Arsenic	6.90E+00	mg/kg	5.75E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	8.62E-07	1.68E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	5.59E-03
			Chromium VI	1.76E+00	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	9.63E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								8.62E-07					5.59E-03
	Exposure Point Total									1.01E-06					7.05E-03

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.2b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Medium:	Area 2 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	5.01E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	3.66E-08	5.84E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.50E-07	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	3.01E-07	1.75E-06	mg/kg-day	2.00E-05	$(mg/kg\text{-}day)^{-1}$	8.77E-02
			Inorganics												
			Antimony	4.08E+01	mg/kg	1.28E-05	mg/kg-day	NA	NA	NA	1.49E-04	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	3.73E-01
			Arsenic	2.94E+01	mg/kg	5.52E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	8.28E-06	6.44E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.15E-01
			Chromium VI	5.80E-01	mg/kg	1.82E-07	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	9.08E-08	2.12E-06	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	7.06E-04
			Cobalt	1.77E+00	mg/kg	5.54E-07	mg/kg-day	NA	NA	NA	6.46E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.15E-02
			Copper	5.43E+01	mg/kg	1.70E-05	mg/kg-day	NA	NA	NA	1.98E-04	mg/kg-day	4.00E-02	$(mg/kg\text{-}day)^{-1}$	4.96E-03
			Iron	1.79E+04	mg/kg	5.61E-03	mg/kg-day	NA	NA	NA	6.54E-02	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	9.34E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	5.40E-06	mg/kg-day	NA	NA	NA	6.30E-05	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	1.26E-02
		Exp. Route Total								8.70E-06					8.08E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	2.15E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.57E-08	2.51E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	6.94E-08	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.39E-07	8.10E-07	mg/kg-day	2.00E-05	$(mg/kg\text{-}day)^{-1}$	4.05E-02
			Inorganics												
			Antimony	4.08E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	2.94E+01	mg/kg	9.10E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.37E-06	1.06E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	3.54E-02
			Chromium VI	5.80E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	1.77E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Copper	5.43E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.79E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								1.52E-06					7.59E-02
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	6.19E-11	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	6.81E-14	7.22E-13	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.86E-09	$\mu g/m^3$	5.70E-04	$(\mu g/m^3)^{-1}$	1.06E-12	2.17E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Antimony	4.08E+01	mg/kg	1.58E-07	$\mu g/m^3$	NA	NA	NA	1.84E-09	mg/m^3	NA	NA	NA
			Arsenic	2.94E+01	mg/kg	1.14E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	4.88E-10	1.33E-09	mg/m^3	1.50E-05	mg/m^3	8.83E-05
			Chromium VI	5.80E-01	mg/kg	2.24E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	2.69E-11	2.62E-11	mg/m^3	1.00E-04	mg/m^3	2.62E-07
			Cobalt	1.77E+00	mg/kg	6.84E-09	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	6.16E-11	7.98E-11	mg/m^3	6.00E-06	mg/m^3	1.33E-05
			Copper	5.43E+01	mg/kg	2.10E-07	$\mu g/m^3$	NA	NA	NA	2.45E-09	mg/m^3	NA	NA	NA
			Iron	1.79E+04	mg/kg	6.92E-05	$\mu g/m^3$	NA	NA	NA	8.08E-07	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	6.67E-08	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	5.33E-10	7.78E-10	mg/m^3	1.00E-04	mg/m^3	7.78E-06
		Exp. Route Total								1.11E-09					1.10E-04
	Exposure Point Total									1.02E-05					8.84E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.2b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Medium:	Area 2 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	4.31E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.14E-09	5.02E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	4.93E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.60E-09	5.75E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	1.69E-04	mg/kg-day	NA	NA	NA	1.97E-03	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	1.97E-03
			Antimony	1.93E+01	µg/L	1.51E-06	mg/kg-day	NA	NA	NA	1.76E-05	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	4.41E-02
			Arsenic	4.02E+01	µg/L	3.15E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.72E-06	3.67E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.22E-01
			Cobalt	1.70E+01	µg/L	1.33E-06	mg/kg-day	NA	NA	NA	1.55E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	5.18E-02
			Copper	9.77E+01	µg/L	7.65E-06	mg/kg-day	NA	NA	NA	8.92E-05	mg/kg-day	4.00E-02	$(mg/kg\text{-}day)^{-1}$	2.23E-03
			Iron	6.60E+03	µg/L	5.17E-04	mg/kg-day	NA	NA	NA	6.03E-03	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	8.61E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	2.39E-05	mg/kg-day	NA	NA	NA	2.78E-04	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	1.99E-03
			Vanadium	9.49E+01	µg/L	7.43E-06	mg/kg-day	NA	NA	NA	8.67E-05	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	1.73E-02
		Exp. Route Total								4.73E-06					2.50E-01
Surface Water	Surface Water	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	2.67E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.95E-07	3.12E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	4.56E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.33E-07	5.32E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	2.23E-05	mg/kg-day	NA	NA	NA	2.61E-04	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	2.61E-04
			Antimony	1.93E+01	µg/L	2.00E-07	mg/kg-day	NA	NA	NA	2.33E-06	mg/kg-day	6.00E-05	$(mg/kg\text{-}day)^{-1}$	3.88E-02
			Arsenic	4.02E+01	µg/L	4.16E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	6.24E-07	4.85E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.62E-02
			Cobalt	1.70E+01	µg/L	7.03E-08	mg/kg-day	NA	NA	NA	8.20E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.73E-03
			Copper	9.77E+01	µg/L	1.01E-06	mg/kg-day	NA	NA	NA	1.18E-05	mg/kg-day	4.00E-02	$(mg/kg\text{-}day)^{-1}$	2.94E-04
			Iron	6.60E+03	µg/L	6.82E-05	mg/kg-day	NA	NA	NA	7.96E-04	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	1.14E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	3.15E-06	mg/kg-day	NA	NA	NA	3.67E-05	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	2.62E-04
			Vanadium	9.49E+01	µg/L	9.81E-07	mg/kg-day	NA	NA	NA	1.14E-05	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	2.29E-03
		Exp. Route Total								1.15E-06					6.19E-02
	Exposure Point Total									5.88E-06					3.12E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.2b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Medium:	Area 2 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Inorganics**												
			Arsenic	6.90E+00	mg/kg	2.16E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.24E-07	2.52E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	8.40E-03
			Chromium VI	1.76E+00	mg/kg	5.50E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	2.75E-08	6.42E-07	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	2.14E-04
			Iron	9.63E+03	mg/kg	3.02E-04	mg/kg-day	NA	NA	NA	3.52E-03	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	5.03E-03
		Exp. Route Total								3.52E-07					1.36E-02
Sediment	Sediment	Dermal Contact	**Inorganics**												
			Arsenic	6.90E+00	mg/kg	2.72E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.08E-07	3.18E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.06E-02
			Chromium VI	1.76E+00	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	9.63E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								4.08E-07					1.06E-02
	Exposure Point Total									7.60E-07					2.42E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.3a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Areas 3 and 4 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	2.41E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.76E-08	1.41E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	2.39E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.74E-07	1.39E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	2.39E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.75E-08	1.39E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	5.31E-04	mg/kg-day	NA	NA	NA	3.10E-03	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	3.10E-03
			Antimony	3.95E+00	mg/kg	4.82E-07	mg/kg-day	NA	NA	NA	2.81E-06	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	7.04E-03
			Arsenic	1.35E+01	mg/kg	9.86E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.48E-06	5.75E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.92E-02
			Chromium VI	1.01E+00	mg/kg	1.23E-07	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	6.16E-08	7.19E-07	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	2.40E-04
			Cobalt	3.73E+00	mg/kg	4.56E-07	mg/kg-day	NA	NA	NA	2.66E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	8.87E-03
			Iron	1.55E+04	mg/kg	1.90E-03	mg/kg-day	NA	NA	NA	1.11E-02	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	1.58E-02
			Manganese	1.86E+02	mg/kg	2.27E-05	mg/kg-day	NA	NA	NA	1.33E-04	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	9.47E-04
			Vanadium	2.17E+01	mg/kg	2.65E-06	mg/kg-day	NA	NA	NA	1.54E-05	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	3.09E-03
			Zinc	3.37E+02	mg/kg	4.12E-05	mg/kg-day	NA	NA	NA	2.40E-04	mg/kg-day	3.00E-01	$(mg/kg\text{-}day)^{-1}$	8.01E-04
		Exp. Route Total								1.75E-06					5.90E-02
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	1.25E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	9.14E-09	7.30E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	1.24E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	9.04E-08	7.23E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	1.24E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	9.05E-09	7.23E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Antimony	3.95E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	1.35E+01	mg/kg	1.97E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.95E-07	1.15E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	3.83E-03
			Chromium VI	1.01E+00	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	3.73E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.55E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Manganese	1.86E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.17E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
			Zinc	3.37E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								4.04E-07					3.83E-03
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	6.22E-10	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	6.85E-14	3.63E-12	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	6.16E-10	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	6.78E-13	3.59E-12	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	6.17E-10	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	6.78E-14	3.60E-12	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	1.37E-05	$\mu g/m^3$	NA	NA	NA	7.98E-08	mg/m^3	5.00E-03	mg/m^3	1.60E-05
			Antimony	3.95E+00	mg/kg	1.24E-08	$\mu g/m^3$	NA	NA	NA	7.26E-11	mg/m^3	NA	NA	NA
			Arsenic	1.35E+01	mg/kg	4.24E-08	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	1.82E-10	2.47E-10	mg/m^3	1.50E-05	mg/m^3	1.65E-05
			Chromium VI	1.01E+00	mg/kg	3.18E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	3.81E-11	1.85E-11	mg/m^3	1.00E-04	mg/m^3	1.85E-07
			Cobalt	3.73E+00	mg/kg	1.18E-08	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	1.06E-10	6.86E-11	mg/m^3	6.00E-06	mg/m^3	1.14E-05
			Iron	1.55E+04	mg/kg	4.89E-05	$\mu g/m^3$	NA	NA	NA	2.85E-07	mg/m^3	NA	NA	NA
			Manganese	1.86E+02	mg/kg	5.86E-07	$\mu g/m^3$	NA	NA	NA	3.42E-09	mg/m^3	5.00E-05	mg/m^3	6.84E-05
			Vanadium	2.17E+01	mg/kg	6.83E-08	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	5.46E-10	3.98E-10	mg/m^3	1.00E-04	mg/m^3	3.98E-06
			Zinc	3.37E+02	mg/kg	1.06E-06	$\mu g/m^3$	NA	NA	NA	6.20E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								8.73E-10					1.16E-04
	Exposure Point Total									2.15E-06					6.30E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.3b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Areas 3 and 4 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	3.50E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	2.56E-09	2.04E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	3.47E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.53E-08	2.02E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	3.47E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	2.53E-09	2.02E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	7.70E-05	mg/kg-day	NA	NA	NA	4.49E-04	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	4.49E-04
			Antimony	3.95E+00	mg/kg	7.00E-08	mg/kg-day	NA	NA	NA	4.08E-07	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	1.02E-03
			Arsenic	1.35E+01	mg/kg	1.43E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.15E-07	8.35E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.78E-03
			Chromium VI	1.01E+00	mg/kg	1.79E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	8.94E-09	1.04E-07	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	3.48E-05
			Cobalt	3.73E+00	mg/kg	6.62E-08	mg/kg-day	NA	NA	NA	3.86E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.29E-03
			Iron	1.55E+04	mg/kg	2.75E-04	mg/kg-day	NA	NA	NA	1.60E-03	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	2.29E-03
			Manganese	1.86E+02	mg/kg	3.30E-06	mg/kg-day	NA	NA	NA	1.92E-05	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	1.37E-04
			Vanadium	2.17E+01	mg/kg	3.84E-07	mg/kg-day	NA	NA	NA	2.24E-06	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	4.48E-04
			Zinc	3.37E+02	mg/kg	5.98E-06	mg/kg-day	NA	NA	NA	3.49E-05	mg/kg-day	3.00E-01	$(mg/kg\text{-}day)^{-1}$	1.16E-04
		Exp. Route Total								2.54E-07					8.57E-03
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	1.59E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.16E-09	9.30E-09	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	1.58E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.15E-08	9.20E-09	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	1.58E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.15E-09	9.21E-09	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Antimony	3.95E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	1.35E+01	mg/kg	2.50E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.76E-08	1.46E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.87E-04
			Chromium VI	1.01E+00	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	3.73E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.55E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Manganese	1.86E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.17E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
			Zinc	3.37E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								5.14E-08					4.87E-04
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	1.37E-10	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	1.50E-14	7.98E-13	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	1.35E-10	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	1.49E-13	7.90E-13	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	1.36E-10	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	1.49E-14	7.91E-13	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	3.01E-06	$\mu g/m^3$	NA	NA	NA	1.75E-08	mg/m^3	5.00E-03	mg/m^3	3.51E-06
			Antimony	3.95E+00	mg/kg	2.73E-09	$\mu g/m^3$	NA	NA	NA	1.60E-11	mg/m^3	NA	NA	NA
			Arsenic	1.35E+01	mg/kg	9.32E-09	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	4.01E-11	5.43E-11	mg/m^3	1.50E-05	mg/m^3	3.62E-06
			Chromium VI	1.01E+00	mg/kg	6.98E-10	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	8.38E-12	4.07E-12	mg/m^3	1.00E-04	mg/m^3	4.07E-08
			Cobalt	3.73E+00	mg/kg	2.58E-09	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	2.33E-11	1.51E-11	mg/m^3	6.00E-06	mg/m^3	2.51E-06
			Iron	1.55E+04	mg/kg	1.07E-05	$\mu g/m^3$	NA	NA	NA	6.27E-08	mg/m^3	NA	NA	NA
			Manganese	1.86E+02	mg/kg	1.29E-07	$\mu g/m^3$	NA	NA	NA	7.51E-10	mg/m^3	5.00E-05	mg/m^3	1.50E-05
			Vanadium	2.17E+01	mg/kg	1.50E-08	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	1.20E-10	8.75E-11	mg/m^3	1.00E-04	mg/m^3	8.75E-07
			Zinc	3.37E+02	mg/kg	2.33E-07	$\mu g/m^3$	NA	NA	NA	1.36E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								1.92E-10					2.56E-05
	Exposure Point Total									3.06E-07					9.08E-03

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.3c
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6)
Exposure Medium:	Areas 3 and 4 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	1.13E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	8.22E-08	1.31E-06	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	1.11E-07	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	8.14E-07	1.30E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	1.12E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	8.15E-08	1.30E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	2.48E-03	mg/kg-day	NA	NA	NA	2.89E-02	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	2.89E-02
			Antimony	3.95E+00	mg/kg	2.25E-06	mg/kg-day	NA	NA	NA	2.63E-05	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	6.57E-02
			Arsenic	1.35E+01	mg/kg	4.60E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	6.90E-06	5.37E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.79E-01
			Chromium VI	1.01E+00	mg/kg	5.75E-07	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	2.87E-07	6.71E-06	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	2.24E-03
			Cobalt	3.73E+00	mg/kg	2.13E-06	mg/kg-day	NA	NA	NA	2.48E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	8.28E-02
			Iron	1.55E+04	mg/kg	8.85E-03	mg/kg-day	NA	NA	NA	1.03E-01	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	1.47E-01
			Manganese	1.86E+02	mg/kg	1.06E-04	mg/kg-day	NA	NA	NA	1.24E-03	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	8.84E-03
			Vanadium	2.17E+01	mg/kg	1.24E-05	mg/kg-day	NA	NA	NA	1.44E-04	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	2.88E-02
			Zinc	3.37E+02	mg/kg	1.92E-04	mg/kg-day	NA	NA	NA	2.24E-03	mg/kg-day	3.00E-01	$(mg/kg\text{-}day)^{-1}$	7.48E-03
		Exp. Route Total								8.17E-06					5.51E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	2.19E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.60E-08	2.55E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	2.17E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.58E-07	2.53E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	2.17E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.58E-08	2.53E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Antimony	3.95E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	1.35E+01	mg/kg	3.44E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	5.16E-07	4.01E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.34E-02
			Chromium VI	1.01E+00	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	3.73E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.55E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Manganese	1.86E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.17E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
			Zinc	3.37E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								7.06E-07					1.34E-02
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	3.11E-10	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	3.42E-14	3.63E-12	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	3.08E-10	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	3.39E-13	3.59E-12	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	3.08E-10	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	3.39E-14	3.60E-12	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	6.84E-06	$\mu g/m^3$	NA	NA	NA	7.98E-08	mg/m^3	5.00E-03	mg/m^3	1.60E-05
			Antimony	3.95E+00	mg/kg	6.22E-09	$\mu g/m^3$	NA	NA	NA	7.26E-11	mg/m^3	NA	NA	NA
			Arsenic	1.35E+01	mg/kg	2.12E-08	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	9.11E-11	2.47E-10	mg/m^3	1.50E-05	mg/m^3	1.65E-05
			Chromium VI	1.01E+00	mg/kg	1.59E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	1.91E-11	1.85E-11	mg/m^3	1.00E-04	mg/m^3	1.85E-07
			Cobalt	3.73E+00	mg/kg	5.88E-09	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	5.29E-11	6.86E-11	mg/m^3	6.00E-06	mg/m^3	1.14E-05
			Iron	1.55E+04	mg/kg	2.44E-05	$\mu g/m^3$	NA	NA	NA	2.85E-07	mg/m^3	NA	NA	NA
			Manganese	1.86E+02	mg/kg	2.93E-07	$\mu g/m^3$	NA	NA	NA	3.42E-09	mg/m^3	5.00E-05	mg/m^3	6.84E-05
			Vanadium	2.17E+01	mg/kg	3.41E-08	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	2.73E-10	3.98E-10	mg/m^3	1.00E-04	mg/m^3	3.98E-06
			Zinc	3.37E+02	mg/kg	5.31E-07	$\mu g/m^3$	NA	NA	NA	6.20E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								4.37E-10					1.16E-04
	Exposure Point Total									8.87E-06					5.65E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.4a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Areas 5, 6 and Beach Area of Area 9 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface	Ingestion	**Semi-volatile Organic Compounds**												
	Soil		Benzo(a)pyrene	4.00E-02	mg/kg	5.37E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	3.92E-08	1.57E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.56E+03	mg/kg	2.09E-04	mg/kg-day	NA	NA	NA	6.11E-04	mg/kg-day	1.00E+00	mg/kg-day	6.11E-04
			Antimony	6.84E+00	mg/kg	9.18E-07	mg/kg-day	NA	NA	NA	2.68E-06	mg/kg-day	4.00E-04	mg/kg-day	6.69E-03
			Arsenic	6.90E+00	mg/kg	5.56E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	8.33E-07	1.62E-06	mg/kg-day	3.00E-04	mg/kg-day	5.40E-03
			Chromium VI	6.57E-01	mg/kg	8.82E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	4.41E-08	2.57E-07	mg/kg-day	3.00E-03	mg/kg-day	8.57E-05
			Cobalt	2.10E+00	mg/kg	2.81E-07	mg/kg-day	NA	NA	NA	8.20E-07	mg/kg-day	3.00E-04	mg/kg-day	2.73E-03
			Iron	1.60E+04	mg/kg	2.15E-03	mg/kg-day	NA	NA	NA	6.28E-03	mg/kg-day	7.00E-01	mg/kg-day	8.97E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.59E+01	mg/kg	1.29E-05	mg/kg-day	NA	NA	NA	3.75E-05	mg/kg-day	1.40E-01	mg/kg-day	2.68E-04
			Vanadium	2.09E+01	mg/kg	2.80E-06	mg/kg-day	NA	NA	NA	8.16E-06	mg/kg-day	5.00E-03	mg/kg-day	1.63E-03
		Exp. Route Total								9.17E-07					2.64E-02
Soil	Surface	Dermal	**Semi-volatile Organic Compounds**												
	Soil	Contact	Benzo(a)pyrene	4.00E-02	mg/kg	8.79E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	6.42E-08	2.56E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.56E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	mg/kg-day	NA
			Antimony	6.84E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	mg/kg-day	NA
			Arsenic	6.90E+00	mg/kg	3.50E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	5.25E-07	1.02E-06	mg/kg-day	3.00E-04	mg/kg-day	3.40E-03
			Chromium VI	6.57E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	mg/kg-day	NA
			Cobalt	2.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	mg/kg-day	NA
			Iron	1.60E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	mg/kg-day	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.59E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	mg/kg-day	NA
			Vanadium	2.09E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	mg/kg-day	NA
		Exp. Route Total								5.89E-07					3.40E-03
Soil	Surface	Inhalation	**Semi-volatile Organic Compounds**												
	Soil		Benzo(a)pyrene	4.00E-02	mg/kg	8.67E-10	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	9.54E-13	2.53E-12	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	1.56E+03	mg/kg	3.38E-05	$\mu g/m^3$	NA	NA	NA	9.87E-08	mg/m^3	5.00E-03	mg/m^3	1.97E-05
			Antimony	6.84E+00	mg/kg	1.48E-07	$\mu g/m^3$	NA	NA	NA	4.33E-10	mg/m^3	NA	NA	NA
			Arsenic	6.90E+00	mg/kg	1.50E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	6.43E-10	4.36E-10	mg/m^3	1.50E-05	mg/m^3	2.91E-05
			Chromium VI	6.57E-01	mg/kg	1.42E-08	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	1.71E-10	4.15E-11	mg/m^3	1.00E-04	mg/m^3	4.15E-07
			Cobalt	2.10E+00	mg/kg	4.54E-08	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	4.09E-10	1.32E-10	mg/m^3	6.00E-06	mg/m^3	2.21E-05
			Iron	1.60E+04	mg/kg	3.48E-04	$\mu g/m^3$	NA	NA	NA	1.01E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.59E+01	mg/kg	2.08E-06	$\mu g/m^3$	NA	NA	NA	6.07E-09	mg/m^3	5.00E-05	mg/m^3	1.21E-04
			Vanadium	2.09E+01	mg/kg	4.52E-07	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	3.62E-09	1.32E-09	mg/m^3	1.00E-04	mg/m^3	1.32E-05
		Exp. Route Total								4.84E-09					2.06E-04
	Exposure Point Total									1.51E-06					3.00E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.4a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Areas 5, 6 and Beach Area of Area 9 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	1.48E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.08E-09	4.31E-09	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	1.69E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.23E-09	4.93E-09	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	5.80E-05	mg/kg-day	NA	NA	NA	1.69E-04	mg/kg-day	1.00E+00	mg/kg-day	1.69E-04
			Antimony	1.93E+01	µg/L	5.18E-07	mg/kg-day	NA	NA	NA	1.51E-06	mg/kg-day	4.00E-04	mg/kg-day	3.78E-03
			Arsenic	4.02E+01	µg/L	1.08E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.62E-06	3.15E-06	mg/kg-day	3.00E-04	mg/kg-day	1.05E-02
			Cobalt	1.70E+01	µg/L	4.56E-07	mg/kg-day	NA	NA	NA	1.33E-06	mg/kg-day	3.00E-04	mg/kg-day	4.44E-03
			Copper	9.77E+01	µg/L	2.62E-06	mg/kg-day	NA	NA	NA	7.65E-06	mg/kg-day	4.00E-02	mg/kg-day	1.91E-04
			Iron	6.60E+03	µg/L	1.77E-04	mg/kg-day	NA	NA	NA	5.17E-04	mg/kg-day	7.00E-01	mg/kg-day	7.38E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	8.18E-06	mg/kg-day	NA	NA	NA	2.39E-05	mg/kg-day	1.40E-01	mg/kg-day	1.70E-04
			Vanadium	9.49E+01	µg/L	2.55E-06	mg/kg-day	NA	NA	NA	7.43E-06	mg/kg-day	5.00E-03	mg/kg-day	1.49E-03
		Exp. Route Total								1.62E-06					2.15E-02
Surface Water	Surface Water	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	6.24E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	4.56E-07	1.82E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	1.07E-06	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	7.78E-07	3.11E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	5.22E-05	mg/kg-day	NA	NA	NA	1.52E-04	mg/kg-day	1.00E+00	mg/kg-day	1.52E-04
			Antimony	1.93E+01	µg/L	4.66E-07	mg/kg-day	NA	NA	NA	1.36E-06	mg/kg-day	6.00E-05	mg/kg-day	2.27E-02
			Arsenic	4.02E+01	µg/L	9.72E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.46E-06	2.83E-06	mg/kg-day	3.00E-04	mg/kg-day	9.45E-03
			Cobalt	1.70E+01	µg/L	1.64E-07	mg/kg-day	NA	NA	NA	4.79E-07	mg/kg-day	3.00E-04	mg/kg-day	1.60E-03
			Copper	9.77E+01	µg/L	2.36E-06	mg/kg-day	NA	NA	NA	6.88E-06	mg/kg-day	4.00E-02	mg/kg-day	1.72E-04
			Iron	6.60E+03	µg/L	1.59E-04	mg/kg-day	NA	NA	NA	4.65E-04	mg/kg-day	7.00E-01	mg/kg-day	6.64E-04
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	7.36E-06	mg/kg-day	NA	NA	NA	2.15E-05	mg/kg-day	1.40E-01	mg/kg-day	1.53E-04
			Vanadium	9.49E+01	µg/L	2.29E-06	mg/kg-day	NA	NA	NA	6.69E-06	mg/kg-day	5.00E-03	mg/kg-day	1.34E-03
		Exp. Route Total								2.69E-06					3.62E-02
	Exposure Point Total									4.31E-06					5.77E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.4a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Areas 5, 6 and Beach Area of Area 9 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.80E-02	mg/kg	2.42E-10	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.76E-09	7.05E-10	mg/kg-day	NA	NA	NA
			Inorganics												
			Antimony	3.75E+00	mg/kg	5.04E-08	mg/kg-day	NA	NA	NA	1.47E-07	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	3.67E-04
			Arsenic	5.62E+00	mg/kg	7.54E-08	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	1.13E-07	2.20E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	7.33E-04
			Chromium VI	5.50E-01	mg/kg	7.38E-09	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	3.69E-09	2.15E-08	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	7.18E-06
			Cobalt	1.64E+00	mg/kg	2.20E-08	mg/kg-day	NA	NA	NA	6.41E-08	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.14E-04
			Iron	1.78E+04	mg/kg	2.38E-04	mg/kg-day	NA	NA	NA	6.95E-04	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	9.93E-04
			Vanadium	1.73E+01	mg/kg	2.33E-07	mg/kg-day	NA	NA	NA	6.79E-07	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	1.36E-04
		Exp. Route Total								1.19E-07					2.45E-03
Sediment	Sediment	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.80E-02	mg/kg	6.50E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	4.74E-08	1.90E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Antimony	3.75E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	5.62E+00	mg/kg	4.68E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	7.03E-07	1.37E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.55E-03
			Chromium VI	5.50E-01	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	1.64E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Iron	1.78E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								7.50E-07					4.55E-03
	Exposure Point Total									8.69E-07					7.00E-03

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.4b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Medium:	Areas 5, 6 and Beach Area of Area 9 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	4.00E-02	mg/kg	1.25E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	9.14E-08	1.46E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.56E+03	mg/kg	4.89E-04	mg/kg-day	NA	NA	NA	5.70E-03	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	5.70E-03
			Antimony	6.84E+00	mg/kg	2.14E-06	mg/kg-day	NA	NA	NA	2.50E-05	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	6.25E-02
			Arsenic	6.90E+00	mg/kg	1.30E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.94E-06	1.51E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	5.04E-02
			Chromium VI	6.57E-01	mg/kg	2.06E-07	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.03E-07	2.40E-06	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	8.00E-04
			Cobalt	2.10E+00	mg/kg	6.56E-07	mg/kg-day	NA	NA	NA	7.65E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.55E-02
			Iron	1.60E+04	mg/kg	5.02E-03	mg/kg-day	NA	NA	NA	5.86E-02	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	8.37E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.59E+01	mg/kg	3.00E-05	mg/kg-day	NA	NA	NA	3.50E-04	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	2.50E-03
			Vanadium	2.09E+01	mg/kg	6.53E-06	mg/kg-day	NA	NA	NA	7.62E-05	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	1.52E-02
		Exp. Route Total								2.14E-06					2.46E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	4.00E-02	mg/kg	5.37E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	3.92E-08	6.27E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	1.56E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Antimony	6.84E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	6.90E+00	mg/kg	2.14E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.21E-07	2.50E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	8.32E-03
			Chromium VI	6.57E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	2.10E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.60E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.59E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.09E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								3.60E-07					8.32E-03
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	4.00E-02	mg/kg	2.17E-10	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	2.38E-13	2.53E-12	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	1.56E+03	mg/kg	8.46E-06	$\mu g/m^3$	NA	NA	NA	9.87E-08	mg/m^3	5.00E-03	mg/m^3	1.97E-05
			Antimony	6.84E+00	mg/kg	3.71E-08	$\mu g/m^3$	NA	NA	NA	4.33E-10	mg/m^3	NA	NA	NA
			Arsenic	6.90E+00	mg/kg	3.74E-08	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	1.61E-10	4.36E-10	mg/m^3	1.50E-05	mg/m^3	2.91E-05
			Chromium VI	6.57E-01	mg/kg	3.56E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	4.27E-11	4.15E-11	mg/m^3	1.00E-04	mg/m^3	4.15E-07
			Cobalt	2.10E+00	mg/kg	1.14E-08	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	1.02E-10	1.32E-10	mg/m^3	6.00E-06	mg/m^3	2.21E-05
			Iron	1.60E+04	mg/kg	8.69E-05	$\mu g/m^3$	NA	NA	NA	1.01E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	$\mu g/m^3$	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.59E+01	mg/kg	5.20E-07	$\mu g/m^3$	NA	NA	NA	6.07E-09	mg/m^3	5.00E-05	mg/m^3	1.21E-04
			Vanadium	2.09E+01	mg/kg	1.13E-07	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	9.04E-10	1.32E-09	mg/m^3	1.00E-04	mg/m^3	1.32E-05
		Exp. Route Total								1.21E-09					2.06E-04
	Exposure Point Total									2.50E-06					2.55E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.4b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Medium:	Areas 5, 6 and Beach Area of Area 9 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	4.31E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.14E-09	5.02E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	4.93E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.60E-09	5.75E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	1.69E-04	mg/kg-day	NA	NA	NA	1.97E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.97E-03
			Antimony	1.93E+01	µg/L	1.51E-06	mg/kg-day	NA	NA	NA	1.76E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	4.41E-02
			Arsenic	4.02E+01	µg/L	3.15E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	4.72E-06	3.67E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.22E-01
			Cobalt	1.70E+01	µg/L	1.33E-06	mg/kg-day	NA	NA	NA	1.55E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.18E-02
			Copper	9.77E+01	µg/L	7.65E-06	mg/kg-day	NA	NA	NA	8.92E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	2.23E-03
			Iron	6.60E+03	µg/L	5.17E-04	mg/kg-day	NA	NA	NA	6.03E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	8.61E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	2.39E-05	mg/kg-day	NA	NA	NA	2.78E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.99E-03
			Vanadium	9.49E+01	µg/L	7.43E-06	mg/kg-day	NA	NA	NA	8.67E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	1.73E-02
		Exp. Route Total								4.73E-06					2.50E-01
Surface Water	Surface Water	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	5.50E-02	µg/L	2.67E-07	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.95E-07	3.12E-06	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	6.30E-02	µg/L	4.56E-07	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.33E-07	5.32E-06	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	2.16E+03	µg/L	2.23E-05	mg/kg-day	NA	NA	NA	2.61E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	2.61E-04
			Antimony	1.93E+01	µg/L	2.00E-07	mg/kg-day	NA	NA	NA	2.33E-06	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	3.88E-02
			Arsenic	4.02E+01	µg/L	4.16E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6.24E-07	4.85E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.62E-02
			Cobalt	1.70E+01	µg/L	7.03E-08	mg/kg-day	NA	NA	NA	8.20E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.73E-03
			Copper	9.77E+01	µg/L	1.01E-06	mg/kg-day	NA	NA	NA	1.18E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	2.94E-04
			Iron	6.60E+03	µg/L	6.82E-05	mg/kg-day	NA	NA	NA	7.96E-04	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	1.14E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.05E+02	µg/L	3.15E-06	mg/kg-day	NA	NA	NA	3.67E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.62E-04
			Vanadium	9.49E+01	µg/L	9.81E-07	mg/kg-day	NA	NA	NA	1.14E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	2.29E-03
		Exp. Route Total								1.15E-06					6.19E-02
	Exposure Point Total									5.88E-06					3.12E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.4b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Medium:	Areas 5, 6 and Beach Area of Area 9 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.80E-02	mg/kg	5.64E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	4.11E-09	6.58E-09	mg/kg-day	NA	NA	NA
			Inorganics												
			Antimony	3.75E+00	mg/kg	1.18E-07	mg/kg-day	NA	NA	NA	1.37E-06	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	3.43E-03
			Arsenic	5.62E+00	mg/kg	1.76E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.64E-07	2.05E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	6.84E-03
			Chromium VI	5.50E-01	mg/kg	1.72E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	8.61E-09	2.01E-07	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	6.70E-05
			Cobalt	1.64E+00	mg/kg	5.13E-08	mg/kg-day	NA	NA	NA	5.98E-07	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.99E-03
			Iron	1.78E+04	mg/kg	5.56E-04	mg/kg-day	NA	NA	NA	6.49E-03	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	9.27E-03
			Vanadium	1.73E+01	mg/kg	5.43E-07	mg/kg-day	NA	NA	NA	6.33E-06	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	1.27E-03
		Exp. Route Total								2.77E-07					2.29E-02
Sediment	Sediment	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.80E-02	mg/kg	3.08E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.25E-08	3.59E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Antimony	3.75E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	5.62E+00	mg/kg	2.22E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.33E-07	2.59E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	8.62E-03
			Chromium VI	5.50E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	1.64E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.78E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	1.73E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								3.55E-07					8.62E-03
	Exposure Point Total									6.32E-07					3.15E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.5a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Upland Area of Area 9 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.76E-01	mg/kg	1.18E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	8.62E-09	6.88E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.32E-01	mg/kg	8.82E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	6.44E-08	5.15E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.64E-01	mg/kg	1.10E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	8.05E-09	6.43E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	3.03E-02	mg/kg	2.04E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.49E-08	1.19E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.23E-02	mg/kg	4.85E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.54E-09	2.83E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.95E+00	mg/kg	1.98E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	3.95E-07	1.15E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	5.77E-02
			Inorganics												
			Aluminum	4.27E+03	mg/kg	2.86E-04	mg/kg-day	NA	NA	NA	1.67E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.67E-03
			Antimony	9.43E+01	mg/kg	6.33E-06	mg/kg-day	NA	NA	NA	3.69E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	9.23E-02
			Arsenic	3.46E+01	mg/kg	1.39E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.09E-06	8.13E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.71E-02
			Cadmium	6.79E-01	mg/kg	4.56E-08	mg/kg-day	NA	NA	NA	2.66E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	2.66E-04
			Chromium VI	7.39E-01	mg/kg	4.96E-08	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	2.48E-08	2.89E-07	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	9.64E-05
			Cobalt	2.39E+00	mg/kg	1.60E-07	mg/kg-day	NA	NA	NA	9.33E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.11E-03
			Copper	9.66E+01	mg/kg	6.48E-06	mg/kg-day	NA	NA	NA	3.78E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	9.45E-04
			Iron	2.17E+04	mg/kg	1.46E-03	mg/kg-day	NA	NA	NA	8.49E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	1.21E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.04E+02	mg/kg	7.00E-06	mg/kg-day	NA	NA	NA	4.09E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.92E-04
			Vanadium	2.71E+01	mg/kg	1.82E-06	mg/kg-day	NA	NA	NA	1.06E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	2.12E-03
		Exp. Route Total								2.61E-06					1.98E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.76E-01	mg/kg	6.12E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.47E-09	3.57E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.32E-01	mg/kg	4.58E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.34E-08	2.67E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.64E-01	mg/kg	5.72E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.18E-09	3.34E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	3.03E-02	mg/kg	1.06E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	7.71E-09	6.16E-09	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.23E-02	mg/kg	2.52E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.84E-09	1.47E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.95E+00	mg/kg	1.10E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	2.21E-07	6.44E-07	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	3.22E-02
			Inorganics												
			Aluminum	4.27E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	9.43E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	3.46E+01	mg/kg	2.78E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	4.17E-07	1.62E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.40E-03
			Cadmium	6.79E-01	mg/kg	1.82E-10	mg/kg-day	NA	NA	NA	1.06E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	4.24E-05
			Chromium VI	7.39E-01	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.39E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	9.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	2.17E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.04E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.71E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								6.89E-07					3.77E-02

TABLE B-7.5a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Upland Area of Area 9 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.76E-01	mg/kg	3.49E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.84E-14	2.03E-12	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.32E-01	mg/kg	2.61E-10	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	2.87E-13	1.52E-12	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.64E-01	mg/kg	3.26E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.59E-14	1.90E-12	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	3.03E-02	mg/kg	6.01E-11	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	7.22E-14	3.51E-13	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.23E-02	mg/kg	1.43E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.58E-14	8.36E-13	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.95E+00	mg/kg	5.84E-09	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	3.33E-12	3.41E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	4.27E+03	mg/kg	8.46E-06	µg/m^3	NA	NA	NA	4.93E-08	mg/m^3	5.00E-03	mg/m^3	9.86E-06
			Antimony	9.43E+01	mg/kg	1.87E-07	µg/m^3	NA	NA	NA	1.09E-09	mg/m^3	NA	NA	NA
			Arsenic	3.46E+01	mg/kg	6.86E-08	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	2.95E-10	4.00E-10	mg/m^3	1.50E-05	mg/m^3	2.67E-05
			Cadmium	6.79E-01	mg/kg	1.35E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	2.42E-12	7.85E-12	mg/m^3	1.00E-05	mg/m^3	7.85E-07
			Chromium VI	7.39E-01	mg/kg	1.47E-09	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	1.76E-11	8.55E-12	mg/m^3	1.00E-04	mg/m^3	8.55E-08
			Cobalt	2.39E+00	mg/kg	4.73E-09	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	4.26E-11	2.76E-11	mg/m^3	6.00E-06	mg/m^3	4.60E-06
			Copper	9.66E+01	mg/kg	1.91E-07	µg/m^3	NA	NA	NA	1.12E-09	mg/m^3	NA	NA	NA
			Iron	2.17E+04	mg/kg	4.30E-05	µg/m^3	NA	NA	NA	2.51E-07	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.04E+02	mg/kg	2.07E-07	µg/m^3	NA	NA	NA	1.21E-09	mg/m^3	5.00E-05	mg/m^3	2.41E-05
			Vanadium	2.71E+01	mg/kg	5.37E-08	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	4.29E-10	3.13E-10	mg/m^3	1.00E-04	mg/m^3	3.13E-06
		Exp. Route Total								7.91E-10					6.93E-05
	Exposure Point Total									3.30E-06					2.35E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.5a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Upland Area of Area 9 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Volatile Organic Compounds**												
			Chloroform	4.60E-01	µg/L	6.17E-10	mg/kg-day	3.10E-02	$(mg/kg\text{-}day)^{-1}$	1.91E-11	3.60E-09	mg/kg-day	1.00E-02	mg/kg-day	3.60E-07
			Semi-volatile Organic Compounds												
			Benzo(a)anthracene	5.30E-02	µg/L	7.11E-11	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	5.19E-11	4.15E-10	mg/kg-day	NA	NA	NA
			Pentachlorophenol	5.20E-01	µg/L	6.98E-10	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	2.79E-10	4.07E-09	mg/kg-day	5.00E-03	mg/kg-day	8.14E-07
			Inorganics												
			Arsenic	2.10E+00	µg/L	2.82E-09	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.23E-09	1.64E-08	mg/kg-day	3.00E-04	mg/kg-day	5.48E-05
			Iron	8.34E+03	µg/L	1.12E-05	mg/kg-day	NA	NA	NA	6.53E-05	mg/kg-day	7.00E-01	mg/kg-day	9.33E-05
			Manganese	4.02E+02	µg/L	5.39E-07	mg/kg-day	NA	NA	NA	3.15E-06	mg/kg-day	1.40E-01	mg/kg-day	2.25E-05
		Exp. Route Total								4.58E-09					1.72E-04
Surface Water	Surface Water	Dermal Contact	**Volatile Organic Compounds**												
			Chloroform	4.60E-01	µg/L	1.45E-08	mg/kg-day	3.10E-02	$(mg/kg\text{-}day)^{-1}$	4.49E-10	8.45E-08	mg/kg-day	1.00E-02	mg/kg-day	8.45E-06
			Semi-volatile Organic Compounds												
			Benzo(a)anthracene	5.30E-02	µg/L	1.15E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	8.42E-08	6.73E-07	mg/kg-day	NA	NA	NA
			Pentachlorophenol	5.20E-01	µg/L	9.39E-07	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	3.76E-07	5.48E-06	mg/kg-day	5.00E-03	mg/kg-day	1.10E-03
			Inorganics												
			Arsenic	2.10E+00	µg/L	9.72E-09	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.46E-08	5.67E-08	mg/kg-day	3.00E-04	mg/kg-day	1.89E-04
			Iron	8.34E+03	µg/L	3.86E-05	mg/kg-day	NA	NA	NA	2.25E-04	mg/kg-day	7.00E-01	mg/kg-day	3.22E-04
			Manganese	4.02E+02	µg/L	1.86E-06	mg/kg-day	NA	NA	NA	1.09E-05	mg/kg-day	1.40E-01	mg/kg-day	7.75E-05
		Exp. Route Total								4.75E-07					1.69E-03
	Exposure Point Total									4.79E-07					1.86E-03

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.5a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Medium:	Upland Area of Area 9 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.17E-01	mg/kg	7.84E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	5.72E-09	4.57E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.05E-01	mg/kg	7.07E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	5.16E-08	4.13E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	2.84E-01	mg/kg	1.90E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.39E-08	1.11E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	2.59E-02	mg/kg	1.74E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.27E-08	1.01E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.42E-01	mg/kg	1.63E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.19E-08	9.49E-08	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	8.32E+03	mg/kg	5.58E-04	mg/kg-day	NA	NA	NA	3.26E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	3.26E-03
			Antimony	1.09E+01	mg/kg	7.31E-07	mg/kg-day	NA	NA	NA	4.27E-06	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.07E-02
			Arsenic	2.00E+01	mg/kg	1.34E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.01E-06	7.81E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.60E-02
			Chromium VI	1.17E+00	mg/kg	7.86E-08	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	3.93E-08	4.58E-07	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	1.53E-04
			Cobalt	5.65E+00	mg/kg	3.79E-07	mg/kg-day	NA	NA	NA	2.21E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	7.37E-03
			Copper	3.20E+02	mg/kg	2.15E-05	mg/kg-day	NA	NA	NA	1.25E-04	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	3.13E-03
			Iron	3.37E+04	mg/kg	2.26E-03	mg/kg-day	NA	NA	NA	1.32E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	1.88E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.56E+01	mg/kg	6.41E-06	mg/kg-day	NA	NA	NA	3.74E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.67E-04
			Mercury	3.46E-01	mg/kg	2.32E-08	mg/kg-day	NA	NA	NA	1.35E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.51E-04
			Vanadium	4.99E+01	mg/kg	3.34E-06	mg/kg-day	NA	NA	NA	1.95E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	3.90E-03
		Exp. Route Total								2.14E-06					7.41E-02
Sediment	Sediment	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.17E-01	mg/kg	2.11E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.54E-08	1.23E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.05E-01	mg/kg	1.90E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.39E-07	1.11E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	2.84E-01	mg/kg	5.12E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.74E-08	2.99E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	2.59E-02	mg/kg	4.67E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.41E-08	2.73E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.42E-01	mg/kg	4.38E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.19E-08	2.55E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	8.32E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	1.09E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	2.00E+01	mg/kg	8.32E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	1.25E-06	4.85E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.62E-02
			Chromium VI	1.17E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	5.65E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	3.20E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	3.37E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.56E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Mercury	3.46E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Vanadium	4.99E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.51E-06					1.62E-02
	Exposure Point Total									3.65E-06					9.02E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.5b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Upland Area of Area 9 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.76E-01	mg/kg	1.56E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.14E-08	9.09E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.32E-01	mg/kg	1.17E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	8.51E-08	6.80E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.64E-01	mg/kg	1.46E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.06E-08	8.50E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	3.03E-02	mg/kg	2.69E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.96E-08	1.57E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.23E-02	mg/kg	6.41E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.68E-09	3.74E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.95E+00	mg/kg	2.61E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	5.22E-07	1.52E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	7.62E-02
			Inorganics												
			Aluminum	4.27E+03	mg/kg	3.78E-04	mg/kg-day	NA	NA	NA	2.20E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	2.20E-03
			Antimony	9.43E+01	mg/kg	8.36E-06	mg/kg-day	NA	NA	NA	4.87E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.22E-01
			Arsenic	3.46E+01	mg/kg	1.84E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.76E-06	1.07E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.58E-02
			Cadmium	6.79E-01	mg/kg	6.02E-08	mg/kg-day	NA	NA	NA	3.51E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	3.51E-04
			Chromium VI	7.39E-01	mg/kg	6.55E-08	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	3.27E-08	3.82E-07	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	1.27E-04
			Cobalt	2.39E+00	mg/kg	2.11E-07	mg/kg-day	NA	NA	NA	1.23E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.11E-03
			Copper	9.66E+01	mg/kg	8.56E-06	mg/kg-day	NA	NA	NA	4.99E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.25E-03
			Iron	2.17E+04	mg/kg	1.92E-03	mg/kg-day	NA	NA	NA	1.12E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	1.60E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.04E+02	mg/kg	9.25E-06	mg/kg-day	NA	NA	NA	5.40E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	3.85E-04
			Vanadium	2.71E+01	mg/kg	2.40E-06	mg/kg-day	NA	NA	NA	1.40E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	2.80E-03
		Exp. Route Total								3.45E-06					2.61E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.76E-01	mg/kg	7.09E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	5.18E-09	4.14E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.32E-01	mg/kg	5.30E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.87E-08	3.09E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.64E-01	mg/kg	6.63E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.84E-09	3.87E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	3.03E-02	mg/kg	1.22E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	8.93E-09	7.14E-09	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.23E-02	mg/kg	2.91E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.13E-09	1.70E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.95E+00	mg/kg	1.28E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	2.56E-07	7.46E-07	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	3.73E-02
			Inorganics												
			Aluminum	4.27E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	9.43E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	3.46E+01	mg/kg	3.22E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	4.83E-07	1.88E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	6.26E-03
			Cadmium	6.79E-01	mg/kg	2.11E-10	mg/kg-day	NA	NA	NA	1.23E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	4.91E-05
			Chromium VI	7.39E-01	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.39E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	9.66E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	2.17E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.04E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.71E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								7.99E-07					4.36E-02

TABLE B-7.5b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Upland Area of Area 9 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.76E-01	mg/kg	3.49E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.84E-14	2.03E-12	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.32E-01	mg/kg	2.61E-10	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	2.87E-13	1.52E-12	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.64E-01	mg/kg	3.26E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.59E-14	1.90E-12	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	3.03E-02	mg/kg	6.01E-11	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	7.22E-14	3.51E-13	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.23E-02	mg/kg	1.43E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.58E-14	8.36E-13	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.95E+00	mg/kg	5.84E-09	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	3.33E-12	3.41E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	4.27E+03	mg/kg	8.46E-06	µg/m^3	NA	NA	NA	4.93E-08	mg/m^3	5.00E-03	mg/m^3	9.86E-06
			Antimony	9.43E+01	mg/kg	1.87E-07	µg/m^3	NA	NA	NA	1.09E-09	mg/m^3	NA	NA	NA
			Arsenic	3.46E+01	mg/kg	6.86E-08	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	2.95E-10	4.00E-10	mg/m^3	1.50E-05	mg/m^3	2.67E-05
			Cadmium	6.79E-01	mg/kg	1.35E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	2.42E-12	7.85E-12	mg/m^3	1.00E-05	mg/m^3	7.85E-07
			Chromium VI	7.39E-01	mg/kg	1.47E-09	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	1.76E-11	8.55E-12	mg/m^3	1.00E-04	mg/m^3	8.55E-08
			Cobalt	2.39E+00	mg/kg	4.73E-09	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	4.26E-11	2.76E-11	mg/m^3	6.00E-06	mg/m^3	4.60E-06
			Copper	9.66E+01	mg/kg	1.91E-07	µg/m^3	NA	NA	NA	1.12E-09	mg/m^3	NA	NA	NA
			Iron	2.17E+04	mg/kg	4.30E-05	µg/m^3	NA	NA	NA	2.51E-07	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.04E+02	mg/kg	2.07E-07	µg/m^3	NA	NA	NA	1.21E-09	mg/m^3	5.00E-05	mg/m^3	2.41E-05
			Vanadium	2.71E+01	mg/kg	5.37E-08	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	4.29E-10	3.13E-10	mg/m^3	1.00E-04	mg/m^3	3.13E-06
		Exp. Route Total								7.91E-10					6.93E-05
	Exposure Point Total									4.25E-06					3.05E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.5b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Wetland Area of Area 9 - Surface Water

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Water	Surface Water	Ingestion	**Volatile Organic Compounds**												
			Chloroform	4.60E-01	µg/L	2.04E-09	mg/kg-day	3.10E-02	$(mg/kg\text{-}day)^{-1}$	6.32E-11	1.19E-08	mg/kg-day	1.00E-02	mg/kg-day	1.19E-06
			Semi-volatile Organic Compounds												
			Benzo(a)anthracene	5.30E-02	µg/L	2.35E-10	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.71E-10	1.37E-09	mg/kg-day	NA	NA	NA
			Pentachlorophenol	5.20E-01	µg/L	2.30E-09	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	9.22E-10	1.34E-08	mg/kg-day	5.00E-03	mg/kg-day	2.69E-06
			Inorganics												
			Arsenic	2.10E+00	µg/L	9.30E-09	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.40E-08	5.43E-08	mg/kg-day	3.00E-04	mg/kg-day	1.81E-04
			Iron	8.34E+03	µg/L	3.70E-05	mg/kg-day	NA	NA	NA	2.16E-04	mg/kg-day	7.00E-01	mg/kg-day	3.08E-04
			Manganese	4.02E+02	µg/L	1.78E-06	mg/kg-day	NA	NA	NA	1.04E-05	mg/kg-day	1.40E-01	mg/kg-day	7.42E-05
		Exp. Route Total								1.51E-08					5.67E-04
Surface Water	Surface Water	Dermal Contact	**Volatile Organic Compounds**												
			Chloroform	4.60E-01	µg/L	1.69E-08	mg/kg-day	3.10E-02	$(mg/kg\text{-}day)^{-1}$	5.24E-10	9.86E-08	mg/kg-day	1.00E-02	mg/kg-day	9.86E-06
			Semi-volatile Organic Compounds												
			Benzo(a)anthracene	5.30E-02	µg/L	1.35E-07	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	9.83E-08	7.85E-07	mg/kg-day	NA	NA	NA
			Pentachlorophenol	5.20E-01	µg/L	1.10E-06	mg/kg-day	4.00E-01	$(mg/kg\text{-}day)^{-1}$	4.39E-07	6.39E-06	mg/kg-day	5.00E-03	mg/kg-day	1.28E-03
			Inorganics												
			Arsenic	2.10E+00	µg/L	1.14E-08	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.70E-08	6.62E-08	mg/kg-day	3.00E-04	mg/kg-day	2.21E-04
			Iron	8.34E+03	µg/L	4.51E-05	mg/kg-day	NA	NA	NA	2.63E-04	mg/kg-day	7.00E-01	mg/kg-day	3.76E-04
			Manganese	4.02E+02	µg/L	2.17E-06	mg/kg-day	NA	NA	NA	1.27E-05	mg/kg-day	1.40E-01	mg/kg-day	9.05E-05
		Exp. Route Total								5.54E-07					1.98E-03
	Exposure Point Total									5.69E-07					2.54E-03

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day

TABLE B-7.5b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Wetland Area of Area 9 - Sediment

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Sediment	Sediment	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.17E-01	mg/kg	1.04E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	7.56E-09	6.04E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.05E-01	mg/kg	9.34E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	6.82E-08	5.45E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	2.84E-01	mg/kg	2.51E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.83E-08	1.47E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	2.59E-02	mg/kg	2.29E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.67E-08	1.34E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.42E-01	mg/kg	2.15E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.57E-08	1.25E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	8.32E+03	mg/kg	7.37E-04	mg/kg-day	NA	NA	NA	4.30E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	4.30E-03
			Antimony	1.09E+01	mg/kg	9.66E-07	mg/kg-day	NA	NA	NA	5.63E-06	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.41E-02
			Arsenic	2.00E+01	mg/kg	1.77E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.65E-06	1.03E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.44E-02
			Chromium VI	1.17E+00	mg/kg	1.04E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	5.19E-08	6.05E-07	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	2.02E-04
			Cobalt	5.65E+00	mg/kg	5.00E-07	mg/kg-day	NA	NA	NA	2.92E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	9.73E-03
			Copper	3.20E+02	mg/kg	2.84E-05	mg/kg-day	NA	NA	NA	1.66E-04	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	4.14E-03
			Iron	3.37E+04	mg/kg	2.98E-03	mg/kg-day	NA	NA	NA	1.74E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.49E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.56E+01	mg/kg	8.47E-06	mg/kg-day	NA	NA	NA	4.94E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	3.53E-04
			Mercury	3.46E-01	mg/kg	3.07E-08	mg/kg-day	NA	NA	NA	1.79E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.96E-04
			Vanadium	4.99E+01	mg/kg	4.42E-06	mg/kg-day	NA	NA	NA	2.58E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	5.15E-03
		Exp. Route Total								2.83E-06					9.78E-02
Sediment	Sediment	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.17E-01	mg/kg	2.46E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.80E-08	1.44E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.05E-01	mg/kg	2.22E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.62E-07	1.30E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	2.84E-01	mg/kg	5.98E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.36E-08	3.49E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	2.59E-02	mg/kg	5.46E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.98E-08	3.18E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.42E-01	mg/kg	5.11E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.73E-08	2.98E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	8.32E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	1.09E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	2.00E+01	mg/kg	9.71E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	1.46E-06	5.66E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.89E-02
			Chromium VI	1.17E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	5.65E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	3.20E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	3.37E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	9.56E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Mercury	3.46E-01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Vanadium	4.99E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.76E-06					1.89E-02
	Exposure Point Total									4.59E-06					1.17E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day

TABLE B-7.6a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Medium:	All Areas (except Areas 2, 8, and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.52E-01	mg/kg	3.57E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.61E-08	2.08E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.30E-01	mg/kg	3.06E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	2.23E-07	1.78E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.52E-01	mg/kg	3.56E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.60E-08	2.08E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.28E-02	mg/kg	1.94E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.42E-07	1.13E-07	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.01E-01	mg/kg	2.38E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.73E-08	1.39E-07	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.74E+00	mg/kg	4.09E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	8.17E-07	2.38E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.19E-01
			Inorganics												
			Aluminum	2.52E+03	mg/kg	5.92E-04	mg/kg-day	NA	NA	NA	3.45E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	3.45E-03
			Antimony	3.35E+01	mg/kg	7.86E-06	mg/kg-day	NA	NA	NA	4.59E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.15E-01
			Arsenic	1.51E+01	mg/kg	2.12E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	3.19E-06	1.24E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.13E-02
			Cadmium	4.19E-01	mg/kg	9.84E-08	mg/kg-day	NA	NA	NA	5.74E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	5.74E-04
			Chromium VI	1.02E+00	mg/kg	2.39E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	1.20E-07	1.40E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	4.65E-04
			Cobalt	2.17E+00	mg/kg	5.09E-07	mg/kg-day	NA	NA	NA	2.97E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	9.89E-03
			Copper	3.64E+01	mg/kg	8.55E-06	mg/kg-day	NA	NA	NA	4.98E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.25E-03
			Iron	1.91E+04	mg/kg	4.48E-03	mg/kg-day	NA	NA	NA	2.61E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	3.73E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.51E+01	mg/kg	2.00E-05	mg/kg-day	NA	NA	NA	1.17E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	8.32E-04
			Vanadium	2.28E+01	mg/kg	5.34E-06	mg/kg-day	NA	NA	NA	3.12E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	6.23E-03
			Zinc	6.93E+01	mg/kg	1.63E-05	mg/kg-day	NA	NA	NA	9.49E-05	mg/kg-day	3.00E-01	(mg/kg-day)$^{-1}$	3.16E-04
		Exp. Route Total								4.56E-06					3.36E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.52E-01	mg/kg	1.85E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.35E-08	1.08E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.30E-01	mg/kg	1.58E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.16E-07	9.24E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.52E-01	mg/kg	1.85E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.35E-08	1.08E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.28E-02	mg/kg	1.01E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	7.36E-08	5.88E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.01E-01	mg/kg	1.23E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	9.00E-09	7.19E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.74E+00	mg/kg	2.28E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	4.56E-07	1.33E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	6.66E-02
			Inorganics												
			Aluminum	2.52E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	3.35E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	1.51E+01	mg/kg	4.24E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6.36E-07	2.47E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	8.24E-03
			Cadmium	4.19E-01	mg/kg	3.93E-10	mg/kg-day	NA	NA	NA	2.29E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	9.16E-05
			Chromium VI	1.02E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.17E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	3.64E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	1.91E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.51E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.28E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
			Zinc	6.93E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.32E-06					7.49E-02

TABLE B-7.6a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Medium:	All Areas (except Areas 2, 8, and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.52E-01	mg/kg	3.30E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.63E-13	1.93E-11	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.30E-01	mg/kg	2.82E-09	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	3.11E-12	1.65E-11	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.52E-01	mg/kg	3.29E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.62E-13	1.92E-11	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	8.28E-02	mg/kg	1.80E-09	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	2.16E-12	1.05E-11	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.01E-01	mg/kg	2.20E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	2.42E-13	1.28E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.74E+00	mg/kg	3.78E-08	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	2.15E-11	2.20E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	2.52E+03	mg/kg	5.47E-05	µg/m^3	NA	NA	NA	3.19E-07	mg/m^3	5.00E-03	mg/m^3	6.38E-05
			Antimony	3.35E+01	mg/kg	7.27E-07	µg/m^3	NA	NA	NA	4.24E-09	mg/m^3	NA	NA	NA
			Arsenic	1.51E+01	mg/kg	3.27E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	1.41E-09	1.91E-09	mg/m^3	1.50E-05	mg/m^3	1.27E-04
			Cadmium	4.19E-01	mg/kg	9.09E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	1.64E-11	5.30E-11	mg/m^3	1.00E-05	mg/m^3	5.30E-06
			Chromium VI	1.02E+00	mg/kg	2.21E-08	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	2.65E-10	1.29E-10	mg/m^3	1.00E-04	mg/m^3	1.29E-06
			Cobalt	2.17E+00	mg/kg	4.70E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	4.23E-10	2.74E-10	mg/m^3	6.00E-06	mg/m^3	4.57E-05
			Copper	3.64E+01	mg/kg	7.90E-07	µg/m^3	NA	NA	NA	4.61E-09	mg/m^3	NA	NA	NA
			Iron	1.91E+04	mg/kg	4.14E-04	µg/m^3	NA	NA	NA	2.42E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.51E+01	mg/kg	1.85E-06	µg/m^3	NA	NA	NA	1.08E-08	mg/m^3	5.00E-05	mg/m^3	2.15E-04
			Vanadium	2.28E+01	mg/kg	4.94E-07	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	3.95E-09	2.88E-09	mg/m^3	1.00E-04	mg/m^3	2.88E-05
			Zinc	6.93E+01	mg/kg	1.50E-06	µg/m^3	NA	NA	NA	8.77E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								6.09E-09					4.88E-04
	Exposure Point Total									5.88E-06					4.11E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.6b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	All Areas (except Areas 2, 8, and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.52E-01	mg/kg	4.72E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.45E-08	2.75E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.30E-01	mg/kg	4.04E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	2.95E-07	2.35E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.52E-01	mg/kg	4.71E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.44E-08	2.75E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.28E-02	mg/kg	2.57E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.87E-07	1.50E-07	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.01E-01	mg/kg	3.14E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.29E-08	1.83E-07	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.74E+00	mg/kg	5.40E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1.08E-06	3.15E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.57E-01
			Inorganics												
			Aluminum	2.52E+03	mg/kg	7.82E-04	mg/kg-day	NA	NA	NA	4.56E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	4.56E-03
			Antimony	3.35E+01	mg/kg	1.04E-05	mg/kg-day	NA	NA	NA	6.06E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.51E-01
			Arsenic	1.51E+01	mg/kg	2.81E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	4.21E-06	1.64E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.46E-02
			Cadmium	4.19E-01	mg/kg	1.30E-07	mg/kg-day	NA	NA	NA	7.58E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	7.58E-04
			Chromium VI	1.02E+00	mg/kg	3.16E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	1.58E-07	1.84E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	6.15E-04
			Cobalt	2.17E+00	mg/kg	6.72E-07	mg/kg-day	NA	NA	NA	3.92E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.31E-02
			Copper	3.64E+01	mg/kg	1.13E-05	mg/kg-day	NA	NA	NA	6.58E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.65E-03
			Iron	1.91E+04	mg/kg	5.92E-03	mg/kg-day	NA	NA	NA	3.45E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	4.93E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.51E+01	mg/kg	2.64E-05	mg/kg-day	NA	NA	NA	1.54E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.10E-03
			Vanadium	2.28E+01	mg/kg	7.06E-06	mg/kg-day	NA	NA	NA	4.12E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	8.23E-03
			Zinc	6.93E+01	mg/kg	2.15E-05	mg/kg-day	NA	NA	NA	1.25E-04	mg/kg-day	3.00E-01	(mg/kg-day)$^{-1}$	4.18E-04
		Exp. Route Total								6.02E-06					4.43E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.52E-01	mg/kg	2.15E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.57E-08	1.25E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.30E-01	mg/kg	1.84E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.34E-07	1.07E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.52E-01	mg/kg	2.14E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.56E-08	1.25E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.28E-02	mg/kg	1.17E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	8.52E-08	6.81E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.01E-01	mg/kg	1.43E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.04E-08	8.33E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.74E+00	mg/kg	2.64E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	5.29E-07	1.54E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	7.71E-02
			Inorganics												
			Aluminum	2.52E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	3.35E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	1.51E+01	mg/kg	4.91E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	7.37E-07	2.86E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	9.55E-03
			Cadmium	4.19E-01	mg/kg	4.55E-10	mg/kg-day	NA	NA	NA	2.65E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	1.06E-04
			Chromium VI	1.02E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.17E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	3.64E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	1.91E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.51E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.28E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
			Zinc	6.93E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.53E-06					8.68E-02

TABLE B-7.6b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	All Areas (except Areas 2, 8, and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.52E-01	mg/kg	3.30E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.63E-13	1.93E-11	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.30E-01	mg/kg	2.82E-09	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	3.11E-12	1.65E-11	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.52E-01	mg/kg	3.29E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.62E-13	1.92E-11	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	8.28E-02	mg/kg	1.80E-09	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	2.16E-12	1.05E-11	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1.01E-01	mg/kg	2.20E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	2.42E-13	1.28E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.74E+00	mg/kg	3.78E-08	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	2.15E-11	2.20E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	2.52E+03	mg/kg	5.47E-05	µg/m^3	NA	NA	NA	3.19E-07	mg/m^3	5.00E-03	mg/m^3	6.38E-05
			Antimony	3.35E+01	mg/kg	7.27E-07	µg/m^3	NA	NA	NA	4.24E-09	mg/m^3	NA	NA	NA
			Arsenic	1.51E+01	mg/kg	3.27E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	1.41E-09	1.91E-09	mg/m^3	1.50E-05	mg/m^3	1.27E-04
			Cadmium	4.19E-01	mg/kg	9.09E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	1.64E-11	5.30E-11	mg/m^3	1.00E-05	mg/m^3	5.30E-06
			Chromium VI	1.02E+00	mg/kg	2.21E-08	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	2.65E-10	1.29E-10	mg/m^3	1.00E-04	mg/m^3	1.29E-06
			Cobalt	2.17E+00	mg/kg	4.70E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	4.23E-10	2.74E-10	mg/m^3	6.00E-06	mg/m^3	4.57E-05
			Copper	3.64E+01	mg/kg	7.90E-07	µg/m^3	NA	NA	NA	4.61E-09	mg/m^3	NA	NA	NA
			Iron	1.91E+04	mg/kg	4.14E-04	µg/m^3	NA	NA	NA	2.42E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.51E+01	mg/kg	1.85E-06	µg/m^3	NA	NA	NA	1.08E-08	mg/m^3	5.00E-05	mg/m^3	2.15E-04
			Vanadium	2.28E+01	mg/kg	4.94E-07	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	3.95E-09	2.88E-09	mg/m^3	1.00E-04	mg/m^3	2.88E-05
			Zinc	6.93E+01	mg/kg	1.50E-06	µg/m^3	NA	NA	NA	8.77E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								6.09E-09					4.88E-04
	Exposure Point Total									7.55E-06					5.30E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.7a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Medium:	All Areas (except Areas 8 and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.47E-01	mg/kg	3.46E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.52E-08	2.02E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.26E-01	mg/kg	2.97E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	2.17E-07	1.73E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.47E-01	mg/kg	3.45E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.52E-08	2.01E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.20E-02	mg/kg	1.93E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.41E-07	1.12E-07	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9.94E-02	mg/kg	2.33E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.70E-08	1.36E-07	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.65E+00	mg/kg	3.87E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	7.74E-07	2.26E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.13E-01
			Inorganics												
			Aluminum	2.42E+03	mg/kg	5.69E-04	mg/kg-day	NA	NA	NA	3.32E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	3.32E-03
			Antimony	3.28E+01	mg/kg	7.70E-06	mg/kg-day	NA	NA	NA	4.49E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.12E-01
			Arsenic	1.55E+01	mg/kg	2.19E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	3.28E-06	1.28E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.25E-02
			Cadmium	4.02E-01	mg/kg	9.44E-08	mg/kg-day	NA	NA	NA	5.51E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	5.51E-04
			Chromium VI	9.52E-01	mg/kg	2.24E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	1.12E-07	1.30E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	4.35E-04
			Cobalt	2.09E+00	mg/kg	4.91E-07	mg/kg-day	NA	NA	NA	2.86E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	9.54E-03
			Copper	3.61E+01	mg/kg	8.48E-06	mg/kg-day	NA	NA	NA	4.95E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.24E-03
			Iron	1.85E+04	mg/kg	4.34E-03	mg/kg-day	NA	NA	NA	2.53E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	3.62E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.04E+01	mg/kg	1.89E-05	mg/kg-day	NA	NA	NA	1.10E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	7.87E-04
			Vanadium	2.21E+01	mg/kg	5.19E-06	mg/kg-day	NA	NA	NA	3.02E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	6.05E-03
			Zinc	6.60E+01	mg/kg	1.55E-05	mg/kg-day	NA	NA	NA	9.04E-05	mg/kg-day	3.00E-01	(mg/kg-day)$^{-1}$	3.01E-04
		Exp. Route Total								4.59E-06					3.26E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.47E-01	mg/kg	1.79E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.31E-08	1.05E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.26E-01	mg/kg	1.54E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.12E-07	8.98E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.47E-01	mg/kg	1.79E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.31E-08	1.04E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.20E-02	mg/kg	9.99E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	7.29E-08	5.83E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9.94E-02	mg/kg	1.21E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	8.84E-09	7.06E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.65E+00	mg/kg	2.16E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	4.32E-07	1.26E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	6.31E-02
			Inorganics												
			Aluminum	2.42E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	3.28E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	1.55E+01	mg/kg	4.36E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	6.54E-07	2.54E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	8.48E-03
			Cadmium	4.02E-01	mg/kg	3.77E-10	mg/kg-day	NA	NA	NA	2.20E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	8.79E-05
			Chromium VI	9.52E-01	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.09E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	3.61E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	1.85E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.04E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.21E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
			Zinc	6.60E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.31E-06					7.16E-02

TABLE B-7.7a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Medium:	All Areas (except Areas 8 and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.47E-01	mg/kg	3.22E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.54E-13	1.88E-11	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.26E-01	mg/kg	2.76E-09	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	3.04E-12	1.61E-11	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.47E-01	mg/kg	3.21E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	3.53E-13	1.87E-11	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	8.20E-02	mg/kg	1.79E-09	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	2.15E-12	1.05E-11	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9.94E-02	mg/kg	2.17E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	2.39E-13	1.27E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.65E+00	mg/kg	3.60E-08	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	2.05E-11	2.10E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	2.42E+03	mg/kg	5.30E-05	µg/m^3	NA	NA	NA	3.09E-07	mg/m^3	5.00E-03	mg/m^3	6.18E-05
			Antimony	3.28E+01	mg/kg	7.17E-07	µg/m^3	NA	NA	NA	4.18E-09	mg/m^3	NA	NA	NA
			Arsenic	1.55E+01	mg/kg	3.39E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	1.46E-09	1.98E-09	mg/m^3	1.50E-05	mg/m^3	1.32E-04
			Cadmium	4.02E-01	mg/kg	8.79E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	1.58E-11	5.13E-11	mg/m^3	1.00E-05	mg/m^3	5.13E-06
			Chromium VI	9.52E-01	mg/kg	2.08E-08	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	2.50E-10	1.21E-10	mg/m^3	1.00E-04	mg/m^3	1.21E-06
			Cobalt	2.09E+00	mg/kg	4.57E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	4.11E-10	2.66E-10	mg/m^3	6.00E-06	mg/m^3	4.44E-05
			Copper	3.61E+01	mg/kg	7.89E-07	µg/m^3	NA	NA	NA	4.60E-09	mg/m^3	NA	NA	NA
			Iron	1.85E+04	mg/kg	4.04E-04	µg/m^3	NA	NA	NA	2.36E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	mg/m^3	NA	NA	NA
			Manganese	8.04E+01	mg/kg	1.76E-06	µg/m^3	NA	NA	NA	1.03E-08	mg/m^3	5.00E-05	mg/m^3	2.05E-04
			Vanadium	2.21E+01	mg/kg	4.83E-07	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	3.86E-09	2.82E-09	mg/m^3	1.00E-04	mg/m^3	2.82E-05
			Zinc	6.60E+01	mg/kg	1.44E-06	µg/m^3	NA	NA	NA	8.41E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								6.02E-09					4.78E-04
	Exposure Point Total									5.90E-06					3.98E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.7b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	All Areas (except Areas 8 and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.47E-01	mg/kg	4.57E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.33E-08	2.66E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.26E-01	mg/kg	3.92E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	2.86E-07	2.29E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.47E-01	mg/kg	4.56E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.33E-08	2.66E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.20E-02	mg/kg	2.54E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.86E-07	1.48E-07	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9.94E-02	mg/kg	3.08E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.25E-08	1.80E-07	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.65E+00	mg/kg	5.11E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	1.02E-06	2.98E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.49E-01
			Inorganics												
			Aluminum	2.42E+03	mg/kg	7.52E-04	mg/kg-day	NA	NA	NA	4.38E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	4.38E-03
			Antimony	3.28E+01	mg/kg	1.02E-05	mg/kg-day	NA	NA	NA	5.93E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.48E-01
			Arsenic	1.55E+01	mg/kg	2.89E-06	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	4.33E-06	1.68E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.62E-02
			Cadmium	4.02E-01	mg/kg	1.25E-07	mg/kg-day	NA	NA	NA	7.27E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	7.27E-04
			Chromium VI	9.52E-01	mg/kg	2.95E-07	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	1.48E-07	1.72E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	5.74E-04
			Cobalt	2.09E+00	mg/kg	6.48E-07	mg/kg-day	NA	NA	NA	3.78E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.26E-02
			Copper	3.61E+01	mg/kg	1.12E-05	mg/kg-day	NA	NA	NA	6.53E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.63E-03
			Iron	1.85E+04	mg/kg	5.74E-03	mg/kg-day	NA	NA	NA	3.35E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	4.78E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.04E+01	mg/kg	2.49E-05	mg/kg-day	NA	NA	NA	1.46E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.04E-03
			Vanadium	2.21E+01	mg/kg	6.85E-06	mg/kg-day	NA	NA	NA	3.99E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	7.99E-03
			Zinc	6.60E+01	mg/kg	2.05E-05	mg/kg-day	NA	NA	NA	1.19E-04	mg/kg-day	3.00E-01	(mg/kg-day)$^{-1}$	3.98E-04
		Exp. Route Total								6.06E-06					4.31E-01
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.47E-01	mg/kg	2.08E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.52E-08	1.21E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.26E-01	mg/kg	1.78E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.30E-07	1.04E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.47E-01	mg/kg	2.07E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.51E-08	1.21E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	8.20E-02	mg/kg	1.16E-08	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	8.45E-08	6.75E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9.94E-02	mg/kg	1.40E-08	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.02E-08	8.18E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.65E+00	mg/kg	2.50E-07	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	5.01E-07	1.46E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	7.31E-02
			Inorganics												
			Aluminum	2.42E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	3.28E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	1.55E+01	mg/kg	5.05E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	7.58E-07	2.95E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	9.83E-03
			Cadmium	4.02E-01	mg/kg	4.36E-10	mg/kg-day	NA	NA	NA	2.55E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	1.02E-04
			Chromium VI	9.52E-01	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.09E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	3.61E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	1.85E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	8.04E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.21E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
			Zinc	6.60E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								1.51E-06					8.30E-02

TABLE B-7.7b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	All Areas (except Areas 8 and 11) - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.47E-01	mg/kg	3.22E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	3.54E-13	1.88E-11	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.26E-01	mg/kg	2.76E-09	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	3.04E-12	1.61E-11	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.47E-01	mg/kg	3.21E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	3.53E-13	1.87E-11	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	8.20E-02	mg/kg	1.79E-09	$\mu g/m^3$	1.20E-03	$(\mu g/m^3)^{-1}$	2.15E-12	1.05E-11	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9.94E-02	mg/kg	2.17E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	2.39E-13	1.27E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	1.65E+00	mg/kg	3.60E-08	$\mu g/m^3$	5.70E-04	$(\mu g/m^3)^{-1}$	2.05E-11	2.10E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	2.42E+03	mg/kg	5.30E-05	$\mu g/m^3$	NA	NA	NA	3.09E-07	mg/m^3	5.00E-03	mg/m^3	6.18E-05
			Antimony	3.28E+01	mg/kg	7.17E-07	$\mu g/m^3$	NA	NA	NA	4.18E-09	mg/m^3	NA	NA	NA
			Arsenic	1.55E+01	mg/kg	3.39E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	1.46E-09	1.98E-09	mg/m^3	1.50E-05	mg/m^3	1.32E-04
			Cadmium	4.02E-01	mg/kg	8.79E-09	$\mu g/m^3$	1.80E-03	$(\mu g/m^3)^{-1}$	1.58E-11	5.13E-11	mg/m^3	1.00E-05	mg/m^3	5.13E-06
			Chromium VI	9.52E-01	mg/kg	2.08E-08	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	2.50E-10	1.21E-10	mg/m^3	1.00E-04	mg/m^3	1.21E-06
			Cobalt	2.09E+00	mg/kg	4.57E-08	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	4.11E-10	2.66E-10	mg/m^3	6.00E-06	mg/m^3	4.44E-05
			Copper	3.61E+01	mg/kg	7.89E-07	$\mu g/m^3$	NA	NA	NA	4.60E-09	mg/m^3	NA	NA	NA
			Iron	1.85E+04	mg/kg	4.04E-04	$\mu g/m^3$	NA	NA	NA	2.36E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	mg/m^3	NA	NA	NA
			Manganese	8.04E+01	mg/kg	1.76E-06	$\mu g/m^3$	NA	NA	NA	1.03E-08	mg/m^3	5.00E-05	mg/m^3	2.05E-04
			Vanadium	2.21E+01	mg/kg	4.83E-07	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	3.86E-09	2.82E-09	mg/m^3	1.00E-04	mg/m^3	2.82E-05
			Zinc	6.60E+01	mg/kg	1.44E-06	$\mu g/m^3$	NA	NA	NA	8.41E-09	mg/m^3	NA	NA	NA
		Exp. Route Total								6.02E-09					4.78E-04
	Exposure Point Total									7.58E-06					5.14E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.8a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Fish

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Fish	Fish	Ingestion	**Inorganics**												
			Arsenic	2.63E-01	mg/kg wet wt.	4.25E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	6.38E-05	1.24E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.14E-01
			Mercury	2.17E-02	mg/kg wet wt.	3.50E-06	mg/kg-day	NA	NA	NA	1.02E-05	mg/kg-day	1.00E-04	$(mg/kg\text{-}day)^{-1}$	1.02E-01
		Exp. Route Total								6.38E-05					5.16E-01
	Exposure Point Total									6.38E-05					5.16E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.8b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Fish

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Fish	Fish	Ingestion	**Inorganics**												
			Arsenic	2.63E-01	mg/kg wet wt.	1.65E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.48E-05	1.93E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	6.43E-01
			Mercury	2.17E-02	mg/kg wet wt.	1.36E-06	mg/kg-day	NA	NA	NA	1.59E-05	mg/kg-day	1.00E-04	$(mg/kg\text{-}day)^{-1}$	1.59E-01
		Exp. Route Total								2.48E-05					8.02E-01
	Exposure Point Total									2.48E-05					8.02E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.9a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Hard Clam

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Hard Clam	Hard Clam	Ingestion	**Inorganics**												
			Arsenic	1.60E+00	mg/kg wet wt.	1.25E-04	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.88E-04	3.66E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.22E+00
			Cadmium	1.70E-01	mg/kg wet wt.	1.33E-05	mg/kg-day	NA	NA	NA	3.89E-05	mg/kg-day	1.00E-03	$(mg/kg\text{-}day)^{-1}$	3.89E-02
			Cobalt	1.30E-01	mg/kg wet wt.	1.02E-05	mg/kg-day	NA	NA	NA	2.97E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	9.90E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.40E+01	mg/kg wet wt.	2.66E-03	mg/kg-day	NA	NA	NA	7.77E-03	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	5.55E-02
		Exp. Route Total								1.88E-04					1.41E+00
	Exposure Point Total									1.88E-04					1.41E+00

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.9b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Hard Clam

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Hard Clam	Hard Clam	Ingestion	**Inorganics**												
			Arsenic	1.60E+00	mg/kg wet wt.	4.88E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	7.31E-05	5.69E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.90E+00
			Cadmium	1.70E-01	mg/kg wet wt.	5.18E-06	mg/kg-day	NA	NA	NA	6.04E-05	mg/kg-day	1.00E-03	$(mg/kg\text{-}day)^{-1}$	6.04E-02
			Cobalt	1.30E-01	mg/kg wet wt.	3.96E-06	mg/kg-day	NA	NA	NA	4.62E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.54E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.40E+01	mg/kg wet wt.	1.04E-03	mg/kg-day	NA	NA	NA	1.21E-02	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	8.63E-02
		Exp. Route Total								7.31E-05					2.20E+00
	Exposure Point Total									7.31E-05					2.20E+00

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.10a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Ribbed Mussel

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Ribbed Mussel	Ribbed Mussel	Ingestion	**Inorganics**												
			Arsenic	8.90E-01	mg/kg wet wt.	6.97E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.05E-04	2.03E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	6.78E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Exp. Route Total								1.05E-04					6.78E-01
	Exposure Point Total									1.05E-04					6.78E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.10b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Ribbed Mussel

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Ribbed Mussel	Ribbed Mussel	Ingestion	**Inorganics**												
			Arsenic	8.90E-01	mg/kg wet wt.	2.71E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.07E-05	3.16E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.05E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Exp. Route Total								4.07E-05					1.05E+00
	Exposure Point Total									4.07E-05					1.05E+00

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.11a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Blue Crab (Muscle)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Blue Crab Muscle	Blue Crab Muscle	Ingestion	**Inorganics**												
			Arsenic	2.80E-01	mg/kg wet wt.	2.19E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.29E-05	6.40E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.13E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Exp. Route Total								3.29E-05					2.13E-01
	Exposure Point Total									3.29E-05					2.13E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.11b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Blue Crab (Muscle)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Blue Crab Muscle	Blue Crab Muscle	Ingestion	**Inorganics**												
			Arsenic	2.80E-01	mg/kg wet wt.	8.53E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.28E-05	9.96E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	3.32E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Exp. Route Total								1.28E-05					3.32E-01
	Exposure Point Total									1.28E-05					3.32E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.12a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Blue Crab (Muscle and Hepatopancreas)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Blue Crab	Blue Crab	Ingestion	**Inorganics**												
(Muscle and	(Muscle and		Arsenic	3.50E-01	mg/kg wet wt.	2.74E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.11E-05	8.00E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.67E-01
Hepatopancreas)	Hepatopancreas)		Cadmium	1.60E-01	mg/kg wet wt.	1.25E-05	mg/kg-day	NA	NA	NA	3.66E-05	mg/kg-day	1.00E-03	$(mg/kg\text{-}day)^{-1}$	3.66E-02
			Cobalt	3.60E-01	mg/kg wet wt.	2.82E-05	mg/kg-day	NA	NA	NA	8.23E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.74E-01
			Copper	8.30E+00	mg/kg wet wt.	6.50E-04	mg/kg-day	NA	NA	NA	1.90E-03	mg/kg-day	4.00E-02	$(mg/kg\text{-}day)^{-1}$	4.74E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Exp. Route Total								4.11E-05					6.25E-01
	Exposure Point Total									4.11E-05					6.25E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.12b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Blue Crab (Muscle and Hepatopancreas)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Blue Crab	Blue Crab	Ingestion	**Inorganics**												
(Muscle and	(Muscle and		Arsenic	3.50E-01	mg/kg wet wt.	1.07E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.60E-05	1.24E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.15E-01
Hepatopancreas)	Hepatopancreas)		Cadmium	1.60E-01	mg/kg wet wt.	4.88E-06	mg/kg-day	NA	NA	NA	5.69E-05	mg/kg-day	1.00E-03	$(mg/kg\text{-}day)^{-1}$	5.69E-02
			Cobalt	3.60E-01	mg/kg wet wt.	1.10E-05	mg/kg-day	NA	NA	NA	1.28E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.27E-01
			Copper	8.30E+00	mg/kg wet wt.	2.53E-04	mg/kg-day	NA	NA	NA	2.95E-03	mg/kg-day	4.00E-02	$(mg/kg\text{-}day)^{-1}$	7.38E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Exp. Route Total								1.60E-05					9.72E-01
	Exposure Point Total									1.60E-05					9.72E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE B-7.13a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Medium:	Area 2 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Surface Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	5.58E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	4.08E-09	3.26E-09	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.67E-08	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	3.35E-08	9.77E-08	mg/kg-day	2.00E-05	mg/kg-day	4.88E-03
			Inorganics												
			Antimony	4.08E+01	mg/kg	1.42E-06	mg/kg-day	NA	NA	NA	8.31E-06	mg/kg-day	4.00E-04	mg/kg-day	2.08E-02
			Arsenic	2.94E+01	mg/kg	6.15E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	9.22E-07	3.59E-06	mg/kg-day	3.00E-04	mg/kg-day	1.20E-02
			Chromium VI	5.80E-01	mg/kg	2.02E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.01E-08	1.18E-07	mg/kg-day	3.00E-03	mg/kg-day	3.93E-05
			Cobalt	1.77E+00	mg/kg	6.17E-08	mg/kg-day	NA	NA	NA	3.60E-07	mg/kg-day	3.00E-04	mg/kg-day	1.20E-03
			Copper	5.43E+01	mg/kg	1.89E-06	mg/kg-day	NA	NA	NA	1.10E-05	mg/kg-day	4.00E-02	mg/kg-day	2.76E-04
			Iron	1.79E+04	mg/kg	6.25E-04	mg/kg-day	NA	NA	NA	3.64E-03	mg/kg-day	7.00E-01	mg/kg-day	5.21E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	6.01E-07	mg/kg-day	NA	NA	NA	3.51E-06	mg/kg-day	5.00E-03	mg/kg-day	7.02E-04
		Exp. Route Total								9.70E-07					4.50E-02
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	2.90E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.11E-09	1.69E-09	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	9.35E-09	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.87E-08	5.46E-08	mg/kg-day	2.00E-05	mg/kg-day	2.73E-03
			Inorganics												
			Antimony	4.08E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	mg/kg-day	NA
			Arsenic	2.94E+01	mg/kg	1.23E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.84E-07	7.16E-07	mg/kg-day	3.00E-04	mg/kg-day	2.39E-03
			Chromium VI	5.80E-01	mg/kg	NA	NA	1.25E-02	NA	NA	NA	NA	7.50E-05	mg/kg-day	NA
			Cobalt	1.77E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	mg/kg-day	NA
			Copper	5.43E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	mg/kg-day	NA
			Iron	1.79E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	mg/kg-day	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	mg/kg-day	NA
		Exp. Route Total								2.05E-07					5.11E-03
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	6.44E-11	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	7.08E-14	3.16E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.93E-09	$\mu g/m^3$	5.70E-04	$(\mu g/m^3)^{-1}$	1.10E-12	9.49E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Antimony	4.08E+01	mg/kg	1.64E-07	$\mu g/m^3$	NA	NA	NA	8.07E-08	mg/m^3	NA	NA	NA
			Arsenic	2.94E+01	mg/kg	1.18E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	5.08E-10	5.80E-08	mg/m^3	2.00E-04	mg/m^3	2.90E-04
			Chromium VI	5.80E-01	mg/kg	2.33E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	2.80E-11	1.15E-09	mg/m^3	NA	NA	NA
			Cobalt	1.77E+00	mg/kg	7.11E-09	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	6.40E-11	3.50E-09	mg/m^3	NA	NA	NA
			Copper	5.43E+01	mg/kg	2.18E-07	$\mu g/m^3$	NA	NA	NA	1.07E-07	mg/m^3	1.00E-01	mg/m^3	1.07E-06
			Iron	1.79E+04	mg/kg	7.20E-05	$\mu g/m^3$	NA	NA	NA	3.54E-05	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	6.93E-08	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	5.55E-10	3.41E-08	mg/m^3	3.00E-02	mg/m^3	1.14E-06
		Exp. Route Total								1.16E-09					2.92E-04
	Exposure Point Total									1.18E-06					5.04E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.13b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Area 2 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	7.37E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	5.38E-09	4.30E-09	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	2.21E-08	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	4.42E-08	1.29E-07	mg/kg-day	2.00E-05	mg/kg-day	6.45E-03
			Inorganics												
			Antimony	4.08E+01	mg/kg	1.88E-06	mg/kg-day	NA	NA	NA	1.10E-05	mg/kg-day	4.00E-04	mg/kg-day	2.74E-02
			Arsenic	2.94E+01	mg/kg	8.12E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.22E-06	4.74E-06	mg/kg-day	3.00E-04	mg/kg-day	1.58E-02
			Chromium VI	5.80E-01	mg/kg	2.67E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.34E-08	1.56E-07	mg/kg-day	3.00E-03	mg/kg-day	5.20E-05
			Cobalt	1.77E+00	mg/kg	8.15E-08	mg/kg-day	NA	NA	NA	4.76E-07	mg/kg-day	3.00E-04	mg/kg-day	1.59E-03
			Copper	5.43E+01	mg/kg	2.50E-06	mg/kg-day	NA	NA	NA	1.46E-05	mg/kg-day	4.00E-02	mg/kg-day	3.65E-04
			Iron	1.79E+04	mg/kg	8.25E-04	mg/kg-day	NA	NA	NA	4.81E-03	mg/kg-day	7.00E-01	mg/kg-day	6.88E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	7.94E-07	mg/kg-day	NA	NA	NA	4.63E-06	mg/kg-day	5.00E-03	mg/kg-day	9.27E-04
		Exp. Route Total								1.28E-06					5.95E-02
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	3.35E-10	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.45E-09	1.96E-09	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.08E-08	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	2.17E-08	6.32E-08	mg/kg-day	2.00E-05	mg/kg-day	3.16E-03
			Inorganics												
			Antimony	4.08E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	mg/kg-day	NA
			Arsenic	2.94E+01	mg/kg	1.42E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.13E-07	8.29E-07	mg/kg-day	3.00E-04	mg/kg-day	2.76E-03
			Chromium VI	5.80E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	mg/kg-day	NA
			Cobalt	1.77E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	mg/kg-day	NA
			Copper	5.43E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	mg/kg-day	NA
			Iron	1.79E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	mg/kg-day	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	mg/kg-day	NA
		Exp. Route Total								2.37E-07					5.92E-03
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)pyrene	1.60E-02	mg/kg	6.44E-11	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	7.08E-14	3.16E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	4.80E-01	mg/kg	1.93E-09	$\mu g/m^3$	5.70E-04	$(\mu g/m^3)^{-1}$	1.10E-12	9.49E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Antimony	4.08E+01	mg/kg	1.64E-07	$\mu g/m^3$	NA	NA	NA	8.07E-08	mg/m^3	NA	NA	NA
			Arsenic	2.94E+01	mg/kg	1.18E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	5.08E-10	5.80E-08	mg/m^3	2.00E-04	mg/m^3	2.90E-04
			Chromium VI	5.80E-01	mg/kg	2.33E-09	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	2.80E-11	1.15E-09	mg/m^3	NA	NA	NA
			Cobalt	1.77E+00	mg/kg	7.11E-09	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	6.40E-11	3.50E-09	mg/m^3	NA	NA	NA
			Copper	5.43E+01	mg/kg	2.18E-07	$\mu g/m^3$	NA	NA	NA	1.07E-07	mg/m^3	1.00E-01	mg/m^3	1.07E-06
			Iron	1.79E+04	mg/kg	7.20E-05	$\mu g/m^3$	NA	NA	NA	3.54E-05	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	$\mu g/m^3$	NA	NA	NA	NA	mg/m^3	NA	NA	NA
			Vanadium	1.72E+01	mg/kg	6.93E-08	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	5.55E-10	3.41E-08	mg/m^3	3.00E-02	mg/m^3	1.14E-06
		Exp. Route Total								1.16E-09					2.92E-04
	Exposure Point Total									1.52E-06					6.57E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.14a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Medium:	Areas 8 and 11 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface	Ingestion	**Semi-volatile Organic Compounds**												
	Soil		Benzo(a)anthracene	4.11E-01	mg/kg	1.43E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.05E-08	8.37E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	3.33E-01	mg/kg	1.16E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	8.49E-08	6.78E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	4.16E-01	mg/kg	1.45E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.06E-08	8.46E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	7.44E-02	mg/kg	2.60E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.90E-08	1.51E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.09E-01	mg/kg	7.28E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	5.32E-09	4.25E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.22E-01	mg/kg	7.76E-09	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.55E-08	4.52E-08	mg/kg-day	2.00E-05	mg/kg-day	2.26E-03
			Inorganics												
			Aluminum	3.47E+03	mg/kg	1.21E-04	mg/kg-day	NA	NA	NA	7.06E-04	mg/kg-day	1.00E+00	mg/kg-day	7.06E-04
			Antimony	2.11E+02	mg/kg	7.35E-06	mg/kg-day	NA	NA	NA	4.29E-05	mg/kg-day	4.00E-04	mg/kg-day	1.07E-01
			Arsenic	1.55E+02	mg/kg	3.25E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	4.87E-06	1.89E-05	mg/kg-day	3.00E-04	mg/kg-day	6.31E-02
			Cadmium	1.30E+00	mg/kg	4.55E-08	mg/kg-day	NA	NA	NA	2.65E-07	mg/kg-day	1.00E-03	mg/kg-day	2.65E-04
			Chromium VI	6.63E-01	mg/kg	2.31E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.16E-08	1.35E-07	mg/kg-day	3.00E-03	mg/kg-day	4.50E-05
			Cobalt	4.30E+00	mg/kg	1.50E-07	mg/kg-day	NA	NA	NA	8.75E-07	mg/kg-day	3.00E-04	mg/kg-day	2.92E-03
			Copper	2.83E+02	mg/kg	9.87E-06	mg/kg-day	NA	NA	NA	5.76E-05	mg/kg-day	4.00E-02	mg/kg-day	1.44E-03
			Iron	2.79E+04	mg/kg	9.74E-04	mg/kg-day	NA	NA	NA	5.68E-03	mg/kg-day	7.00E-01	mg/kg-day	8.12E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.72E+02	mg/kg	6.01E-06	mg/kg-day	NA	NA	NA	3.51E-05	mg/kg-day	1.40E-01	mg/kg-day	2.51E-04
			Nickel	5.47E+01	mg/kg	1.91E-06	mg/kg-day	NA	NA	NA	1.11E-05	mg/kg-day	2.00E-02	mg/kg-day	5.57E-04
			Vanadium	2.62E+01	mg/kg	9.13E-07	mg/kg-day	NA	NA	NA	5.33E-06	mg/kg-day	5.00E-03	mg/kg-day	1.07E-03
			Zinc	2.40E+02	mg/kg	8.36E-06	mg/kg-day	NA	NA	NA	4.87E-05	mg/kg-day	3.00E-01	mg/kg-day	1.62E-04
		Exp. Route Total								5.03E-06					1.88E-01
Soil	Surface	Dermal	**Semi-volatile Organic Compounds**												
	Soil	Contact	Benzo(a)anthracene	4.11E-01	mg/kg	7.44E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	5.43E-09	4.34E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	3.33E-01	mg/kg	6.03E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	4.40E-08	3.52E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	4.16E-01	mg/kg	7.52E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	5.49E-09	4.39E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	7.44E-02	mg/kg	1.35E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	9.83E-09	7.86E-09	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.09E-01	mg/kg	3.78E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	2.76E-09	2.20E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.22E-01	mg/kg	4.33E-09	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	8.66E-09	2.53E-08	mg/kg-day	2.00E-05	mg/kg-day	1.26E-03
			Inorganics												
			Aluminum	3.47E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	mg/kg-day	NA
			Antimony	2.11E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	mg/kg-day	NA
			Arsenic	1.55E+02	mg/kg	6.48E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	9.72E-07	3.78E-06	mg/kg-day	3.00E-04	mg/kg-day	1.26E-02
			Cadmium	1.30E+00	mg/kg	1.81E-10	mg/kg-day	NA	NA	NA	1.06E-09	mg/kg-day	2.50E-05	mg/kg-day	4.23E-05
			Chromium VI	6.63E-01	mg/kg	NA	NA	1.25E-02	NA	NA	NA	NA	7.50E-05	mg/kg-day	NA
			Cobalt	4.30E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	mg/kg-day	NA
			Copper	2.83E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	mg/kg-day	NA
			Iron	2.79E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	mg/kg-day	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	mg/kg-day	NA
			Nickel	5.47E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	8.00E-04	mg/kg-day	NA
			Vanadium	2.62E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	mg/kg-day	NA
			Zinc	2.40E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	mg/kg-day	NA
		Exp. Route Total								1.05E-06					1.39E-02

TABLE B-7.14a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Medium:	Areas 8 and 11 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	4.11E-01	mg/kg	1.15E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.27E-13	5.65E-10	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	3.33E-01	mg/kg	9.33E-10	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	1.03E-12	4.58E-10	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	4.16E-01	mg/kg	1.16E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.28E-13	5.71E-10	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	7.44E-02	mg/kg	2.08E-10	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	2.50E-13	1.02E-10	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.09E-01	mg/kg	5.84E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	6.42E-14	2.87E-10	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.22E-01	mg/kg	6.22E-10	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	3.55E-13	3.06E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	3.47E+03	mg/kg	9.71E-06	µg/m^3	NA	NA	NA	4.77E-06	mg/m^3	NA	NA	NA
			Antimony	2.11E+02	mg/kg	5.89E-07	µg/m^3	NA	NA	NA	2.90E-07	mg/m^3	NA	NA	NA
			Arsenic	1.55E+02	mg/kg	4.34E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	1.87E-09	2.13E-07	mg/m^3	2.00E-04	mg/m^3	1.07E-03
			Cadmium	1.30E+00	mg/kg	3.65E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	6.56E-12	1.79E-09	mg/m^3	3.00E-05	mg/m^3	5.97E-05
			Chromium VI	6.63E-01	mg/kg	1.86E-09	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	2.23E-11	9.11E-10	mg/m^3	NA	NA	NA
			Cobalt	4.30E+00	mg/kg	1.20E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	1.08E-10	5.91E-09	mg/m^3	NA	NA	NA
			Copper	2.83E+02	mg/kg	7.92E-07	µg/m^3	NA	NA	NA	3.89E-07	mg/m^3	1.00E-01	mg/m^3	3.89E-06
			Iron	2.79E+04	mg/kg	7.81E-05	µg/m^3	NA	NA	NA	3.84E-05	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.72E+02	mg/kg	4.82E-07	µg/m^3	NA	NA	NA	2.37E-07	mg/m^3	1.70E-04	mg/m^3	1.39E-03
			Nickel	5.47E+01	mg/kg	1.53E-07	µg/m^3	2.60E-04	(µg/m^3)$^{-1}$	3.98E-11	7.52E-08	mg/m^3	6.00E-03	mg/m^3	1.25E-05
			Vanadium	2.62E+01	mg/kg	7.33E-08	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	5.86E-10	3.60E-08	mg/m^3	3.00E-02	mg/m^3	1.20E-06
			Zinc	2.40E+02	mg/kg	6.70E-07	µg/m^3	NA	NA	NA	3.29E-07	mg/m^3	NA	NA	NA
		Exp. Route Total								2.63E-09					2.54E-03
	Exposure Point Total									6.08E-06					2.05E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.14b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Areas 8 and 11 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface	Ingestion	**Semi-volatile Organic Compounds**												
	Soil		Benzo(a)anthracene	4.11E-01	mg/kg	1.89E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.38E-08	1.11E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	3.33E-01	mg/kg	1.54E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.12E-07	8.96E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	4.16E-01	mg/kg	1.92E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	1.40E-08	1.12E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	7.44E-02	mg/kg	3.43E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	2.50E-08	2.00E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.09E-01	mg/kg	9.62E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	7.02E-09	5.61E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.22E-01	mg/kg	1.02E-08	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	2.05E-08	5.98E-08	mg/kg-day	2.00E-05	mg/kg-day	2.99E-03
			Inorganics												
			Aluminum	3.47E+03	mg/kg	1.60E-04	mg/kg-day	NA	NA	NA	9.33E-04	mg/kg-day	1.00E+00	mg/kg-day	9.33E-04
			Antimony	2.11E+02	mg/kg	9.70E-06	mg/kg-day	NA	NA	NA	5.66E-05	mg/kg-day	4.00E-04	mg/kg-day	1.42E-01
			Arsenic	1.55E+02	mg/kg	4.29E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	6.43E-06	2.50E-05	mg/kg-day	3.00E-04	mg/kg-day	8.34E-02
			Cadmium	1.30E+00	mg/kg	6.00E-08	mg/kg-day	NA	NA	NA	3.50E-07	mg/kg-day	1.00E-03	mg/kg-day	3.50E-04
			Chromium VI	6.63E-01	mg/kg	3.06E-08	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.53E-08	1.78E-07	mg/kg-day	3.00E-03	mg/kg-day	5.94E-05
			Cobalt	4.30E+00	mg/kg	1.98E-07	mg/kg-day	NA	NA	NA	1.16E-06	mg/kg-day	3.00E-04	mg/kg-day	3.85E-03
			Copper	2.83E+02	mg/kg	1.30E-05	mg/kg-day	NA	NA	NA	7.61E-05	mg/kg-day	4.00E-02	mg/kg-day	1.90E-03
			Iron	2.79E+04	mg/kg	1.29E-03	mg/kg-day	NA	NA	NA	7.50E-03	mg/kg-day	7.00E-01	mg/kg-day	1.07E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.72E+02	mg/kg	7.94E-06	mg/kg-day	NA	NA	NA	4.63E-05	mg/kg-day	1.40E-01	mg/kg-day	3.31E-04
			Nickel	5.47E+01	mg/kg	2.52E-06	mg/kg-day	NA	NA	NA	1.47E-05	mg/kg-day	2.00E-02	mg/kg-day	7.35E-04
			Vanadium	2.62E+01	mg/kg	1.21E-06	mg/kg-day	NA	NA	NA	7.04E-06	mg/kg-day	5.00E-03	mg/kg-day	1.41E-03
			Zinc	2.40E+02	mg/kg	1.10E-05	mg/kg-day	NA	NA	NA	6.44E-05	mg/kg-day	3.00E-01	mg/kg-day	2.15E-04
		Exp. Route Total								6.64E-06					2.48E-01
Soil	Surface	Dermal	**Semi-volatile Organic Compounds**												
	Soil	Contact	Benzo(a)anthracene	4.11E-01	mg/kg	8.62E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	6.29E-09	5.03E-08	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	3.33E-01	mg/kg	6.99E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	5.10E-08	4.08E-08	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	4.16E-01	mg/kg	8.71E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	6.36E-09	5.08E-08	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	7.44E-02	mg/kg	1.56E-09	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	1.14E-08	9.10E-09	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.09E-01	mg/kg	4.38E-09	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.19E-09	2.55E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.22E-01	mg/kg	5.02E-09	mg/kg-day	2.00E+00	$(mg/kg\text{-}day)^{-1}$	1.00E-08	2.93E-08	mg/kg-day	2.00E-05	mg/kg-day	1.46E-03
			Inorganics												
			Aluminum	3.47E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	mg/kg-day	NA
			Antimony	2.11E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	mg/kg-day	NA
			Arsenic	1.55E+02	mg/kg	7.50E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.13E-06	4.38E-06	mg/kg-day	3.00E-04	mg/kg-day	1.46E-02
			Cadmium	1.30E+00	mg/kg	2.10E-10	mg/kg-day	NA	NA	NA	1.23E-09	mg/kg-day	2.50E-05	mg/kg-day	4.90E-05
			Chromium VI	6.63E-01	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	mg/kg-day	NA
			Cobalt	4.30E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	mg/kg-day	NA
			Copper	2.83E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	mg/kg-day	NA
			Iron	2.79E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	mg/kg-day	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.72E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	mg/kg-day	NA
			Nickel	5.47E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	8.00E-04	mg/kg-day	NA
			Vanadium	2.62E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	mg/kg-day	NA
			Zinc	2.40E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	mg/kg-day	NA
		Exp. Route Total								1.21E-06					1.61E-02

TABLE B-7.14b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Medium:	Areas 8 and 11 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	4.11E-01	mg/kg	1.15E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.27E-13	5.65E-10	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	3.33E-01	mg/kg	9.33E-10	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	1.03E-12	4.58E-10	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	4.16E-01	mg/kg	1.16E-09	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	1.28E-13	5.71E-10	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	7.44E-02	mg/kg	2.08E-10	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	2.50E-13	1.02E-10	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2.09E-01	mg/kg	5.84E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	6.42E-14	2.87E-10	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	2.22E-01	mg/kg	6.22E-10	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	3.55E-13	3.06E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	3.47E+03	mg/kg	9.71E-06	µg/m^3	NA	NA	NA	4.77E-06	mg/m^3	NA	NA	NA
			Antimony	2.11E+02	mg/kg	5.89E-07	µg/m^3	NA	NA	NA	2.90E-07	mg/m^3	NA	NA	NA
			Arsenic	1.55E+02	mg/kg	4.34E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	1.87E-09	2.13E-07	mg/m^3	2.00E-04	mg/m^3	1.07E-03
			Cadmium	1.30E+00	mg/kg	3.65E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	6.56E-12	1.79E-09	mg/m^3	3.00E-05	mg/m^3	5.97E-05
			Chromium VI	6.63E-01	mg/kg	1.86E-09	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	2.23E-11	9.11E-10	mg/m^3	NA	NA	NA
			Cobalt	4.30E+00	mg/kg	1.20E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	1.08E-10	5.91E-09	mg/m^3	NA	NA	NA
			Copper	2.83E+02	mg/kg	7.92E-07	µg/m^3	NA	NA	NA	3.89E-07	mg/m^3	1.00E-01	mg/m^3	3.89E-06
			Iron	2.79E+04	mg/kg	7.81E-05	µg/m^3	NA	NA	NA	3.84E-05	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.72E+02	mg/kg	4.82E-07	µg/m^3	NA	NA	NA	2.37E-07	mg/m^3	1.70E-04	mg/m^3	1.39E-03
			Nickel	5.47E+01	mg/kg	1.53E-07	µg/m^3	2.60E-04	(µg/m^3)$^{-1}$	3.98E-11	7.52E-08	mg/m^3	6.00E-03	mg/m^3	1.25E-05
			Vanadium	2.62E+01	mg/kg	7.33E-08	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	5.86E-10	3.60E-08	mg/m^3	3.00E-02	mg/m^3	1.20E-06
			Zinc	2.40E+02	mg/kg	6.70E-07	µg/m^3	NA	NA	NA	3.29E-07	mg/m^3	NA	NA	NA
		Exp. Route Total								2.63E-09					2.54E-03
	Exposure Point Total									7.86E-06					2.67E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.15
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker
Receptor Age:	Adult
Exposure Medium:	Areas 3 and 4 - Surface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	6.21E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	4.54E-08	1.74E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	6.15E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	4.49E-07	1.72E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	6.16E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	4.50E-08	1.72E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	1.37E-03	mg/kg-day	NA	NA	NA	3.83E-03	mg/kg-day	1.00E+00	$(mg/kg\text{-}day)^{-1}$	3.83E-03
			Antimony	3.95E+00	mg/kg	1.24E-06	mg/kg-day	NA	NA	NA	3.48E-06	mg/kg-day	4.00E-04	$(mg/kg\text{-}day)^{-1}$	8.70E-03
			Arsenic	1.35E+01	mg/kg	2.54E-06	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.81E-06	7.11E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	2.37E-02
			Chromium VI	1.01E+00	mg/kg	3.17E-07	mg/kg-day	5.00E-01	$(mg/kg\text{-}day)^{-1}$	1.59E-07	8.89E-07	mg/kg-day	3.00E-03	$(mg/kg\text{-}day)^{-1}$	2.96E-04
			Cobalt	3.73E+00	mg/kg	1.17E-06	mg/kg-day	NA	NA	NA	3.29E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	1.10E-02
			Iron	1.55E+04	mg/kg	4.88E-03	mg/kg-day	NA	NA	NA	1.37E-02	mg/kg-day	7.00E-01	$(mg/kg\text{-}day)^{-1}$	1.95E-02
			Manganese	1.86E+02	mg/kg	5.85E-05	mg/kg-day	NA	NA	NA	1.64E-04	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	1.17E-03
			Vanadium	2.17E+01	mg/kg	6.82E-06	mg/kg-day	NA	NA	NA	1.91E-05	mg/kg-day	5.00E-03	$(mg/kg\text{-}day)^{-1}$	3.82E-03
			Zinc	3.37E+02	mg/kg	1.06E-04	mg/kg-day	NA	NA	NA	2.97E-04	mg/kg-day	3.00E-01	$(mg/kg\text{-}day)^{-1}$	9.90E-04
		Exp. Route Total								4.51E-06					7.30E-02
Soil	Surface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	5.33E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.89E-08	1.49E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	5.28E-08	mg/kg-day	7.30E+00	$(mg/kg\text{-}day)^{-1}$	3.85E-07	1.48E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	5.28E-08	mg/kg-day	7.30E-01	$(mg/kg\text{-}day)^{-1}$	3.86E-08	1.48E-07	mg/kg-day	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	$(mg/kg\text{-}day)^{-1}$	NA
			Antimony	3.95E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Arsenic	1.35E+01	mg/kg	8.38E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.26E-06	2.35E-06	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	7.82E-03
			Chromium VI	1.01E+00	mg/kg	NA	NA	1.25E-02	$(mg/kg\text{-}day)^{-1}$	NA	NA	NA	7.50E-05	$(mg/kg\text{-}day)^{-1}$	NA
			Cobalt	3.73E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	$(mg/kg\text{-}day)^{-1}$	NA
			Iron	1.55E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Manganese	1.86E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	$(mg/kg\text{-}day)^{-1}$	NA
			Vanadium	2.17E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	$(mg/kg\text{-}day)^{-1}$	NA
			Zinc	3.37E+02	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	$(mg/kg\text{-}day)^{-1}$	NA
		Exp. Route Total								1.72E-06					7.82E-03
Soil	Surface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.98E-01	mg/kg	6.41E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	7.05E-13	1.80E-11	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.96E-01	mg/kg	6.35E-09	$\mu g/m^3$	1.10E-03	$(\mu g/m^3)^{-1}$	6.98E-12	1.78E-11	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.96E-01	mg/kg	6.35E-09	$\mu g/m^3$	1.10E-04	$(\mu g/m^3)^{-1}$	6.99E-13	1.78E-11	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	4.35E+03	mg/kg	1.41E-04	$\mu g/m^3$	NA	NA	NA	3.95E-07	mg/m^3	5.00E-03	mg/m^3	7.90E-05
			Antimony	3.95E+00	mg/kg	1.28E-07	$\mu g/m^3$	NA	NA	NA	3.59E-10	mg/m^3	NA	NA	NA
			Arsenic	1.35E+01	mg/kg	4.37E-07	$\mu g/m^3$	4.30E-03	$(\mu g/m^3)^{-1}$	1.88E-09	1.22E-09	mg/m^3	1.50E-05	mg/m^3	8.15E-05
			Chromium VI	1.01E+00	mg/kg	3.27E-08	$\mu g/m^3$	1.20E-02	$(\mu g/m^3)^{-1}$	3.93E-10	9.17E-11	mg/m^3	1.00E-04	mg/m^3	9.17E-07
			Cobalt	3.73E+00	mg/kg	1.21E-07	$\mu g/m^3$	9.00E-03	$(\mu g/m^3)^{-1}$	1.09E-09	3.39E-10	mg/m^3	6.00E-06	mg/m^3	5.65E-05
			Iron	1.55E+04	mg/kg	5.04E-04	$\mu g/m^3$	NA	NA	NA	1.41E-06	mg/m^3	NA	NA	NA
			Manganese	1.86E+02	mg/kg	6.04E-06	$\mu g/m^3$	NA	NA	NA	1.69E-08	mg/m^3	5.00E-05	mg/m^3	3.38E-04
			Vanadium	2.17E+01	mg/kg	7.03E-07	$\mu g/m^3$	8.00E-03	$(\mu g/m^3)^{-1}$	5.63E-09	1.97E-09	mg/m^3	1.00E-04	mg/m^3	1.97E-05
			Zinc	3.37E+02	mg/kg	1.09E-05	$\mu g/m^3$	NA	NA	NA	3.06E-08	mg/m^3	NA	NA	NA
		Exp. Route Total								9.00E-09					5.76E-04
	Exposure Point Total									6.24E-06					8.14E-02

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
$\mu g/m^3$ = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.16
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Construction/Utility Worker
Receptor Age:	Adult
Exposure Medium:	All Upland Areas - Surface/Subsurface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface / Subsurface Soil	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.24E-01	mg/kg	5.72E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.18E-09	4.00E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.08E-01	mg/kg	5.00E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	3.65E-08	3.50E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.32E-01	mg/kg	6.07E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	4.43E-09	4.25E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	5.80E-02	mg/kg	2.68E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.95E-08	1.87E-07	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.78E-02	mg/kg	3.59E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	2.62E-09	2.51E-07	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	9.42E-01	mg/kg	4.35E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	8.69E-08	3.04E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	1.52E-01
			Inorganics												
			Aluminum	3.08E+03	mg/kg	1.42E-04	mg/kg-day	NA	NA	NA	9.93E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	9.93E-03
			Antimony	4.22E+01	mg/kg	1.95E-06	mg/kg-day	NA	NA	NA	1.36E-04	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	3.41E-01
			Arsenic	3.36E+01	mg/kg	9.31E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	1.40E-06	6.52E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.17E-01
			Cadmium	4.50E-01	mg/kg	2.08E-08	mg/kg-day	NA	NA	NA	1.45E-06	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	1.45E-03
			Chromium VI	1.30E+00	mg/kg	6.00E-08	mg/kg-day	5.00E-01	(mg/kg-day)$^{-1}$	3.00E-08	4.20E-06	mg/kg-day	3.00E-03	(mg/kg-day)$^{-1}$	1.40E-03
			Cobalt	2.15E+00	mg/kg	9.89E-08	mg/kg-day	NA	NA	NA	6.93E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.31E-02
			Copper	7.98E+01	mg/kg	3.68E-06	mg/kg-day	NA	NA	NA	2.58E-04	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	6.44E-03
			Iron	1.85E+04	mg/kg	8.55E-04	mg/kg-day	NA	NA	NA	5.99E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	8.55E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.38E+01	mg/kg	3.41E-06	mg/kg-day	NA	NA	NA	2.38E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.70E-03
			Vanadium	2.03E+01	mg/kg	9.36E-07	mg/kg-day	NA	NA	NA	6.55E-05	mg/kg-day	5.00E-03	(mg/kg-day)$^{-1}$	1.31E-02
			Zinc	7.41E+01	mg/kg	3.42E-06	mg/kg-day	NA	NA	NA	2.39E-04	mg/kg-day	3.00E-01	(mg/kg-day)$^{-1}$	7.97E-04
		Exp. Route Total								1.58E-06					8.53E-01
Soil	Surface / Subsurface Soil	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.24E-01	mg/kg	2.23E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.63E-09	1.56E-07	mg/kg-day	NA	NA	NA
			Benzo(a)pyrene	1.08E-01	mg/kg	1.95E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	1.42E-08	1.37E-07	mg/kg-day	NA	NA	NA
			Benzo(b)fluoranthene	1.32E-01	mg/kg	2.37E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.73E-09	1.66E-07	mg/kg-day	NA	NA	NA
			Dibenzo(a,h)anthracene	5.80E-02	mg/kg	1.04E-09	mg/kg-day	7.30E+00	(mg/kg-day)$^{-1}$	7.62E-09	7.30E-08	mg/kg-day	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.78E-02	mg/kg	1.40E-09	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.02E-09	9.79E-08	mg/kg-day	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	9.42E-01	mg/kg	1.83E-08	mg/kg-day	2.00E+00	(mg/kg-day)$^{-1}$	3.65E-08	1.28E-06	mg/kg-day	2.00E-05	(mg/kg-day)$^{-1}$	6.39E-02
			Inorganics												
			Aluminum	3.08E+03	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.00E+00	(mg/kg-day)$^{-1}$	NA
			Antimony	4.22E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	6.00E-05	(mg/kg-day)$^{-1}$	NA
			Arsenic	3.36E+01	mg/kg	1.40E-07	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.09E-07	9.77E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	3.26E-02
			Cadmium	4.50E-01	mg/kg	6.23E-11	mg/kg-day	NA	NA	NA	4.36E-09	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	1.74E-04
			Chromium VI	1.30E+00	mg/kg	NA	NA	1.25E-02	(mg/kg-day)$^{-1}$	NA	NA	NA	7.50E-05	(mg/kg-day)$^{-1}$	NA
			Cobalt	2.15E+00	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-04	(mg/kg-day)$^{-1}$	NA
			Copper	7.98E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	4.00E-02	(mg/kg-day)$^{-1}$	NA
			Iron	1.85E+04	mg/kg	NA	NA	NA	NA	NA	NA	NA	7.00E-01	(mg/kg-day)$^{-1}$	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.38E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	1.40E-01	(mg/kg-day)$^{-1}$	NA
			Vanadium	2.03E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	5.00E-03	(mg/kg-day)$^{-1}$	NA
			Zinc	7.41E+01	mg/kg	NA	NA	NA	NA	NA	NA	NA	3.00E-01	(mg/kg-day)$^{-1}$	NA
		Exp. Route Total								2.72E-07					9.66E-02

TABLE B-7.16
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Construction/Utility Worker
Receptor Age:	Adult
Exposure Medium:	All Upland Areas - Surface/Subsurface Soil

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Soil	Surface / Subsurface Soil	Inhalation	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.24E-01	mg/kg	5.92E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	6.51E-14	4.14E-11	mg/m^3	NA	NA	NA
			Benzo(a)pyrene	1.08E-01	mg/kg	5.17E-10	µg/m^3	1.10E-03	(µg/m^3)$^{-1}$	5.69E-13	3.62E-11	mg/m^3	NA	NA	NA
			Benzo(b)fluoranthene	1.32E-01	mg/kg	6.28E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	6.90E-14	4.39E-11	mg/m^3	NA	NA	NA
			Dibenzo(a,h)anthracene	5.80E-02	mg/kg	2.77E-10	µg/m^3	1.20E-03	(µg/m^3)$^{-1}$	3.32E-13	1.94E-11	mg/m^3	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7.78E-02	mg/kg	3.71E-10	µg/m^3	1.10E-04	(µg/m^3)$^{-1}$	4.08E-14	2.60E-11	mg/m^3	NA	NA	NA
			PCBs/Pesticides												
			Aroclor 1254	9.42E-01	mg/kg	4.50E-09	µg/m^3	5.70E-04	(µg/m^3)$^{-1}$	2.56E-12	3.15E-10	mg/m^3	NA	NA	NA
			Inorganics												
			Aluminum	3.08E+03	mg/kg	1.47E-05	µg/m^3	NA	NA	NA	1.03E-06	mg/m^3	NA	NA	NA
			Antimony	4.22E+01	mg/kg	2.01E-07	µg/m^3	NA	NA	NA	1.41E-08	mg/m^3	2.00E-04	mg/m^3	7.05E-05
			Arsenic	3.36E+01	mg/kg	1.60E-07	µg/m^3	4.30E-03	(µg/m^3)$^{-1}$	6.90E-10	1.12E-08	mg/m^3	NA	NA	NA
			Cadmium	4.50E-01	mg/kg	2.15E-09	µg/m^3	1.80E-03	(µg/m^3)$^{-1}$	3.87E-12	1.50E-10	mg/m^3	NA	NA	NA
			Chromium VI	1.30E+00	mg/kg	6.21E-09	µg/m^3	1.20E-02	(µg/m^3)$^{-1}$	7.45E-11	4.35E-10	mg/m^3	3.00E-04	mg/m^3	1.45E-06
			Cobalt	2.15E+00	mg/kg	1.02E-08	µg/m^3	9.00E-03	(µg/m^3)$^{-1}$	9.21E-11	7.17E-10	mg/m^3	2.00E-05	mg/m^3	3.58E-05
			Copper	7.98E+01	mg/kg	3.81E-07	µg/m^3	NA	NA	NA	2.67E-08	mg/m^3	NA	NA	NA
			Iron	1.85E+04	mg/kg	8.85E-05	µg/m^3	NA	NA	NA	6.19E-06	mg/m^3	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	7.38E+01	mg/kg	3.52E-07	µg/m^3	NA	NA	NA	2.47E-08	mg/m^3	NA	NA	NA
			Vanadium	2.03E+01	mg/kg	9.69E-08	µg/m^3	8.00E-03	(µg/m^3)$^{-1}$	7.75E-10	6.78E-09	mg/m^3	1.00E-04	mg/m^3	6.78E-05
			Zinc	7.41E+01	mg/kg	3.54E-07	µg/m^3	NA	NA	NA	2.48E-08	mg/m^3	NA	NA	NA
		Exp. Route Total								1.64E-09					1.76E-04
	Exposure Point Total									1.85E-06					9.50E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/m^3 = microgram per cubic meter
mg/m^3 = milligram per cubic meter

TABLE B-7.16
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Construction/Utility Worker
Receptor Age:	Adult
Exposure Medium:	Groundwater (<10 feet bgs)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer Risk	Intake/ Exposure Concentration		RfD/RfC		Hazard Quotient
				Value	Unit	Value	Unit	Value	Unit		Value	Unit	Value	Unit	
Groundwater	Groundwater (<10 feet bgs)	Ingestion	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.70E-01	µg/L	4.75E-11	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	3.47E-11	3.33E-09	mg/kg-day	NA	NA	NA
			Dibenzofuran	1.10E+01	µg/L	3.08E-09	mg/kg-day	NA	NA	NA	2.15E-07	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	2.15E-04
			Naphthalene	1.60E+01	µg/L	4.47E-09	mg/kg-day	NA	NA	NA	3.13E-07	mg/kg-day	2.00E-02	(mg/kg-day)$^{-1}$	1.57E-05
			Inorganics												
			Aluminum	3.48E+04	µg/L	9.73E-06	mg/kg-day	NA	NA	NA	6.81E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	6.81E-04
			Antimony	2.10E+00	µg/L	5.87E-10	mg/kg-day	NA	NA	NA	4.11E-08	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.03E-04
			Arsenic	6.80E+00	µg/L	1.90E-09	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	2.85E-09	1.33E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.44E-04
			Cadmium	4.70E+00	µg/L	1.31E-09	mg/kg-day	NA	NA	NA	9.20E-08	mg/kg-day	5.00E-04	(mg/kg-day)$^{-1}$	1.84E-04
			Cobalt	4.01E+01	µg/L	1.12E-08	mg/kg-day	NA	NA	NA	7.85E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.62E-03
			Iron	3.72E+05	µg/L	1.04E-04	mg/kg-day	NA	NA	NA	7.28E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	1.04E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.84E+03	µg/L	5.14E-07	mg/kg-day	NA	NA	NA	3.60E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.57E-04
		Exp. Route Total								2.89E-09					1.49E-02
Groundwater	Groundwater (<10 feet bgs)	Dermal Contact	**Semi-volatile Organic Compounds**												
			Benzo(a)anthracene	1.70E-01	µg/L	2.55E-07	mg/kg-day	7.30E-01	(mg/kg-day)$^{-1}$	1.86E-07	3.13E-06	mg/kg-day	NA	NA	NA
			Dibenzofuran	1.10E+01	µg/L	3.42E-06	mg/kg-day	NA	NA	NA	4.20E-05	mg/kg-day	1.00E-03	(mg/kg-day)$^{-1}$	4.20E-02
			Naphthalene	1.60E+01	µg/L	2.38E-06	mg/kg-day	NA	NA	NA	2.92E-05	mg/kg-day	2.00E-02	(mg/kg-day)$^{-1}$	1.46E-03
			Inorganics												
			Aluminum	3.48E+04	µg/L	1.11E-04	mg/kg-day	NA	NA	NA	1.36E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.36E-03
			Antimony	2.10E+00	µg/L	6.69E-09	mg/kg-day	NA	NA	NA	8.22E-08	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	1.37E-03
			Arsenic	6.80E+00	µg/L	2.17E-08	mg/kg-day	1.50E+00	(mg/kg-day)$^{-1}$	3.25E-08	2.66E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	8.87E-04
			Cadmium	4.70E+00	µg/L	1.50E-08	mg/kg-day	NA	NA	NA	1.84E-07	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	7.36E-03
			Cobalt	4.01E+01	µg/L	5.11E-08	mg/kg-day	NA	NA	NA	6.28E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.09E-03
			Iron	3.72E+05	µg/L	1.19E-03	mg/kg-day	NA	NA	NA	1.46E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.08E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.84E+03	µg/L	5.86E-06	mg/kg-day	NA	NA	NA	7.20E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	5.14E-04
		Exp. Route Total								2.18E-07					7.78E-02
	Exposure Point Total									2.21E-07					9.27E-02

NA = not applicable
bgs = below ground surface
RfD = reference dose
RfC = reference concentration
mg/kg = milligram per kilogram
mg/kg-day = milligram per kilogram per day
µg/L = microgram per liter

TABLE B-7.17
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Medium:	Groundwater (All Wells)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer Risk
				Value	Unit	Value	Unit	Value	Unit	
Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**							
			Tetrachloroethene	1.96E+00	µg/L	2.91E-05	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	1.57E-05
			Inorganics							
			Aluminum	8.17E+03	µg/L	1.22E-01	mg/kg-day	NA	NA	NA
			Antimony	1.52E+00	µg/L	2.26E-05	mg/kg-day	NA	NA	NA
			Arsenic	2.76E+00	µg/L	4.10E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	6.15E-05
			Cadmium	1.90E+00	µg/L	2.82E-05	mg/kg-day	NA	NA	NA
			Cobalt	2.27E+01	µg/L	3.38E-04	mg/kg-day	NA	NA	NA
			Copper	8.09E+01	µg/L	1.20E-03	mg/kg-day	NA	NA	NA
			Iron	7.99E+04	µg/L	1.19E+00	mg/kg-day	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	1.95E-02	mg/kg-day	NA	NA	NA
		Exp. Route Total								7.72E-05
Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**							
			Tetrachloroethene	1.96E+00	µg/L	1.82E-05	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	9.82E-06
			Inorganics							
			Aluminum	8.17E+03	µg/L	2.30E-03	mg/kg-day	NA	NA	NA
			Antimony	1.52E+00	µg/L	4.28E-07	mg/kg-day	NA	NA	NA
			Arsenic	2.76E+00	µg/L	7.76E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.16E-06
			Cadmium	1.90E+00	µg/L	5.34E-07	mg/kg-day	NA	NA	NA
			Cobalt	2.27E+01	µg/L	2.56E-06	mg/kg-day	NA	NA	NA
			Copper	8.09E+01	µg/L	2.28E-05	mg/kg-day	NA	NA	NA
			Iron	7.99E+04	µg/L	2.25E-02	mg/kg-day	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	3.68E-04	mg/kg-day	NA	NA	NA
		Exp. Route Total								1.10E-05
Groundwater	Tap Water	Inhalation at Showerhead	**Volatile Organic Compounds**							
			Tetrachloroethene	1.96E+00	µg/L	4.50E-01	$\mu g/m^3$	5.90E-06	$(\mu g/m^3)^{-1}$	2.66E-06
			Inorganics							
			Aluminum	8.17E+03	µg/L	NA	NA	NA	NA	NA
			Antimony	1.52E+00	µg/L	NA	NA	NA	NA	NA
			Arsenic	2.76E+00	µg/L	NA	NA	4.30E-03	$(\mu g/m^3)^{-1}$	NA
			Cadmium	1.90E+00	µg/L	NA	NA	1.80E-03	$(\mu g/m^3)^{-1}$	NA
			Cobalt	2.27E+01	µg/L	NA	NA	9.00E-03	$(\mu g/m^3)^{-1}$	NA
			Copper	8.09E+01	µg/L	NA	NA	NA	NA	NA
			Iron	7.99E+04	µg/L	NA	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	NA	NA	NA	NA	NA
		Exp. Route Total								2.66E-06
	Exposure Point Total									9.09E-05

NA = not applicable

RfD = reference dose
RfC = reference concentration

$\mu g/m^3$ = microgram per cubic meter
mg/kg-day = milligram per kilogram per day
µg/L = microgram per liter

TABLE B-7.17
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Medium:	Groundwater (All Wells)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Noncancer Hazard Calculation (Adult)					Noncancer Hazard Calculation (Child)				
						Intake/ Exposure Concentration		RfD/RfC		Hazard	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Quotient	Value	Unit	Value	Unit	Quotient
Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
			Tetrachloroethene	1.96E+00	µg/L	5.36E-05	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	5.36E-03	1.25E-04	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	1.25E-02
			Inorganics												
			Aluminum	8.17E+03	µg/L	2.24E-01	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	2.24E-01	5.22E-01	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	5.22E-01
			Antimony	1.52E+00	µg/L	4.17E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	1.04E-01	9.72E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	2.43E-01
			Arsenic	2.76E+00	µg/L	7.55E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.52E-01	1.76E-04	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.87E-01
			Cadmium	1.90E+00	µg/L	5.20E-05	mg/kg-day	5.00E-04	(mg/kg-day)$^{-1}$	1.04E-01	1.21E-04	mg/kg-day	5.00E-04	(mg/kg-day)$^{-1}$	2.43E-01
			Cobalt	2.27E+01	µg/L	6.23E-04	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.08E+00	1.45E-03	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	4.84E+00
			Copper	8.09E+01	µg/L	2.22E-03	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	5.54E-02	5.17E-03	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.29E-01
			Iron	7.99E+04	µg/L	2.19E+00	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	3.13E+00	5.11E+00	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	7.30E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	3.58E-02	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.56E-01	8.36E-02	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	5.97E-01
		Exp. Route Total								6.20E+00					1.45E+01
Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**												
			Tetrachloroethene	1.96E+00	µg/L	3.98E-06	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	3.98E-04	1.23E-05	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	1.23E-03
			Inorganics												
			Aluminum	8.17E+03	µg/L	5.04E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	5.04E-04	1.55E-03	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.55E-03
			Antimony	1.52E+00	µg/L	9.38E-08	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	1.56E-03	2.89E-07	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	4.81E-03
			Arsenic	2.76E+00	µg/L	1.70E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.67E-04	5.23E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.74E-03
			Cadmium	1.90E+00	µg/L	1.17E-07	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	4.68E-03	3.60E-07	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	1.44E-02
			Cobalt	2.27E+01	µg/L	5.60E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.87E-03	1.73E-06	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.75E-03
			Copper	8.09E+01	µg/L	4.99E-06	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.25E-04	1.54E-05	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	3.84E-04
			Iron	7.99E+04	µg/L	4.92E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	7.04E-03	1.52E-02	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.17E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	8.06E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	5.76E-04	2.48E-04	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.77E-03
		Exp. Route Total								1.73E-02					5.33E-02
Groundwater	Tap Water	Inhalation at Showerhead	**Volatile Organic Compounds**												
			Tetrachloroethene	1.96E+00	µg/L	7.43E-04	mg/m^3	2.70E-01	mg/m^3	2.75E-03	5.70E-04	mg/m^3	2.70E-01	mg/m^3	2.11E-03
			Inorganics												
			Aluminum	8.17E+03	µg/L	NA	NA	5.00E-03	mg/m^3	NA	NA	NA	5.00E-03	mg/m^3	NA
			Antimony	1.52E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Arsenic	2.76E+00	µg/L	NA	NA	1.50E-05	mg/m^3	NA	NA	NA	1.50E-05	mg/m^3	NA
			Cadmium	1.90E+00	µg/L	NA	NA	1.00E-05	mg/m^3	NA	NA	NA	1.00E-05	mg/m^3	NA
			Cobalt	2.27E+01	µg/L	NA	NA	6.00E-06	mg/m^3	NA	NA	NA	6.00E-06	mg/m^3	NA
			Copper	8.09E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	7.99E+04	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	NA	NA	5.00E-05	mg/m^3	NA	NA	NA	5.00E-05	mg/m^3	NA
		Exp. Route Total								2.75E-03					2.11E-03
	Exposure Point Total									6.22E+00					1.45E+01

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day
mg/m^3 = milligram per cubic meter

TABLE B-8
CALCULATION OF RADIATION CANCER RISKS
REASONABLE MAXIMUM EXPOSURE

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	NA
Receptor Population:	NA
Receptor Age:	NA

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	Exposure Point Concentration		Risk Calculation Approach	Cancer Risk Calculation				
								Intake/Activity		Cancer Slope Factor		
					Value	Unit		Value	Unit	Value	Unit	Cancer Risk
			NOT APPLICABLE TO THIS SITE									
			Exp. Route Total									
		Exposure Point Total										
											Total of Receptor Risks Across All Media	

There are no radionucleotides in this risk assessment. As a result, this table is blank

TABLE B-9.1a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Area 1

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	6E-09	4E-09	1E-13	1E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	9E-08	6E-08	2E-12	1E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	8E-09	5E-09	2E-13	1E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	5E-08	3E-08	1E-12	9E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7E-09	4E-09	1E-13	1E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	1E-07	8E-08	5E-12	2E-07	Eyes/Fingernails/Immune System	2E-02	1E-02	NA	3E-02
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	1E-03	NA	3E-05	1E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	2E-06	5E-07	1E-09	3E-06	Skin/Developmental/Cardiovascular System/CNS	3E-02	7E-03	1E-04	3E-02
			Chromium VI	1E-07	NA	5E-10	1E-07	Lungs	6E-04	NA	2E-06	6E-04
			Cobalt	NA	NA	2E-10	2E-10	Thyroid Gland/Respiratory System	3E-03	NA	2E-05	3E-03
			Copper	NA	NA	NA	NA	GI Tract	9E-04	NA	NA	9E-04
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-04	NA	8E-05	3E-04
			Vanadium	NA	NA	2E-09	2E-09	Kidney/Respiratory System	2E-03	NA	2E-05	3E-03
			Chemical Total	3E-06	7E-07	4E-09	3E-06	Chemical Total	2E-01	2E-02	3E-04	2E-01
		Exposure Point Total					3E-06					2E-01
	Exposure Medium Total						3E-06					2E-01
Medium Total							3E-06					2E-01
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	5E-10	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	6E-10	4E-07	NA	4E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-04	2E-04	NA	3E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-03	2E-02	NA	3E-02
			Arsenic	8E-07	7E-07	NA	2E-06	Skin	1E-02	9E-03	NA	2E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	4E-03	2E-03	NA	6E-03
			Copper	NA	NA	NA	NA	GI Tract	2E-04	2E-04	NA	4E-04
			Iron	NA	NA	NA	NA	GI Tract	7E-04	7E-04	NA	1E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-04	2E-04	NA	3E-04
			Vanadium	NA	NA	NA	NA	Kidney	1E-03	1E-03	NA	3E-03
			Chemical Total	8E-07	1E-06	--	2E-06	Chemical Total	2E-02	4E-02	--	6E-02
		Exposure Point Total					2E-06					6E-02
	Exposure Medium Total						2E-06					6E-02
Medium Total							2E-06					6E-02

TABLE B-9.1a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Area 1

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	8E-10	2E-08	NA	2E-08	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	8E-05	NA	NA	8E-05
			Arsenic	9E-08	6E-07	NA	6E-07	Skin	1E-03	7E-03	NA	8E-03
			Chromium VI	2E-09	NA	NA	2E-09	NA	9E-06	NA	NA	9E-06
			Cobalt	NA	NA	NA	NA	Thyroid Gland	3E-04	NA	NA	3E-04
			Iron	NA	NA	NA	NA	GI Tract	7E-04	NA	NA	7E-04
			Manganese	NA	NA	NA	NA	CNS	2E-05	NA	NA	2E-05
			Vanadium	NA	NA	NA	NA	Kidney	2E-04	NA	NA	2E-04
			Chemical Total	9E-08	6E-07	--	7E-07	Chemical Total	2E-03	7E-03	--	1E-02
		Exposure Point Total					7E-07					1E-02
	Exposure Medium Total						7E-07					1E-02
Medium Total							7E-07					1E-02
Receptor Total							6E-06					3E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.3

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.1b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Area 1

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	9E-09	6E-09	1E-13	1E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	1E-07	8E-08	2E-12	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-08	7E-09	2E-13	2E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	7E-08	5E-08	1E-12	1E-07	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	9E-09	7E-09	1E-13	2E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	2E-07	1E-07	5E-12	3E-07	Eyes/Fingernails/Immune System	2E-02	2E-02	NA	4E-02
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	1E-03	NA	3E-05	1E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	3E-06	8E-07	1E-09	4E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	1E-02	1E-04	5E-02
			Chromium VI	2E-07	NA	5E-10	2E-07	Lungs	8E-04	NA	2E-06	8E-04
			Cobalt	NA	NA	2E-10	2E-10	Thyroid Gland/Respiratory System	4E-03	NA	2E-05	4E-03
			Copper	NA	NA	NA	NA	GI Tract	1E-03	NA	NA	1E-03
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	NA	8E-05	4E-04
			Vanadium	NA	NA	2E-09	2E-09	Kidney/Respiratory System	3E-03	NA	2E-05	3E-03
			Chemical Total	3E-06	1E-06	4E-09	4E-06	Chemical Total	2E-01	3E-02	3E-04	2E-01
		Exposure Point Total					4E-06					2E-01
	Exposure Medium Total						4E-06					2E-01
Medium Total							4E-06					2E-01
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	2E-09	3E-07	NA	3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2E-09	4E-07	NA	4E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	6E-04	2E-04	NA	7E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-02	2E-02	NA	4E-02
			Arsenic	3E-06	8E-07	NA	3E-06	Skin	3E-02	1E-02	NA	5E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	1E-02	2E-03	NA	2E-02
			Copper	NA	NA	NA	NA	GI Tract	6E-04	2E-04	NA	8E-04
			Iron	NA	NA	NA	NA	GI Tract	2E-03	7E-04	NA	3E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	6E-04	2E-04	NA	7E-04
			Vanadium	NA	NA	NA	NA	Kidney	5E-03	1E-03	NA	6E-03
			Chemical Total	3E-06	1E-06	--	4E-06	Chemical Total	7E-02	4E-02	--	1E-01
		Exposure Point Total					4E-06					1E-01
	Exposure Medium Total						4E-06					1E-01
Medium Total							4E-06					1E-01

TABLE B-9.1b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Area 1

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	8E-10	2E-08	NA	2E-08	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	8E-05	NA	NA	8E-05
			Arsenic	9E-08	6E-07	NA	6E-07	Skin	1E-03	7E-03	NA	8E-03
			Chromium VI	2E-09	NA	NA	2E-09	NA	9E-06	NA	NA	9E-06
			Cobalt	NA	NA	NA	NA	Thyroid Gland	3E-04	NA	NA	3E-04
			Iron	NA	NA	NA	NA	GI Tract	7E-04	NA	NA	7E-04
			Manganese	NA	NA	NA	NA	CNS	2E-05	NA	NA	2E-05
			Vanadium	NA	NA	NA	NA	Kidney	2E-04	NA	NA	2E-04
			Chemical Total	9E-08	6E-07	--	7E-07	Chemical Total	2E-03	7E-03	--	1E-02
		Exposure Point Total					7E-07					1E-02
	Exposure Medium Total						7E-07					1E-02
Medium Total							7E-07					1E-02
Receptor Total							9E-06					4E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.2a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	2E-08	3E-08	3E-13	4E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	1E-07	2E-07	4E-12	4E-07	Eyes/Fingernails/Immune System	9E-03	2E-02	NA	3E-02
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-02	NA	NA	4E-02
			Arsenic	4E-06	2E-06	2E-09	6E-06	Skin/Developmental/Cardiovascular System/CNS	2E-02	1E-02	9E-05	4E-02
			Chromium VI	4E-08	NA	1E-10	4E-08	Lungs	8E-05	NA	3E-07	8E-05
			Cobalt	NA	NA	2E-10	2E-10	Thyroid Gland/Respiratory System	2E-03	NA	1E-05	2E-03
			Copper	NA	NA	NA	NA	GI Tract	5E-04	NA	NA	5E-04
			Iron	NA	NA	NA	NA	GI Tract	1E-02	NA	NA	1E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	2E-09	2E-09	Kidney/Respiratory System	1E-03	NA	8E-06	1E-03
			Chemical Total	4E-06	2E-06	4E-09	6E-06	Chemical Total	9E-02	3E-02	1E-04	1E-01
		Exposure Point Total					6E-06					1E-01
	Exposure Medium Total						6E-06					1E-01
Medium Total							6E-06					1E-01
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	1E-09	5E-07	NA	5E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-09	8E-07	NA	8E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-04	2E-04	NA	3E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-03	2E-02	NA	3E-02
			Arsenic	2E-06	1E-06	NA	3E-06	Skin	1E-02	9E-03	NA	2E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	4E-03	2E-03	NA	6E-03
			Copper	NA	NA	NA	NA	GI Tract	2E-04	2E-04	NA	4E-04
			Iron	NA	NA	NA	NA	GI Tract	7E-04	7E-04	NA	1E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-04	2E-04	NA	3E-04
			Vanadium	NA	NA	NA	NA	Kidney	1E-03	1E-03	NA	3E-03
			Chemical Total	2E-06	3E-06	--	4E-06	Chemical Total	2E-02	4E-02	--	6E-02
		Exposure Point Total					4E-06					6E-02
	Exposure Medium Total						4E-06					6E-02
Medium Total							4E-06					6E-02
Sediment	Sediment	Sediment	**Inorganics**									
			Arsenic	1E-07	9E-07	NA	1E-06	Skin	9E-04	6E-03	NA	6E-03
			Chromium VI	1E-08	NA	NA	1E-08	NA	2E-05	NA	NA	2E-05
			Iron	NA	NA	NA	NA	GI Tract	5E-04	NA	NA	5E-04
			Chemical Total	2E-07	9E-07	--	1E-06	Chemical Total	1E-03	6E-03	--	7E-03
		Exposure Point Total					1E-06					7E-03
	Exposure Medium Total						1E-06					7E-03
Medium Total							1E-06					7E-03
Receptor Total							1E-05					2E-01

Total Excess Cancer Risk Across All Media: 1E-05

Total Hazard Index Across All Media: 0.2

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.2b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	4E-08	2E-08	7E-14	5E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	3E-07	1E-07	1E-12	4E-07	Eyes/Fingernails/Immune System	9E-02	4E-02	NA	1E-01
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-01	NA	NA	4E-01
			Arsenic	8E-06	1E-06	5E-10	1E-05	Skin/Developmental/Cardiovascular System/CNS	2E-01	4E-02	9E-05	3E-01
			Chromium VI	9E-08	NA	3E-11	9E-08	Lungs	7E-04	NA	3E-07	7E-04
			Cobalt	NA	NA	6E-11	6E-11	Thyroid Gland/Respiratory System	2E-02	NA	1E-05	2E-02
			Copper	NA	NA	NA	NA	GI Tract	5E-03	NA	NA	5E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-02	NA	NA	9E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	5E-10	5E-10	Kidney/Respiratory System	1E-02	NA	8E-06	1E-02
			Chemical Total	9E-06	2E-06	1E-09	1E-05	Chemical Total	8E-01	8E-02	1E-04	9E-01
		Exposure Point Total					1E-05					9E-01
	Exposure Medium Total						1E-05					9E-01
Medium Total							1E-05					9E-01
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-09	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-09	3E-07	NA	3E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-03	3E-04	NA	2E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-02	4E-02	NA	8E-02
			Arsenic	5E-06	6E-07	NA	5E-06	Skin	1E-01	2E-02	NA	1E-01
			Cobalt	NA	NA	NA	NA	Thyroid Gland	5E-02	3E-03	NA	5E-02
			Copper	NA	NA	NA	NA	GI Tract	2E-03	3E-04	NA	3E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-03	1E-03	NA	1E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-03	3E-04	NA	2E-03
			Vanadium	NA	NA	NA	NA	Kidney	2E-02	2E-03	NA	2E-02
			Chemical Total	5E-06	1E-06	--	6E-06	Chemical Total	3E-01	6E-02	--	3E-01
		Exposure Point Total					6E-06					3E-01
	Exposure Medium Total						6E-06					3E-01
Medium Total							6E-06					3E-01
Sediment	Sediment	Sediment	**Inorganics**									
			Arsenic	3E-07	4E-07	NA	7E-07	Skin	8E-03	1E-02	NA	2E-02
			Chromium VI	3E-08	NA	NA	3E-08	NA	2E-04	NA	NA	2E-04
			Iron	NA	NA	NA	NA	GI Tract	5E-03	NA	NA	5E-03
			Chemical Total	4E-07	4E-07	--	8E-07	Chemical Total	1E-02	1E-02	--	2E-02
		Exposure Point Total					8E-07					2E-02
	Exposure Medium Total						8E-07					2E-02
Medium Total							8E-07					2E-02
Receptor Total							2E-05					1E+00

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.2b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	4E-08	2E-08	7E-14	5E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	3E-07	1E-07	1E-12	4E-07	Eyes/Fingernails/Immune System	9E-02	4E-02	NA	1E-01
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-01	NA	NA	4E-01
			Arsenic	8E-06	1E-06	5E-10	1E-05	Skin/Developmental/Cardiovascular System/CNS	2E-01	4E-02	9E-05	3E-01
			Chromium VI	9E-08	NA	3E-11	9E-08	Lungs	7E-04	NA	3E-07	7E-04
			Cobalt	NA	NA	6E-11	6E-11	Thyroid Gland/Respiratory System	2E-02	NA	1E-05	2E-02
			Copper	NA	NA	NA	NA	GI Tract	5E-03	NA	NA	5E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-02	NA	NA	9E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	5E-10	5E-10	Kidney/Respiratory System	1E-02	NA	8E-06	1E-02
			Chemical Total	9E-06	2E-06	1E-09	1E-05	Chemical Total	8E-01	8E-02	1E-04	9E-01
		Exposure Point Total					1E-05					9E-01
	Exposure Medium Total						1E-05					9E-01
Medium Total							1E-05					9E-01
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-09	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-09	3E-07	NA	3E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-03	3E-04	NA	2E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-02	4E-02	NA	8E-02
			Arsenic	5E-06	6E-07	NA	5E-06	Skin	1E-01	2E-02	NA	1E-01
			Cobalt	NA	NA	NA	NA	Thyroid Gland	5E-02	3E-03	NA	5E-02
			Copper	NA	NA	NA	NA	GI Tract	2E-03	3E-04	NA	3E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-03	1E-03	NA	1E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-03	3E-04	NA	2E-03
			Vanadium	NA	NA	NA	NA	Kidney	2E-02	2E-03	NA	2E-02
			Chemical Total	5E-06	1E-06	--	6E-06	Chemical Total	3E-01	6E-02	--	3E-01
		Exposure Point Total					6E-06					3E-01
	Exposure Medium Total						6E-06					3E-01
Medium Total							6E-06					3E-01
Sediment	Sediment	Sediment	**Inorganics**									
			Arsenic	3E-07	4E-07	NA	7E-07	Skin	8E-03	1E-02	NA	2E-02
			Chromium VI	3E-08	NA	NA	3E-08	NA	2E-04	NA	NA	2E-04
			Iron	NA	NA	NA	NA	GI Tract	5E-03	NA	NA	5E-03
			Chemical Total	4E-07	4E-07	--	8E-07	Chemical Total	1E-02	1E-02	--	2E-02
		Exposure Point Total					8E-07					2E-02
	Exposure Medium Total						8E-07					2E-02
Medium Total							8E-07					2E-02
Receptor Total							2E-05					1E+00

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.3a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	2E-08	9E-09	7E-14	3E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2E-07	9E-08	7E-13	3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2E-08	9E-09	7E-14	3E-08	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	3E-03	NA	2E-05	3E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	7E-03	NA	NA	7E-03
			Arsenic	1E-06	3E-07	2E-10	2E-06	Skin/Developmental/Cardiovascular System/CNS	2E-02	4E-03	2E-05	2E-02
			Chromium VI	6E-08	NA	4E-11	6E-08	Lungs	2E-04	NA	2E-07	2E-04
			Cobalt	NA	NA	1E-10	1E-10	Thyroid Gland/Respiratory System	9E-03	NA	1E-05	9E-03
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Manganese	NA	NA	NA	NA	CNS	9E-04	NA	7E-05	1E-03
			Vanadium	NA	NA	5E-10	5E-10	Kidney/Respiratory System	3E-03	NA	4E-06	3E-03
			Zinc	NA	NA	NA	NA	Fetus	8E-04	NA	NA	8E-04
			Chemical Total	2E-06	4E-07	9E-10	2E-06	Chemical Total	6E-02	4E-03	1E-04	6E-02
		Exposure Point Total					2E-06					6E-02
	Exposure Medium Total						2E-06					6E-02
Medium Total							2E-06					6E-02
Receptor Total							2E-06					6E-02

Total Excess Cancer Risk Across All Media: 2E-06

Total Hazard Index Across All Media: 0.06

NA = not applicable GI - gastrointestina CNS = central nervous system

TABLE B-9.3b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-09	1E-09	2E-14	4E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	3E-08	1E-08	1E-13	4E-08	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	3E-09	1E-09	1E-14	4E-09	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	4E-04	NA	4E-06	5E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-03	NA	NA	1E-03
			Arsenic	2E-07	4E-08	4E-11	3E-07	Skin/Developmental/Cardiovascular System/CNS	3E-03	5E-04	4E-06	3E-03
			Chromium VI	9E-09	NA	8E-12	9E-09	Lungs	3E-05	NA	4E-08	3E-05
			Cobalt	NA	NA	2E-11	2E-11	Thyroid Gland/Respiratory System	1E-03	NA	3E-06	1E-03
			Iron	NA	NA	NA	NA	GI Tract	2E-03	NA	NA	2E-03
			Manganese	NA	NA	NA	NA	CNS	1E-04	NA	2E-05	2E-04
			Vanadium	NA	NA	1E-10	1E-10	Kidney/Respiratory System	4E-04	NA	9E-07	4E-04
			Zinc	NA	NA	NA	NA	Fetus	1E-04	NA	NA	1E-04
			Chemical Total	3E-07	5E-08	2E-10	3E-07	Chemical Total	9E-03	5E-04	3E-05	9E-03
		Exposure Point Total					3E-07					9E-03
	Exposure Medium Total						3E-07					9E-03
Medium Total							3E-07					9E-03
Receptor Total							3E-07					9E-03

Total Excess Cancer Risk Across All Media: 3E-07

Total Hazard Index Across All Media: 0.009

NA = not applicable GI - gastrointestina CNS = central nervous system

TABLE B-9.3c
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	8E-08	2E-08	3E-14	1E-07	NA	NA	NA	NA	NA
			Benzo(a)pyrene	8E-07	2E-07	3E-13	1E-06	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	8E-08	2E-08	3E-14	1E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	3E-02	NA	2E-05	3E-02
			Antimony	NA	NA	NA	NA	Longevity/Blood	7E-02	NA	NA	7E-02
			Arsenic	7E-06	5E-07	9E-11	7E-06	Skin/Developmental/Cardiovascular System/CNS	2E-01	1E-02	2E-05	2E-01
			Chromium VI	3E-07	NA	2E-11	3E-07	Lungs	2E-03	NA	2E-07	2E-03
			Cobalt	NA	NA	5E-11	5E-11	Thyroid Gland/Respiratory System	8E-02	NA	1E-05	8E-02
			Iron	NA	NA	NA	NA	GI Tract	1E-01	NA	NA	1E-01
			Manganese	NA	NA	NA	NA	CNS	9E-03	NA	7E-05	9E-03
			Vanadium	NA	NA	3E-10	3E-10	Kidney/Respiratory System	3E-02	NA	4E-06	3E-02
			Zinc	NA	NA	NA	NA	Fetus	7E-03	NA	NA	7E-03
			Chemical Total	8E-06	7E-07	4E-10	9E-06	Chemical Total	6E-01	1E-02	1E-04	6E-01
		Exposure Point Total					9E-06					6E-01
	Exposure Medium Total						9E-06					6E-01
Medium Total							9E-06					6E-01
Receptor Total							9E-06					6E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.6

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.4a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Areas 5, 6 and Beach Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	4E-08	6E-08	1E-12	1E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	6E-04	NA	2E-05	6E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	7E-03	NA	NA	7E-03
			Arsenic	8E-07	5E-07	6E-10	1E-06	Skin/Developmental/Cardiovascular System/CNS	5E-03	3E-03	3E-05	9E-03
			Chromium VI	4E-08	NA	2E-10	4E-08	Lungs	9E-05	NA	4E-07	9E-05
			Cobalt	NA	NA	4E-10	4E-10	Thyroid Gland/Respiratory System	3E-03	NA	2E-05	3E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-03	NA	NA	9E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	NA	1E-04	4E-04
			Vanadium	NA	NA	4E-09	4E-09	Kidney/Respiratory System	2E-03	NA	1E-05	2E-03
			Chemical Total	9E-07	6E-07	5E-09	2E-06	Chemical Total	3E-02	3E-03	2E-04	3E-02
		Exposure Point Total					2E-06					3E-02
	Exposure Medium Total						2E-06					3E-02
Medium Total							2E-06					3E-02
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	1E-09	5E-07	NA	5E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-09	8E-07	NA	8E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-04	2E-04	NA	3E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-03	2E-02	NA	3E-02
			Arsenic	2E-06	1E-06	NA	3E-06	Skin	1E-02	9E-03	NA	2E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	4E-03	2E-03	NA	6E-03
			Copper	NA	NA	NA	NA	GI Tract	2E-04	2E-04	NA	4E-04
			Iron	NA	NA	NA	NA	GI Tract	7E-04	7E-04	NA	1E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-04	2E-04	NA	3E-04
			Vanadium	NA	NA	NA	NA	Kidney	1E-03	1E-03	NA	3E-03
			Chemical Total	2E-06	3E-06	--	4E-06	Chemical Total	2E-02	4E-02	--	6E-02
		Exposure Point Total					4E-06					6E-02
	Exposure Medium Total						4E-06					6E-02
Medium Total							4E-06					6E-02

TABLE B-9.4a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Areas 5, 6 and Beach Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	2E-09	5E-08	NA	5E-08	NA	NA	NA	NA	NA
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-04	NA	NA	4E-04
			Arsenic	1E-07	7E-07	NA	8E-07	Skin	7E-04	5E-03	NA	5E-03
			Chromium VI	4E-09	NA	NA	4E-09	NA	7E-06	NA	NA	7E-06
			Cobalt	NA	NA	NA	NA	Thyroid Gland	2E-04	NA	NA	2E-04
			Iron	NA	NA	NA	NA	GI Tract	1E-03	NA	NA	1E-03
			Vanadium	NA	NA	NA	NA	Kidney	1E-04	NA	NA	1E-04
			Chemical Total	1E-07	8E-07	--	9E-07	Chemical Total	2E-03	5E-03	--	7E-03
		Exposure Point Total					9E-07					7E-03
	Exposure Medium Total						9E-07					7E-03
Medium Total							9E-07					7E-03
Receptor Total							7E-06					9E-02

Total Excess Cancer Risk Across All Media: 7E-06

Total Hazard Index Across All Media: 0.09

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.4b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Areas 5, 6 and Beach Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	9E-08	4E-08	2E-13	1E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	6E-03	NA	2E-05	6E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	6E-02	NA	NA	6E-02
			Arsenic	2E-06	3E-07	2E-10	2E-06	Skin/Developmental/Cardiovascular System/CNS	5E-02	8E-03	3E-05	6E-02
			Chromium VI	1E-07	NA	4E-11	1E-07	Lungs	8E-04	NA	4E-07	8E-04
			Cobalt	NA	NA	1E-10	1E-10	Thyroid Gland/Respiratory System	3E-02	NA	2E-05	3E-02
			Iron	NA	NA	NA	NA	GI Tract	8E-02	NA	NA	8E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-03	NA	1E-04	3E-03
			Vanadium	NA	NA	9E-10	9E-10	Kidney/Respiratory System	2E-02	NA	1E-05	2E-02
			Chemical Total	2E-06	4E-07	1E-09	3E-06	Chemical Total	2E-01	8E-03	2E-04	3E-01
		Exposure Point Total					3E-06					3E-01
	Exposure Medium Total						3E-06					3E-01
Medium Total							3E-06					3E-01
Suface Water	Surface Water	Surface Water	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-09	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-09	3E-07	NA	3E-07	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-03	2E-04	NA	2E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	4E-02	2E-02	NA	7E-02
			Arsenic	5E-06	6E-07	NA	5E-06	Skin	1E-01	9E-03	NA	1E-01
			Cobalt	NA	NA	NA	NA	Thyroid Gland	5E-02	2E-03	NA	5E-02
			Copper	NA	NA	NA	NA	GI Tract	2E-03	2E-04	NA	2E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-03	7E-04	NA	9E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-03	2E-04	NA	2E-03
			Vanadium	NA	NA	NA	NA	Kidney	2E-02	1E-03	NA	2E-02
			Chemical Total	5E-06	1E-06	--	6E-06	Chemical Total	3E-01	4E-02	--	3E-01
		Exposure Point Total					6E-06					3E-01
	Exposure Medium Total						6E-06					3E-01
Medium Total							6E-06					3E-01

TABLE B-9.4b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Areas 5, 6 and Beach Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	4E-09	2E-08	NA	3E-08	NA	NA	NA	NA	NA
			Inorganics									
			Antimony	NA	NA		NA	Longevity/Blood	3E-03	NA		3E-03
			Arsenic	3E-07	3E-07	NA	6E-07	Skin	7E-03	9E-03	NA	2E-02
			Chromium VI	9E-09	NA	NA	9E-09	NA	7E-05	NA	NA	7E-05
			Cobalt	NA	NA		NA	Thyroid Gland	2E-03	NA		2E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-03	NA	NA	9E-03
			Vanadium	NA	NA	NA	NA	Kidney	1E-03	NA	NA	1E-03
			Chemical Total	3E-07	4E-07	--	6E-07	Chemical Total	2E-02	9E-03	--	3E-02
		Exposure Point Total					6E-07					3E-02
	Exposure Medium Total						6E-07					3E-02
Medium Total							6E-07					3E-02
Receptor Total							9E-06					6E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.6

NA = not applicable GI - gastrointestina CNS = central nervous system

TABLE B-9.5a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Upland Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	9E-09	4E-09	4E-14	1E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	6E-08	3E-08	3E-13	1E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	8E-09	4E-09	4E-14	1E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	1E-08	8E-09	7E-14	2E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	4E-09	2E-09	2E-14	5E-09	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	4E-07	2E-07	3E-12	6E-07	Eyes/Fingernails/Immune System	6E-02	3E-02	NA	9E-02
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-03	NA	1E-05	2E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	9E-02	NA	NA	9E-02
			Arsenic	2E-06	4E-07	3E-10	3E-06	Skin/Developmental/Cardiovascular System/CNS	3E-02	5E-03	3E-05	3E-02
			Cadmium	NA	NA	2E-12	2E-12	Kidney	3E-04	4E-05	8E-07	3E-04
			Chromium VI	2E-08	NA	2E-11	2E-08	Lungs	1E-04	NA	9E-08	1E-04
			Cobalt	NA	NA	4E-11	4E-11	Thyroid Gland/Respiratory System	3E-03	NA	5E-06	3E-03
			Copper	NA	NA	NA	NA	GI Tract	9E-04	NA	NA	9E-04
			Iron	NA	NA	NA	NA	GI Tract	1E-02	NA	NA	1E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	NA	2E-05	3E-04
			Vanadium	NA	NA	4E-10	4E-10	Kidney/Respiratory System	2E-03	NA	3E-06	2E-03
			Chemical Total	3E-06	7E-07	8E-10	3E-06	Chemical Total	2E-01	4E-02	7E-05	2E-01
		Exposure Point Total					3E-06					2E-01
	Exposure Medium Total						3E-06					2E-01
Medium Total							3E-06					2E-01
Suface Water	Surface Water	Surface Water	**Volatile Organic Compounds**									
			Chloroform	2E-11	4E-10	NA	5E-10	Liver	4E-07	8E-06	NA	9E-06
			Semi-volatile Organic Compounds									
			Benzo(a)anthracene	5E-11	8E-08	NA	8E-08	NA	NA	NA	NA	NA
			Pentachlorophenol	3E-10	4E-07	NA	4E-07	Liver	8E-07	1E-03	NA	1E-03
			Inorganics									
			Arsenic	4E-09	1E-08	NA	2E-08	Skin	5E-05	2E-04	NA	2E-04
			Iron	NA	NA	NA	NA	GI Tract	9E-05	3E-04	NA	4E-04
			Manganese	NA	NA	NA	NA	CNS	2E-05	8E-05	NA	1E-04
			Chemical Total	5E-09	5E-07	--	5E-07	Chemical Total	2E-04	2E-03	--	2E-03
		Exposure Point Total					5E-07					2E-03
	Exposure Medium Total						5E-07					2E-03
Medium Total							5E-07					2E-03

TABLE B-9.5a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Upland Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	6E-09	2E-08	NA	2E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	5E-08	1E-07	NA	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-08	4E-08	NA	5E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	1E-08	3E-08	NA	5E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	1E-08	3E-08	NA	4E-08	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	3E-03	NA	NA	3E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-02	NA	NA	1E-02
			Arsenic	2E-06	1E-06	NA	3E-06	Skin	3E-02	2E-02	NA	4E-02
			Chromium VI	4E-08	NA	NA	4E-08	NA	2E-04	NA	NA	2E-04
			Cobalt	NA	NA	NA	NA	Thyroid Gland	7E-03	NA	NA	7E-03
			Copper	NA	NA	NA	NA	GI Tract	3E-03	NA	NA	3E-03
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	NA	NA	3E-04
			Mercury	NA	NA	NA	NA	Immune System	5E-04	NA	NA	5E-04
			Vanadium	NA	NA	NA	NA	Kidney	4E-03	NA	NA	4E-03
			Chemical Total	2E-06	2E-06	--	4E-06	Chemical Total	7E-02	2E-02	--	9E-02
		Exposure Point Total					4E-06					9E-02
	Exposure Medium Total						4E-06					9E-02
Medium Total							4E-06					9E-02
Receptor Total							7E-06					3E-01

Total Excess Cancer Risk Across All Media: 7E-06

Total Hazard Index Across All Media: 0.3

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.5b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Upland Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	1E-08	5E-09	4E-14	2E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	9E-08	4E-08	3E-13	1E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-08	5E-09	4E-14	2E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	2E-08	9E-09	7E-14	3E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	5E-09	2E-09	2E-14	7E-09	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	5E-07	3E-07	3E-12	8E-07	Eyes/Fingernails/Immune System	8E-02	4E-02	NA	1E-01
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-03	NA	1E-05	2E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	3E-06	5E-07	3E-10	3E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	6E-03	3E-05	4E-02
			Cadmium	NA	NA	2E-12	2E-12	Kidney	4E-04	5E-05	8E-07	4E-04
			Chromium VI	3E-08	NA	2E-11	3E-08	Lungs	1E-04	NA	9E-08	1E-04
			Cobalt	NA	NA	4E-11	4E-11	Thyroid Gland/Respiratory System	4E-03	NA	5E-06	4E-03
			Copper	NA	NA	NA	NA	GI Tract	1E-03	NA	NA	1E-03
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	4E-04	NA	2E-05	4E-04
			Vanadium	NA	NA	4E-10	4E-10	Kidney/Respiratory System	3E-03	NA	3E-06	3E-03
			Chemical Total	3E-06	8E-07	8E-10	4E-06	Chemical Total	3E-01	4E-02	7E-05	3E-01
		Exposure Point Total					4E-06					3E-01
	Exposure Medium Total						4E-06					3E-01
Medium Total							4E-06					3E-01
Suface Water	Surface Water	Surface Water	**Volatile Organic Compounds**									
			Chloroform	6E-11	5E-10	NA	6E-10	Liver	1E-06	1E-05	NA	1E-05
			Semi-volatile Organic Compounds									
			Benzo(a)anthracene	2E-10	1E-07	NA	1E-07	NA	NA	NA	NA	NA
			Pentachlorophenol	9E-10	4E-07	NA	4E-07	Liver	3E-06	1E-03	NA	1E-03
			Inorganics									
			Arsenic	1E-08	2E-08	NA	3E-08	Skin	2E-04	2E-04	NA	4E-04
			Iron	NA	NA	NA	NA	GI Tract	3E-04	4E-04	NA	7E-04
			Manganese	NA	NA	NA	NA	CNS	7E-05	9E-05	NA	2E-04
			Chemical Total	2E-08	6E-07	--	6E-07	Chemical Total	6E-04	2E-03	--	3E-03
		Exposure Point Total					6E-07					3E-03
	Exposure Medium Total						6E-07					3E-03
Medium Total							6E-07					3E-03

TABLE B-9.5b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Upland Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	8E-09	2E-08	NA	3E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	7E-08	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	2E-08	4E-08	NA	6E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	2E-08	4E-08	NA	6E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2E-08	4E-08	NA	5E-08	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	4E-03	NA	NA	4E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-02	NA	NA	1E-02
			Arsenic	3E-06	1E-06	NA	4E-06	Skin	3E-02	2E-02	NA	5E-02
			Chromium VI	5E-08	NA	NA	5E-08	NA	2E-04	NA	NA	2E-04
			Cobalt	NA	NA	NA	NA	Thyroid Gland	1E-02	NA	NA	1E-02
			Copper	NA	NA	NA	NA	GI Tract	4E-03	NA	NA	4E-03
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	4E-04	NA	NA	4E-04
			Mercury	NA	NA	NA	NA	Immune System	6E-04	NA	NA	6E-04
			Vanadium	NA	NA	NA	NA	Kidney	5E-03	NA	NA	5E-03
			Chemical Total	3E-06	2E-06	--	5E-06	Chemical Total	1E-01	2E-02	--	1E-01
		Exposure Point Total					5E-06					1E-01
	Exposure Medium Total						5E-06					1E-01
Medium Total							5E-06					1E-01
Receptor Total							9E-06					4E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable GI - gastrointestina CNS = central nervous system

TABLE B-9.6a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 2, 8, and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-08	1E-08	4E-13	4E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2E-07	1E-07	3E-12	3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	3E-08	1E-08	4E-13	4E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	1E-07	7E-08	2E-12	2E-07	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2E-08	9E-09	2E-13	3E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	8E-07	5E-07	2E-11	1E-06	Eyes/Fingernails/Immune System	1E-01	7E-02	NA	2E-01
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	3E-03	NA	6E-05	4E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	3E-06	6E-07	1E-09	4E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	8E-03	1E-04	5E-02
			Cadmium	NA	NA	2E-11	2E-11	Kidney	6E-04	9E-05	5E-06	7E-04
			Chromium VI	1E-07	NA	3E-10	1E-07	Lungs	5E-04	NA	1E-06	5E-04
			Cobalt	NA	NA	4E-10	4E-10	Thyroid Gland/Respiratory System	1E-02	NA	5E-05	1E-02
			Copper	NA	NA	NA	NA	GI Tract	1E-03	NA	NA	1E-03
			Iron	NA	NA	NA	NA	GI Tract	4E-02	NA	NA	4E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	8E-04	NA	2E-04	1E-03
			Vanadium	NA	NA	4E-09	4E-09	Kidney/Respiratory System	6E-03	NA	3E-05	6E-03
			Zinc	NA	NA	NA	NA	Fetus	3E-04	NA	NA	3E-04
			Chemical Total	5E-06	1E-06	6E-09	6E-06	Chemical Total	3E-01	7E-02	5E-04	4E-01
		Exposure Point Total					6E-06					4E-01
	Exposure Medium Total						6E-06					4E-01
Medium Total							6E-06					4E-01
Receptor Total							6E-06					4E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable GI - gastrointestina CNS = central nervous system

TABLE B-9.6b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	All Areas (except Areas 2, 8, and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-08	2E-08	4E-13	5E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	3E-07	1E-07	3E-12	4E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	3E-08	2E-08	4E-13	5E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	2E-07	9E-08	2E-12	3E-07	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2E-08	1E-08	2E-13	3E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	1E-06	5E-07	2E-11	2E-06	Eyes/Fingernails/Immune System	2E-01	8E-02	NA	2E-01
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	5E-03	NA	6E-05	5E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	2E-01	NA	NA	2E-01
			Arsenic	4E-06	7E-07	1E-09	5E-06	Skin/Developmental/Cardiovascular System/CNS	5E-02	1E-02	1E-04	6E-02
			Cadmium	NA	NA	2E-11	2E-11	Kidney	8E-04	1E-04	5E-06	9E-04
			Chromium VI	2E-07	NA	3E-10	2E-07	Lungs	6E-04	NA	1E-06	6E-04
			Cobalt	NA	NA	4E-10	4E-10	Thyroid Gland/Respiratory System	1E-02	NA	5E-05	1E-02
			Copper	NA	NA	NA	NA	GI Tract	2E-03	NA	NA	2E-03
			Iron	NA	NA	NA	NA	GI Tract	5E-02	NA	NA	5E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	1E-03	NA	2E-04	1E-03
			Vanadium	NA	NA	4E-09	4E-09	Kidney/Respiratory System	8E-03	NA	3E-05	8E-03
			Zinc	NA	NA	NA	NA	Fetus	4E-04	NA	NA	4E-04
			Chemical Total	6E-06	2E-06	6E-09	8E-06	Chemical Total	4E-01	9E-02	5E-04	5E-01
		Exposure Point Total					8E-06					5E-01
	Exposure Medium Total						8E-06					5E-01
Medium Total							8E-06					5E-01
Receptor Total							8E-06					5E-01

Total Excess Cancer Risk Across All Media: 8E-06

Total Hazard Index Across All Media: 0.5

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.7a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 8 and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-08	1E-08	4E-13	4E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	2E-07	1E-07	3E-12	3E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	3E-08	1E-08	4E-13	4E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	1E-07	7E-08	2E-12	2E-07	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2E-08	9E-09	2E-13	3E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	8E-07	4E-07	2E-11	1E-06	Eyes/Fingernails/Immune System	1E-01	6E-02	NA	2E-01
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	3E-03	NA	6E-05	3E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	3E-06	7E-07	1E-09	4E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	8E-03	1E-04	5E-02
			Cadmium	NA	NA	2E-11	2E-11	Kidney	6E-04	9E-05	5E-06	6E-04
			Chromium VI	1E-07	NA	2E-10	1E-07	Lungs	4E-04	NA	1E-06	4E-04
			Cobalt	NA	NA	4E-10	4E-10	Thyroid Gland/Respiratory System	1E-02	NA	4E-05	1E-02
			Copper	NA	NA	NA	NA	GI Tract	1E-03	NA	NA	1E-03
			Iron	NA	NA	NA	NA	GI Tract	4E-02	NA	NA	4E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	8E-04	NA	2E-04	1E-03
			Vanadium	NA	NA	4E-09	4E-09	Kidney/Respiratory System	6E-03	NA	3E-05	6E-03
			Zinc	NA	NA	NA	NA	Fetus	3E-04	NA	NA	3E-04
			Chemical Total	5E-06	1E-06	6E-09	6E-06	Chemical Total	3E-01	7E-02	5E-04	4E-01
		Exposure Point Total					6E-06					4E-01
	Exposure Medium Total						6E-06					4E-01
Medium Total							6E-06					4E-01
Receptor Total							6E-06					4E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable GI - gastrointestina CNS = central nervous system

TABLE B-9.7b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	All Areas (except Areas 8 and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-08	2E-08	4E-13	5E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	3E-07	1E-07	3E-12	4E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	3E-08	2E-08	4E-13	5E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	2E-07	8E-08	2E-12	3E-07	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	2E-08	1E-08	2E-13	3E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	1E-06	5E-07	2E-11	2E-06	Eyes/Fingernails/Immune System	1E-01	7E-02	NA	2E-01
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	4E-03	NA	6E-05	4E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	4E-06	8E-07	1E-09	5E-06	Skin/Developmental/Cardiovascular System/CNS	6E-02	1E-02	1E-04	7E-02
			Cadmium	NA	NA	2E-11	2E-11	Kidney	7E-04	1E-04	5E-06	8E-04
			Chromium VI	1E-07	NA	2E-10	1E-07	Lungs	6E-04	NA	1E-06	6E-04
			Cobalt	NA	NA	4E-10	4E-10	Thyroid Gland/Respiratory System	1E-02	NA	4E-05	1E-02
			Copper	NA	NA	NA	NA	GI Tract	2E-03	NA	NA	2E-03
			Iron	NA	NA	NA	NA	GI Tract	5E-02	NA	NA	5E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	1E-03	NA	2E-04	1E-03
			Vanadium	NA	NA	4E-09	4E-09	Kidney/Respiratory System	8E-03	NA	3E-05	8E-03
			Zinc	NA	NA	NA	NA	Fetus	4E-04	NA	NA	4E-04
			Chemical Total	6E-06	2E-06	6E-09	8E-06	Chemical Total	4E-01	8E-02	5E-04	5E-01
		Exposure Point Total					8E-06					5E-01
	Exposure Medium Total						8E-06					5E-01
Medium Total							8E-06					5E-01
Receptor Total							8E-06					5E-01

Total Excess Cancer Risk Across All Media: 8E-06

Total Hazard Index Across All Media: 0.5

NA = not applicable GI - gastrointestinal CNS = central nervous system

TABLE B-9.8a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	6E-05	NA	NA	6E-05	Skin	4E-01	NA	NA	4E-01
			Mercury	NA	NA	NA	NA	Immune System	1E-01	NA	NA	1E-01
			Chemical Total	6E-05	--	--	6E-05	Chemical Total	5E-01	--	--	5E-01
		Exposure Point Total					6E-05					5E-01
	Exposure Medium Total						6E-05					5E-01
Medium Total							6E-05					5E-01
Receptor Total							6E-05					5E-01

Total Excess Cancer Risk Across All Media: 6E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

TABLE B-9.8b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	2E-05	NA	NA	2E-05	Skin	6E-01	NA	NA	6E-01
			Mercury	NA	NA	NA	NA	Immune System	2E-01	NA	NA	2E-01
			Chemical Total	2E-05	--	--	2E-05	Chemical Total	8E-01	--	--	8E-01
		Exposure Point Total					2E-05					8E-01
	Exposure Medium Total						2E-05					8E-01
Medium Total							2E-05					8E-01
Receptor Total							2E-05					8E-01

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

Skin HI Across All Media = 1

TABLE B-9.9a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	2E-04	NA	NA	2E-04	Skin	1E+00	NA	NA	1E+00
			Cadmium	NA	NA	NA	NA	Kidney	4E-02	NA	NA	4E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	1E-01	NA	NA	1E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	6E-02	NA	NA	6E-02
			Chemical Total	2E-04	--	--	2E-04	Chemical Total	1E+00	--	--	1E+00
		Exposure Point Total					2E-04					1E+00
	Exposure Medium Total						2E-04					1E+00
Medium Total							2E-04					1E+00
Receptor Total							2E-04					1E+00

Total Excess Cancer Risk Across All Media: 2E-04

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

TABLE B-9.9b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	7E-05	NA	NA	7E-05	Skin	2E+00	NA	NA	2E+00
			Cadmium	NA	NA	NA	NA	Kidney	6E-02	NA	NA	6E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	2E-01	NA	NA	2E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	9E-02	NA	NA	9E-02
			Chemical Total	7E-05	--	--	7E-05	Chemical Total	2E+00	--	--	2E+00
		Exposure Point Total					7E-05					2E+00
	Exposure Medium Total						7E-05					2E+00
Medium Total							7E-05					2E+00
Receptor Total							7E-05					2E+00

Total Excess Cancer Risk Across All Media: 7E-05

Total Hazard Index Across All Media: 2

NA = not applicable

CNS = central nervous system

Skin HI Across All Media = 2

TABLE B-9.10a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Ribbed Mussel	Ribbed Mussel	Ribbed Mussel	**Inorganics**									
			Arsenic	1E-04	NA	NA	1E-04	Skin	7E-01	NA	NA	7E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	1E-04	--	--	1E-04	Chemical Total	7E-01	--	--	7E-01
		Exposure Point Total					1E-04					7E-01
	Exposure Medium Total						1E-04					7E-01
Medium Total							1E-04					7E-01
Receptor Total							1E-04					7E-01

Total Excess Cancer Risk Across All Media: 1E-04

Total Hazard Index Across All Media: 0.7

NA = not applicable CNS = central nervous system

TABLE B-9.10b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Ribbed Mussel	Ribbed Mussel	Ribbed Mussel	**Inorganics**									
			Arsenic	4E-05	NA	NA	4E-05	Skin	1E+00	NA	NA	1E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	4E-05	--	--	4E-05	Chemical Total	1E+00	--	--	1E+00
		Exposure Point Total					4E-05					1E+00
	Exposure Medium Total						4E-05					1E+00
Medium Total							4E-05					1E+00
Receptor Total							4E-05					1E+00

Total Excess Cancer Risk Across All Media: 4E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

TABLE B-9.11a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab Muscle	Blue Crab Muscle	Blue Crab Muscle	**Inorganics**									
			Arsenic	3E-05	NA	NA	3E-05	Skin	2E-01	NA	NA	2E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	3E-05	--	--	3E-05	Chemical Total	2E-01	--	--	2E-01
		Exposure Point Total					3E-05					2E-01
	Exposure Medium Total						3E-05					2E-01
Medium Total							3E-05					2E-01
Receptor Total							3E-05					2E-01

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 0.2

NA = not applicable

CNS = central nervous system

TABLE B-9.11b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab Muscle	Blue Crab Muscle	Blue Crab Muscle	**Inorganics**									
			Arsenic	1E-05	NA	NA	1E-05	Skin	3E-01	NA	NA	3E-01
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	1E-05	--	--	1E-05	Chemical Total	3E-01	--	--	3E-01
		Exposure Point Total					1E-05					3E-01
	Exposure Medium Total						1E-05					3E-01
Medium Total							1E-05					3E-01
Receptor Total							1E-05					3E-01

Total Excess Cancer Risk Across All Media: 1E-05

Total Hazard Index Across All Media: 0.3

NA = not applicable

CNS = central nervous system

TABLE B-9.12a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab (Muscle and Hepatopancreas)	Blue Crab (Muscle and Hepatopancreas)	Blue Crab (Muscle and Hepatopancreas)	**Inorganics**									
			Arsenic	4E-05	NA	NA	4E-05	Skin	3E-01	NA	NA	3E-01
			Cadmium	NA	NA	NA	NA	Kidney	4E-02	NA	NA	4E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	3E-01	NA	NA	3E-01
			Copper	NA	NA	NA	NA	GI Tract	5E-02	NA	NA	5E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	4E-05	--	--	4E-05	Chemical Total	6E-01	--	--	6E-01
		Exposure Point Total					4E-05					6E-01
	Exposure Medium Total						4E-05					6E-01
Medium Total							4E-05					6E-01
Receptor Total							4E-05					6E-01

Total Excess Cancer Risk Across All Media: 4E-05

Total Hazard Index Across All Media: 0.6

NA = not applicable GI = gastrointestinal CNS = central nervous system

TABLE B-9.12b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab (Muscle plus Hepatopancreas)	Blue Crab (Muscle plus Hepatopancreas)	Blue Crab (Muscle plus Hepatopancreas)	**Inorganics**									
			Arsenic	2E-05	NA	NA	2E-05	Skin	4E-01	NA	NA	4E-01
			Cadmium	NA	NA	NA	NA	Kidney	6E-02	NA	NA	6E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	4E-01	NA	NA	4E-01
			Copper	NA	NA	NA	NA	GI Tract	7E-02	NA	NA	7E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Chemical Total	2E-05	--	--	2E-05	Chemical Total	1E+00	--	--	1E+00
		Exposure Point Total					2E-05					1E+00
	Exposure Medium Total						2E-05					1E+00
Medium Total							2E-05					1E+00
Receptor Total							2E-05					1E+00

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

TABLE B-9.13a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	4E-09	2E-09	7E-14	6E-09	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	3E-08	2E-08	1E-12	5E-08	Eyes/Fingernails/Immune System	5E-03	3E-03	NA	8E-03
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood	2E-02	NA	NA	2E-02
			Arsenic	9E-07	2E-07	5E-10	1E-06	Skin/Developmental/Cardiovascular System/CNS	1E-02	2E-03	3E-04	1E-02
			Chromium VI	1E-08	NA	3E-11	1E-08	NA	4E-05	NA	NA	4E-05
			Cobalt	NA	NA	6E-11	6E-11	Thyroid Gland	1E-03	NA	NA	1E-03
			Copper	NA	NA	NA	NA	GI Tract/Respiratory System	3E-04	NA	1E-06	3E-04
			Iron	NA	NA	NA	NA	GI Tract	5E-03	NA	NA	5E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	6E-10	6E-10	Kidney/Respiratory System/Eyes	7E-04	NA	1E-06	7E-04
			Chemical Total	1E-06	2E-07	1E-09	1E-06	Chemical Total	5E-02	5E-03	3E-04	5E-02
		Exposure Point Total					1E-06					5E-02
	Exposure Medium Total						1E-06					5E-02
Medium Total							1E-06					5E-02
Receptor Total							1E-06					5E-02

Total Excess Cancer Risk Across All Media: 1E-06

Total Hazard Index Across All Media: 0.05

NA = not applicable GI = gastrointestinal CNS = central nervous system

TABLE B-9.13b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	5E-09	2E-09	7E-14	8E-09	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	4E-08	2E-08	1E-12	7E-08	Eyes/Fingernails/Immune System	6E-03	3E-03	NA	1E-02
			Inorganics									
			Antimony	NA	NA	NA	NA	Longevity/Blood	3E-02	NA	NA	3E-02
			Arsenic	1E-06	2E-07	5E-10	1E-06	Skin/Developmental/Cardiovascular System/CNS	2E-02	3E-03	3E-04	2E-02
			Chromium VI	1E-08	NA	3E-11	1E-08	NA	5E-05	NA	NA	5E-05
			Cobalt	NA	NA	6E-11	6E-11	Thyroid Gland	2E-03	NA	NA	2E-03
			Copper	NA	NA	NA	NA	GI Tract/Respiratory System	4E-04	NA	1E-06	4E-04
			Iron	NA	NA	NA	NA	GI Tract	7E-03	NA	NA	7E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Vanadium	NA	NA	6E-10	6E-10	Kidney/Respiratory System/Eyes	9E-04	NA	1E-06	9E-04
			Chemical Total	1E-06	2E-07	1E-09	2E-06	Chemical Total	6E-02	6E-03	3E-04	7E-02
		Exposure Point Total					2E-06					7E-02
	Exposure Medium Total						2E-06					7E-02
Medium Total							2E-06					7E-02
Receptor Total							2E-06					7E-02

Total Excess Cancer Risk Across All Media: 2E-06

Total Hazard Index Across All Media: 0.07

NA = not applicable GI = gastrointestina CNS = central nervous system

TABLE B-9.14a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Area:	Areas 8 and 11

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	1E-08	5E-09	1E-13	2E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	8E-08	4E-08	1E-12	1E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-08	5E-09	1E-13	2E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	2E-08	1E-08	2E-13	3E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	5E-09	3E-09	6E-14	8E-09	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	2E-08	9E-09	4E-13	2E-08	Eyes/Fingernails/Immune System	2E-03	1E-03	NA	4E-03
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	7E-04	NA	NA	7E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	5E-06	1E-06	2E-09	6E-06	Skin/Developmental/Cardiovascular System/CNS	6E-02	1E-02	1E-03	8E-02
			Cadmium	NA	NA	7E-12	7E-12	Kidney/Respiratory System	3E-04	4E-05	6E-05	4E-04
			Chromium VI	1E-08	NA	2E-11	1E-08	NA	4E-05	NA	NA	4E-05
			Cobalt	NA	NA	1E-10	1E-10	Thyroid Gland	3E-03	NA	NA	3E-03
			Copper	NA	NA	NA	NA	GI Tract/Respiratory System	1E-03	NA	4E-06	1E-03
			Iron	NA	NA	NA	NA	GI Tract	8E-03	NA	NA	8E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	NA	1E-03	2E-03
			Nickel	NA	NA	4E-11	4E-11	Body Weight/Organ Weight/Respiratory System/Immune System	6E-04	NA	1E-05	6E-04
			Vanadium	NA	NA	6E-10	6E-10	Kidney/Respiratory System/Eyes	1E-03	NA	1E-06	1E-03
			Zinc	NA	NA	NA	NA	Fetus	2E-04	NA	NA	2E-04
			Chemical Total	5E-06	1E-06	3E-09	6E-06	Chemical Total	2E-01	1E-02	3E-03	2E-01
		Exposure Point Total					6E-06					2E-01
	Exposure Medium Total						6E-06					2E-01
Medium Total							6E-06					2E-01
Receptor Total							6E-06					2E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.2

NA = not applicable GI = gastrointestinal CNS = central nervous system

TABLE B-9.14b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Areas 8 and 11

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	1E-08	6E-09	1E-13	2E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	1E-07	5E-08	1E-12	2E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	1E-08	6E-09	1E-13	2E-08	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	3E-08	1E-08	2E-13	4E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	7E-09	3E-09	6E-14	1E-08	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	2E-08	1E-08	4E-13	3E-08	Eyes/Fingernails/Immune System	3E-03	1E-03	NA	4E-03
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	9E-04	NA	NA	9E-04
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-01	NA	NA	1E-01
			Arsenic	6E-06	1E-06	2E-09	8E-06	Skin/Developmental/Cardiovascular System/CNS	8E-02	1E-02	1E-03	1E-01
			Cadmium	NA	NA	7E-12	7E-12	Kidney/Respiratory System	4E-04	5E-05	6E-05	5E-04
			Chromium VI	2E-08	NA	2E-11	2E-08	NA	6E-05	NA	NA	6E-05
			Cobalt	NA	NA	1E-10	1E-10	Thyroid Gland	4E-03	NA	NA	4E-03
			Copper	NA	NA	NA	NA	GI Tract/Respiratory System	2E-03	NA	4E-06	2E-03
			Iron	NA	NA	NA	NA	GI Tract	1E-02	NA	NA	1E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	NA	1E-03	2E-03
			Nickel	NA	NA	4E-11	4E-11	Body Weight/Organ Weight/Respiratory System/Immune System	7E-04	NA	1E-05	7E-04
			Vanadium	NA	NA	6E-10	6E-10	Kidney/Respiratory System/Eyes	1E-03	NA	1E-06	1E-03
			Zinc	NA	NA	NA	NA	Fetus	2E-04	NA	NA	2E-04
			Chemical Total	7E-06	1E-06	3E-09	8E-06	Chemical Total	2E-01	2E-02	3E-03	3E-01
		Exposure Point Total					8E-06					3E-01
	Exposure Medium Total						8E-06					3E-01
Medium Total							8E-06					3E-01
Receptor Total							8E-06					3E-01

Total Excess Cancer Risk Across All Media: 8E-06

Total Hazard Index Across All Media: 0.3

NA = not applicable GI = gastrointestinal CNS = central nervous system

TABLE B-9.15
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker
Receptor Age:	Adult
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	5E-08	4E-08	7E-13	8E-08	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4E-07	4E-07	7E-12	8E-07	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-08	4E-08	7E-13	8E-08	NA	NA	NA	NA	NA
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	4E-03	NA	8E-05	4E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	9E-03	NA	NA	9E-03
			Arsenic	4E-06	1E-06	2E-09	5E-06	Skin	2E-02	8E-03	8E-05	3E-02
			Chromium VI	2E-07	NA	4E-10	2E-07	Respiratory System	3E-04	NA	9E-07	3E-04
			Cobalt	NA	NA	1E-09	1E-09	Thyroid Gland/Respiratory System	1E-02	NA	6E-05	1E-02
			Iron	NA	NA	NA	NA	GI Tract	2E-02	NA	NA	2E-02
			Manganese	NA	NA	NA	NA	CNS	1E-03	NA	3E-04	2E-03
			Vanadium	NA	NA	6E-09	6E-09	Kidney/Lung	4E-03	NA	2E-05	4E-03
			Zinc	NA	NA	NA	NA	Fetus	1E-03	NA	NA	1E-03
			Chemical Total	5E-06	2E-06	9E-09	6E-06	Chemical Total	7E-02	8E-03	6E-04	8E-02
		Exposure Point Total					6E-06					8E-02
	Exposure Medium Total						6E-06					8E-02
Medium Total							6E-06					8E-02
Receptor Total							6E-06					8E-02

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.08

NA = not applicable GI = gastrointestinal CNS = central nervous system

TABLE B-9.16
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Construction/Utility Worker
Receptor Age:	Adult
Exposure Area:	All Upland Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Subsurface Soil	Surface Subsurface Soil	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	4E-09	2E-09	7E-14	6E-09	NA	NA	NA	NA	NA
			Benzo(a)pyrene	4E-08	1E-08	6E-13	5E-08	NA	NA	NA	NA	NA
			Benzo(b)fluoranthene	4E-09	2E-09	7E-14	6E-09	NA	NA	NA	NA	NA
			Dibenzo(a,h)anthracene	2E-08	8E-09	3E-13	3E-08	NA	NA	NA	NA	NA
			Indeno(1,2,3-cd)pyrene	3E-09	1E-09	4E-14	4E-09	NA	NA	NA	NA	NA
			PCBs/Pesticides									
			Aroclor 1254	9E-08	4E-08	3E-12	1E-07	Eyes/Fingernails/Immune System	2E-01	6E-02	NA	2E-01
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	1E-02	NA	NA	1E-02
			Antimony	NA	NA	NA	NA	Longevity/Blood	3E-01	NA	7E-05	3E-01
			Arsenic	1E-06	2E-07	7E-10	2E-06	Skin	2E-01	3E-02	NA	2E-01
			Cadmium	NA	NA	4E-12	4E-12	Kidney	1E-03	2E-04	NA	2E-03
			Chromium VI	3E-08	NA	7E-11	3E-08	Respiratory System	1E-03	NA	1E-06	1E-03
			Cobalt	NA	NA	9E-11	9E-11	Thyroid Gland/Respiratory System	2E-02	NA	4E-05	2E-02
			Copper	NA	NA	NA	NA	GI Tract	6E-03	NA	NA	6E-03
			Iron	NA	NA	NA	NA	GI Tract	9E-02	NA	NA	9E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-03	NA	NA	2E-03
			Vanadium	NA	NA	8E-10	8E-10	Kidney/Lung	1E-02	NA	7E-05	1E-02
			Zinc	NA	NA	NA	NA	Fetus	8E-04	NA	NA	8E-04
			Chemical Total	2E-06	3E-07	2E-09	2E-06	Chemical Total	9E-01	1E-01	2E-04	1E+00
		Exposure Point Total					2E-06					1E+00
	Exposure Medium Total						2E-06					1E+00
Medium Total							2E-06					1E+00
Groundwater	Groundwater (<10 feet bgs)	Groundwater (<10 feet bgs)	**Semi-volatile Organic Compounds**									
			Benzo(a)anthracene	3E-11	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Dibenzofuran	NA	NA	NA	NA	Developmental/Organ Weight	2E-04	4E-02	NA	4E-02
			Naphthalene	NA	NA	NA	NA	Body Weight	2E-05	1E-03	NA	1E-03
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	7E-04	1E-03	NA	2E-03
			Antimony	NA	NA	NA	NA	Longevity/Blood	1E-04	1E-03	NA	1E-03
			Arsenic	3E-09	3E-08	NA	4E-08	Skin	4E-04	9E-04	NA	1E-03
			Cadmium	NA	NA	NA	NA	Kidney	2E-04	7E-03	NA	8E-03
			Cobalt	NA	NA	NA	NA	Thyroid Gland	3E-03	2E-03	NA	5E-03
			Iron	NA	NA	NA	NA	GI Tract	1E-02	2E-02	NA	3E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-04	5E-04	NA	8E-04
			Chemical Total	3E-09	2E-07	--	2E-07	Chemical Total	1E-02	8E-02	--	9E-02
		Exposure Point Total					2E-07					9E-02
	Exposure Medium Total						2E-07					9E-02
Medium Total							2E-07					9E-02
Receptor Total							2E-06					1E+00

Total Excess Cancer Risk Across All Media: 2E-06

Total Hazard Index Across All Media: 1

NA = not applicable GI = gastrointestinal CNS = central nervous system bgs = below ground surface

TABLE B-9.17
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater (All Wells)	Tap Water	**Volatile Organic Compounds**									
			Tetrachloroethene	2E-05	1E-05	3E-06	3E-05	Liver/CNS	1E-02	1E-03	2E-03	2E-02
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	5E-01	2E-03	NA	5E-01
			Antimony	NA	NA	NA	NA	Longevity/Blood	2E-01	5E-03	NA	2E-01
			Arsenic	6E-05	1E-06	NA	6E-05	Skin/Developmental/Cardiovascular System/CNS	6E-01	2E-03	NA	6E-01
			Cadmium	NA	NA	NA	NA	Kidney	2E-01	1E-02	NA	3E-01
			Cobalt	NA	NA	NA	NA	Thyroid Gland/Respiratory System	5E+00	6E-03	NA	5E+00
			Copper	NA	NA	NA	NA	GI Tract	1E-01	4E-04	NA	1E-01
			Iron	NA	NA	NA	NA	GI Tract	7E+00	2E-02	NA	7E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	6E-01	2E-03	NA	6E-01
			Chemical Total	8E-05	1E-05	3E-06	9E-05	Chemical Total	1E+01	5E-02	2E-03	1E+01
		Exposure Point Total					9E-05					1E+01
	Exposure Medium Total						9E-05					1E+01
Medium Total							9E-05					1E+01
Receptor Total							9E-05					1E+01

Total Excess Cancer Risk Across All Media	9E-05
Total Hazard Index Across All Media	15
CNS HI Across All Media =	1
Respiratory HI Across All Media =	5
Thyroid Gland HI Across All Media =	5
GI Tract HI Across All Media =	7

TABLE B-10.1a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Area 1

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	2E-06	5E-07	1E-09	3E-06	Skin/Developmental/Cardiovascular System/CNS	3E-02	7E-03	1E-04	3E-02
			Chemical Total	3E-06	7E-07	4E-09	3E-06	Chemical Total	2E-01	2E-02	3E-04	2E-01
		Exposure Point Total					3E-06					2E-01
	Exposure Medium Total						3E-06					2E-01
Medium Total							3E-06					2E-01
Surface Water	Surface Water	Surface Water	**Inorganics**									
			Arsenic	8E-07	7E-07	NA	2E-06	Skin	1E-02	9E-03	NA	2E-02
			Chemical Total	8E-07	1E-06	--	2E-06	Chemical Total	2E-02	4E-02	--	6E-02
		Exposure Point Total					2E-06					6E-02
	Exposure Medium Total						2E-06					6E-02
Medium Total							2E-06					6E-02
Sediment	Sediment	Sediment	Chemical Total	9E-08	6E-07	--	7E-07	Chemical Total	2E-03	7E-03	--	1E-02
		Exposure Point Total					7E-07					1E-02
	Exposure Medium Total						7E-07					1E-02
Medium Total							7E-07					1E-02
Receptor Total							6E-06					3E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.3

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.1b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Area 1

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics** Arsenic	3E-06	8E-07	1E-09	4E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	1E-02	1E-04	5E-02
			Chemical Total	3E-06	1E-06	4E-09	4E-06	Chemical Total	2E-01	3E-02	3E-04	2E-01
		Exposure Point Total					4E-06					2E-01
	Exposure Medium Total						4E-06					2E-01
Medium Total							4E-06					2E-01
Surface Water	Surface Water	Surface Water	**Inorganics** Arsenic	2.7E-06	8.0E-07	NA	3E-06	Skin	3.5E-02	1.0E-02	NA	5E-02
			Chemical Total	3E-06	1E-06	--	4E-06	Chemical Total	7E-02	4E-02	--	1E-01
		Exposure Point Total					4E-06					1E-01
	Exposure Medium Total						4E-06					1E-01
Medium Total							4E-06					1E-01
Sediment	Sediment	Sediment	Chemical Total	9E-08	6E-07	--	7E-07	Chemical Total	2E-03	7E-03	--	1E-02
		Exposure Point Total					7E-07					1E-02
	Exposure Medium Total						7E-07					1E-02
Medium Total							7E-07					1E-02
Receptor Total							9E-06					4E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.2a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	4E-06	2E-06	2E-09	6E-06	Skin/Developmental/Cardiovascular System/CNS	2E-02	1E-02	9E-05	4E-02
			Chemical Total	4E-06	2E-06	4E-09	6E-06	Chemical Total	9E-02	3E-02	1E-04	1E-01
		Exposure Point Total					6E-06					1E-01
	Exposure Medium Total						6E-06					1E-01
Medium Total							6E-06					1E-01
Surface Water	Surface Water	Surface Water	**Inorganics**									
			Arsenic	2E-06	1E-06	NA	3E-06	Skin	1E-02	9E-03	NA	2E-02
			Chemical Total	2E-06	3E-06	--	4E-06	Chemical Total	2E-02	4E-02	--	6E-02
		Exposure Point Total					4E-06					6E-02
	Exposure Medium Total						4E-06					6E-02
Medium Total							4E-06					6E-02
Sediment	Sediment	Sediment	**Inorganics**									
			Arsenic	1E-07	9E-07	NA	1E-06	Skin	9E-04	6E-03	NA	6E-03
			Chemical Total	2E-07	9E-07	--	1E-06	Chemical Total	1E-03	6E-03	--	7E-03
		Exposure Point Total					1E-06					7E-03
	Exposure Medium Total						1E-06					7E-03
Medium Total							1E-06					7E-03
Receptor Total							1E-05					2E-01

Total Excess Cancer Risk Across All Media: 1E-05

Total Hazard Index Across All Media: 0.2

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.2b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	8E-06	1E-06	5E-10	1E-05	Skin/Developmental/Cardiovascular System/CNS	2E-01	4E-02	9E-05	3E-01
			Chemical Total	9E-06	2E-06	1E-09	1E-05	Chemical Total	8E-01	8E-02	1E-04	9E-01
		Exposure Point Total					1E-05					9E-01
	Exposure Medium Total						1E-05					9E-01
Medium Total							1E-05					9E-01
Surface Water	Surface Water	Surface Water	**Inorganics**									
			Arsenic	5E-06	6E-07	NA	5E-06	Skin	1E-01	2E-02	NA	1E-01
			Chemical Total	5E-06	1E-06	--	6E-06	Chemical Total	3E-01	6E-02	--	3E-01
		Exposure Point Total					6E-06					3E-01
	Exposure Medium Total						6E-06					3E-01
Medium Total							6E-06					3E-01
Sediment	Sediment	Sediment	**Inorganics**									
			Arsenic	3E-07	4E-07	NA	7E-07	Skin	8E-03	1E-02	NA	2E-02
			Chemical Total	4E-07	4E-07	--	8E-07	Chemical Total	1E-02	1E-02	--	2E-02
		Exposure Point Total					8E-07					2E-02
	Exposure Medium Total						8E-07					2E-02
Medium Total							8E-07					2E-02
Receptor Total							2E-05					1E+00

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.3a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	1E-06	3E-07	2E-10	2E-06	Skin/Developmental/Cardiovascular System/CNS	2E-02	4E-03	2E-05	2E-02
			Chemical Total	2E-06	4E-07	9E-10	2E-06	Chemical Total	6E-02	4E-03	1E-04	6E-02
		Exposure Point Total					2E-06					6E-02
	Exposure Medium Total						2E-06					6E-02
Medium Total							2E-06					6E-02
Receptor Total							2E-06					6E-02

Total Excess Cancer Risk Across All Media: 2E-06

Total Hazard Index Across All Media: 0.06

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.3b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Chemical Total	3E-07	5E-08	2E-10	3E-07	Chemical Total	9E-03	5E-04	3E-05	9E-03
		Exposure Point Total					3E-07					9E-03
	Exposure Medium Total						3E-07					9E-03
Medium Total							3E-07					9E-03
Receptor Total							3E-07					9E-03

Total Excess Cancer Risk Across All Media: 3E-07

Total Hazard Index Across All Media: 0.009

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.3c
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	7E-06	5E-07	9E-11	7E-06	Skin/Developmental/Cardiovascular System/CNS	2E-01	1E-02	2E-05	2E-01
			Chemical Total	8E-06	7E-07	4E-10	9E-06	Chemical Total	6E-01	1E-02	1E-04	6E-01
		Exposure Point Total					9E-06					6E-01
	Exposure Medium Total						9E-06					6E-01
Medium Total							9E-06					6E-01
Receptor Total							9E-06					6E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.6

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.4a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Areas 5, 6 and Beach Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	8E-07	5E-07	6E-10	1E-06	Skin/Developmental/Cardiovascular System/CNS	5E-03	3E-03	3E-05	9E-03
			Chemical Total	9E-07	6E-07	5E-09	2E-06	Chemical Total	3E-02	3E-03	2E-04	3E-02
		Exposure Point Total					2E-06					3E-02
	Exposure Medium Total						2E-06					3E-02
Medium Total							2E-06					3E-02
Surface Water	Surface Water	Surface Water	**Inorganics**									
			Arsenic	2E-06	1E-06	NA	3E-06	Skin	1E-02	9E-03	NA	2E-02
			Chemical Total	2E-06	3E-06	--	4E-06	Chemical Total	2E-02	4E-02	--	6E-02
		Exposure Point Total					4E-06					6E-02
	Exposure Medium Total						4E-06					6E-02
Medium Total							4E-06					6E-02
Sediment	Sediment	Sediment	Chemical Total	1E-07	8E-07	--	9E-07	Chemical Total	2E-03	5E-03	--	7E-03
		Exposure Point Total					9E-07					7E-03
	Exposure Medium Total						9E-07					7E-03
Medium Total							9E-07					7E-03
Receptor Total							7E-06					9E-02

Total Excess Cancer Risk Across All Media: 7E-06

Total Hazard Index Across All Media: 0.09

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.4b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Child (0-6 years)
Exposure Area:	Areas 5, 6 and Beach Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics** Arsenic	2E-06	3E-07	2E-10	2E-06	Skin/Developmental/Cardiovascular System/CNS	5E-02	8E-03	3E-05	6E-02
			Chemical Total	2E-06	4E-07	1E-09	3E-06	Chemical Total	2E-01	8E-03	2E-04	3E-01
		Exposure Point Total					3E-06					3E-01
	Exposure Medium Total						3E-06					3E-01
Medium Total							3E-06					3E-01
Surface Water	Surface Water	Surface Water	**Inorganics** Arsenic	5E-06	6E-07	NA	5E-06	Skin	1E-01	9E-03	NA	1E-01
			Chemical Total	5E-06	1E-06	--	6E-06	Chemical Total	3E-01	4E-02	--	3E-01
		Exposure Point Total					6E-06					3E-01
	Exposure Medium Total						6E-06					3E-01
Medium Total							6E-06					3E-01
Sediment	Sediment	Sediment	**Inorganics** Arsenic	3E-07	3E-07	NA	6E-07	Skin	7E-03	9E-03	NA	2E-02
			Chemical Total	3E-07	4E-07	--	6E-07	Chemical Total	2E-02	9E-03	--	3E-02
		Exposure Point Total					6E-07					3E-02
	Exposure Medium Total						6E-07					3E-02
Medium Total							6E-07					3E-02
Receptor Total							9E-06					6E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.6

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.5a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adult
Exposure Area:	Upland Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	2E-06	4E-07	3E-10	3E-06	Skin/Developmental/Cardiovascular System/CNS	3E-02	5E-03	3E-05	3E-02
			Chemical Total	3E-06	7E-07	8E-10	3E-06	Chemical Total	2E-01	4E-02	7E-05	2E-01
		Exposure Point Total					3E-06					2E-01
	Exposure Medium Total						3E-06					2E-01
Medium Total							3E-06					2E-01
Surface Water	Surface Water	Surface Water	Chemical Total	5E-09	5E-07	--	5E-07	Chemical Total	2E-04	2E-03	--	2E-03
		Exposure Point Total					5E-07					2E-03
	Exposure Medium Total						5E-07					2E-03
Medium Total							5E-07					2E-03
Sediment	Sediment	Sediment	**Inorganics**									
			Arsenic	2E-06	1E-06	NA	3E-06	Skin	3E-02	2E-02	NA	4E-02
			Chemical Total	2E-06	2E-06	--	4E-06	Chemical Total	7E-02	2E-02	--	9E-02
		Exposure Point Total					4E-06					9E-02
	Exposure Medium Total						4E-06					9E-02
Medium Total							4E-06					9E-02
Receptor Total							7E-06					3E-01

Total Excess Cancer Risk Across All Media: 7E-06

Total Hazard Index Across All Media: 0.3

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.5b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational User
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Upland Area of Area 9

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	3E-06	5E-07	3E-10	3E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	6E-03	3E-05	4E-02
			Chemical Total	3E-06	8E-07	8E-10	4E-06	Chemical Total	3E-01	4E-02	7E-05	3E-01
		Exposure Point Total					4E-06					3E-01
	Exposure Medium Total						4E-06					3E-01
Medium Total							4E-06					3E-01
Surface Water	Surface Water	Surface Water	Chemical Total	2E-08	6E-07	--	6E-07	Chemical Total	6E-04	2E-03	--	3E-03
		Exposure Point Total					6E-07					3E-03
	Exposure Medium Total						6E-07					3E-03
Medium Total							6E-07					3E-03
Sediment	Sediment	Sediment	**Semi-volatile Organic Compounds**									
			Benzo(a)pyrene	7E-08	2E-07	NA	2E-07	NA	NA	NA	NA	NA
			Inorganics									
			Arsenic	3E-06	1E-06	NA	4E-06	Skin	3E-02	2E-02	NA	5E-02
			Chemical Total	3E-06	2E-06	--	5E-06	Chemical Total	1E-01	2E-02	--	1E-01
		Exposure Point Total					5E-06					1E-01
	Exposure Medium Total						5E-06					1E-01
Medium Total							5E-06					1E-01
Receptor Total							9E-06					4E-01

Total Excess Cancer Risk Across All Media: 9E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.6a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 2, 8, and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	3E-06	6E-07	1E-09	4E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	8E-03	1E-04	5E-02
			Chemical Total	5E-06	1E-06	6E-09	6E-06	Chemical Total	3E-01	7E-02	5E-04	4E-01
		Exposure Point Total					6E-06					4E-01
	Exposure Medium Total						6E-06					4E-01
Medium Total							6E-06					4E-01
Receptor Total							6E-06					4E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.4

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.6b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	All Areas (except Areas 2, 8, and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**PCBs/Pesticides**									
			Aroclor 1254	1E-06	5E-07	2E-11	2E-06	Eyes/Fingernails/Immune System	2E-01	8E-02	NA	2E-01
			Inorganics									
			Arsenic	4E-06	7E-07	1E-09	5E-06	Skin/Developmental/Cardiovascular System/CNS	5E-02	1E-02	1E-04	6E-02
			Chemical Total	6E-06	2E-06	6E-09	8E-06	Chemical Total	4E-01	9E-02	5E-04	5E-01
		Exposure Point Total					8E-06					5E-01
	Exposure Medium Total						8E-06					5E-01
Medium Total							8E-06					5E-01
Receptor Total							8E-06					5E-01

Total Excess Cancer Risk Across All Media: 8E-06

Total Hazard Index Across All Media: 0.5

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.7a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 8 and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	3E-06	7E-07	1E-09	4E-06	Skin/Developmental/Cardiovascular System/CNS	4E-02	8E-03	1E-04	5E-02
			Chemical Total	5E-06	1E-06	6E-09	6E-06	Chemical Total	3E-01	7E-02	5E-04	4E-01
		Exposure Point Total					6E-06					4E-01
	Exposure Medium Total						6E-06					4E-01
Medium Total							6E-06					4E-01
Receptor Total							6E-06					4E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.4

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.7b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Pedestrian
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	All Areas (except Areas 8 and 11)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**PCBs/Pesticides**									
			Aroclor 1254	1E-06	5E-07	2E-11	2E-06	Eyes/Fingernails/Immune System	1E-01	7E-02	NA	2E-01
			Inorganics									
			Arsenic	4E-06	8E-07	1E-09	5E-06	Skin/Developmental/Cardiovascular System/CNS	6E-02	1E-02	1E-04	7E-02
			Chemical Total	6E-06	2E-06	6E-09	8E-06	Chemical Total	4E-01	8E-02	5E-04	5E-01
		Exposure Point Total					8E-06					5E-01
	Exposure Medium Total						8E-06					5E-01
Medium Total							8E-06					5E-01
Receptor Total							8E-06					5E-01

Total Excess Cancer Risk Across All Media: 8E-06

Total Hazard Index Across All Media: 0.5

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.8a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	6E-05	NA	NA	6E-05	Skin	4E-01	NA	NA	4E-01
			Chemical Total	6E-05	--	--	6E-05	Chemical Total	5E-01	--	--	5E-01
		Exposure Point Total					6E-05					5E-01
	Exposure Medium Total						6E-05					5E-01
Medium Total							6E-05					5E-01
Receptor Total							6E-05					5E-01

Total Excess Cancer Risk Across All Media: 6E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.8b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	2E-05	NA	NA	2E-05	Skin	6E-01	NA	NA	6E-01
			Chemical Total	2E-05	--	--	2E-05	Chemical Total	8E-01	--	--	8E-01
		Exposure Point Total					2E-05					8E-01
	Exposure Medium Total						2E-05					8E-01
Medium Total							2E-05					8E-01
Receptor Total							2E-05					8E-01

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

Skin HI Across All Media = 1

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.9a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	2E-04	NA	NA	2E-04	Skin	1E+00	NA	NA	1E+00
			Chemical Total	2E-04	--	--	2E-04	Chemical Total	1E+00	--	--	1E+00
		Exposure Point Total					2E-04					1E+00
	Exposure Medium Total						2E-04					1E+00
Medium Total							2E-04					1E+00
Receptor Total							2E-04					1E+00

Total Excess Cancer Risk Across All Media: 2E-04

Total Hazard Index Across All Media: 1

Skin HI Across All Media = 1

TABLE B-10.9b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	7E-05	NA	NA	7E-05	Skin	2E+00	NA	NA	2E+00
			Chemical Total	7E-05	--	--	7E-05	Chemical Total	2E+00	--	--	2E+00
		Exposure Point Total					7E-05					2E+00
	Exposure Medium Total						7E-05					2E+00
Medium Total							7E-05					2E+00
Receptor Total							7E-05					2E+00

Total Excess Cancer Risk Across All Media: 7E-05

Total Hazard Index Across All Media: 2

NA = not applicable CNS = central nervous system

Skin HI Across All Media = 2

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.10a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Ribbed Mussel	Ribbed Mussel	Ribbed Mussel	**Inorganics**									
			Arsenic	1E-04	NA	NA	1E-04	Skin	7E-01	NA	NA	7E-01
			Chemical Total	1E-04	--	--	1E-04	Chemical Total	7E-01	--	--	7E-01
		Exposure Point Total					1E-04					7E-01
	Exposure Medium Total						1E-04					7E-01
Medium Total							1E-04					7E-01
Receptor Total							1E-04					7E-01

Total Excess Cancer Risk Across All Media: 1E-04

Total Hazard Index Across All Media: 0.7

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.10b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Ribbed Mussel	Ribbed Mussel	Ribbed Mussel	**Inorganics** Arsenic	4E-05	NA	NA	4E-05	Skin	1E+00	NA	NA	1E+00
			Chemical Total	4E-05	--	--	4E-05	Chemical Total	1E+00	--	--	1E+00
		Exposure Point Total					4E-05					1E+00
	Exposure Medium Total						4E-05					1E+00
Medium Total							4E-05					1E+00
Receptor Total							4E-05					1E+00

Total Excess Cancer Risk Across All Media: 4E-05

Total Hazard Index Across All Media: 1

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.11a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab Muscle	Blue Crab Muscle	Blue Crab Muscle	**Inorganics**									
			Arsenic	3E-05	NA	NA	3E-05	Skin	2E-01	NA	NA	2E-01
			Chemical Total	3E-05	--	--	3E-05	Chemical Total	2E-01	--	--	2E-01
		Exposure Point Total					3E-05					2E-01
	Exposure Medium Total						3E-05					2E-01
Medium Total							3E-05					2E-01
Receptor Total							3E-05					2E-01

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 0.2

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.11b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab Muscle	Blue Crab Muscle	Blue Crab Muscle	**Inorganics**									
			Arsenic	1E-05	NA	NA	1E-05	Skin	3E-01	NA	NA	3E-01
			Chemical Total	1E-05	--	--	1E-05	Chemical Total	3E-01	--	--	3E-01
		Exposure Point Total					1E-05					3E-01
	Exposure Medium Total						1E-05					3E-01
Medium Total							1E-05					3E-01
Receptor Total							1E-05					3E-01

Total Excess Cancer Risk Across All Media: 1E-05

Total Hazard Index Across All Media: 0.3

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.12a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab (Muscle and Hepatopancreas)	Blue Crab (Muscle and Hepatopancreas)	Blue Crab (Muscle and Hepatopancreas)	**Inorganics**									
			Arsenic	4E-05	NA	NA	4E-05	Skin	3E-01	NA	NA	3E-01
			Chemical Total	4E-05	--	--	4E-05	Chemical Total	6E-01	--	--	6E-01
		Exposure Point Total					4E-05					6E-01
	Exposure Medium Total						4E-05					6E-01
Medium Total							4E-05					6E-01
Receptor Total							4E-05					6E-01

Total Excess Cancer Risk Across All Media: 4E-05

Total Hazard Index Across All Media: 0.6

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.12b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas (except Areas 3 and 4)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Blue Crab (Muscle plus Hepatopancreas)	Blue Crab (Muscle plus Hepatopancreas)	Blue Crab (Muscle plus Hepatopancreas)	**Inorganics**									
			Arsenic	2E-05	NA	NA	2E-05	Skin	4E-01	NA	NA	4E-01
			Chemical Total	2E-05	--	--	2E-05	Chemical Total	1E+00	--	--	1E+00
		Exposure Point Total					2E-05					1E+00
	Exposure Medium Total						2E-05					1E+00
Medium Total							2E-05					1E+00
Receptor Total							2E-05					1E+00

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 1

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.13a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Chemical Total	1E-06	2E-07	1E-09	1E-06	Chemical Total	5E-02	5E-03	3E-04	5E-02
		Exposure Point Total					1E-06					5E-02
	Exposure Medium Total						1E-06					5E-02
Medium Total							1E-06					5E-02
Receptor Total							1E-06					5E-02

Total Excess Cancer Risk Across All Media: 1E-06

Total Hazard Index Across All Media: 0.05

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.13b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Area 2

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	1E-06	2E-07	5E-10	1E-06	Skin/Developmental/Cardiovascular System/CNS	2E-02	3E-03	3E-04	2E-02
			Chemical Total	1E-06	2E-07	1E-09	2E-06	Chemical Total	6E-02	6E-03	3E-04	7E-02
		Exposure Point Total					2E-06					7E-02
	Exposure Medium Total						2E-06					7E-02
Medium Total							2E-06					7E-02
Receptor Total							2E-06					7E-02

Total Excess Cancer Risk Across All Media: 2E-06

Total Hazard Index Across All Media: 0.07

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-06 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.14a
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adult
Exposure Area:	Areas 8 and 11

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	5E-06	1E-06	2E-09	6E-06	Skin/Developmental/Cardiovascular System/CNS	6E-02	1E-02	1E-03	8E-02
			Chemical Total	5E-06	1E-06	3E-09	6E-06	Chemical Total	2E-01	1E-02	3E-03	2E-01
		Exposure Point Total					6E-06					2E-01
	Exposure Medium Total						6E-06					2E-01
Medium Total							6E-06					2E-01
Receptor Total							6E-06					2E-01

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.2

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.14b
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Trespasser
Receptor Age:	Adolescents (6-18 years)
Exposure Area:	Areas 8 and 11

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	6E-06	1E-06	2E-09	8E-06	Skin/Developmental/Cardiovascular System/CNS	8E-02	1E-02	1E-03	1E-01
			Chemical Total	7E-06	1E-06	3E-09	8E-06	Chemical Total	2E-01	2E-02	3E-03	3E-01
		Exposure Point Total					8E-06					3E-01
	Exposure Medium Total						8E-06					3E-01
Medium Total							8E-06					3E-01
Receptor Total							8E-06					3E-01

Total Excess Cancer Risk Across All Media: 8E-06

Total Hazard Index Across All Media: 0.3

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.15
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker
Receptor Age:	Adult
Exposure Area:	Areas 3 and 4

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface Soil	Surface Soil	**Inorganics**									
			Arsenic	4E-06	1E-06	2E-09	5E-06	Skin	2E-02	8E-03	8E-05	3E-02
			Chemical Total	5E-06	2E-06	9E-09	6E-06	Chemical Total	7E-02	8E-03	6E-04	8E-02
		Exposure Point Total					6E-06					8E-02
	Exposure Medium Total						6E-06					8E-02
Medium Total							6E-06					8E-02
Receptor Total							6E-06					8E-02

Total Excess Cancer Risk Across All Media: 6E-06

Total Hazard Index Across All Media: 0.08

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.16
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Construction/Utility Worker
Receptor Age:	Adult
Exposure Area:	All Upland Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Soil	Surface/ Subsurface Soil	Surface/ Subsurface Soil	**Inorganics** Arsenic	1E-06	2E-07	7E-10	2E-06	Skin	2E-01	3E-02	NA	2E-01
			Chemical Total	2E-06	3E-07	2E-09	2E-06	Chemical Total	9E-01	1E-01	2E-04	1E+00
		Exposure Point Total					2E-06					1E+00
	Exposure Medium Total						2E-06					1E+00
Medium Total							2E-06					1E+00
Groundwater	Groundwater (<10 feet bgs)	Groundwater	Chemical Total	3E-09	2E-07	--	2E-07	Chemical Total	1E-02	8E-02	--	9E-02
		Exposure Point Total					2E-07					9E-02
	Exposure Medium Total						2E-07					9E-02
Medium Total							2E-07					9E-02
Receptor Total							2E-06					1E+00

Total Excess Cancer Risk Across All Media: 2E-06

Total Hazard Index Across All Media: 1

NA = not applicable

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE B-10.17
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater (All Wells)	Tap Water	**Volatile Organic Compounds**									
			Tetrachloroethene	2E-05	1E-05	3E-06	3E-05	Liver/CNS	1E-02	1E-03	2E-03	2E-02
			Inorganics									
			Arsenic	6E-05	1E-06	NA	6E-05	Skin/Developmental/Cardiovascular System/CNS	6E-01	2E-03	NA	6E-01
			Cobalt	NA	NA	NA	NA	Thyroid Gland/Respiratory System	5E+00	6E-03	NA	5E+00
			Iron	NA	NA	NA	NA	GI Tract	7E+00	2E-02	NA	7E+00
			Chemical Total	8E-05	1E-05	3E-06	9E-05	Chemical Total	1E+01	5E-02	2E-03	1E+01
		Exposure Point Total					9E-05					1E+01
	Exposure Medium Total						9E-05					1E+01
Medium Total							9E-05					1E+01
Receptor Total							9E-05					1E+01

Total Excess Cancer Risk Across All Media: 9E-05

Total Hazard Index Across All Media: 15

CNS HI Across All Media =	1
Respiratory HI Across All Media =	5
Thyroid Gland HI Across All Media =	5
GI Tract HI Across All Media =	7

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

Appendix C
ProUCL Output for Chemicals of Potential Concern
(on CD)

Appendix C Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

C-1 Area 1 Surface Soil
C-2 Area 2 Surface Soil
C-3 Areas 3 and 4 Surface Soil
C-4 Areas 5, 6, and Beach Area of Area 9 Surface Soil
C-5 Upland Area of Area 9 Surface Soil
C-6 All Areas (except Areas 2, 8, and 11) Surface Soil
C-7 All Areas (except Areas 8 and 11) Surface Soil
C-8 Areas 8 and 11 Surface Soil
C-9 All Upland Areas Surface/Subsurface Soil
C-10 Groundwater (All Wells)
C-11 All Areas (except Wetland Area of Area 9) Surface Water
C-12 Wetland Area of Area 9 Surface Water
C-13 Area 1 Sediment
C-14 Areas 5, 6, and Beach Area of Area 9 Sediment
C-15 Wetland Area of Area 9 Sediment
C-16 Ribbed Mussel

Appendix C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area1_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations 31
Number of Distinct Observations 26

Raw Statistics

Minimum	3.2
Maximum	600
Mean	90.63
Median	64
SD	118.7
Std. Error of Mean	21.32
Coefficient of Variation	1.31
Skewness	2.951

Log-transformed Statistics

Minimum of Log Data	1.163
Maximum of Log Data	6.397
Mean of log Data	3.767
SD of log Data	1.349

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.681
Shapiro Wilk Critical Value	0.929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.953
Shapiro Wilk Critical Value	0.929

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	126.8

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	137.8
95% Modified-t UCL (Johnson-1978)	128.7

Assuming Lognormal Distribution

95% H-UCL	217.8
95% Chebyshev (MVUE) UCL	234.9
97.5% Chebyshev (MVUE) UCL	292.4
99% Chebyshev (MVUE) UCL	405.3

Gamma Distribution Test

k star (bias corrected)	0.746
Theta Star	121.5
MLE of Mean	90.63
MLE of Standard Deviation	104.9
nu star	46.25
Approximate Chi Square Value (.05)	31.64
Adjusted Level of Significance	0.0413
Adjusted Chi Square Value	30.97
Anderson-Darling Test Statistic	0.564
Anderson-Darling 5% Critical Value	0.785
Kolmogorov-Smirnov Test Statistic	0.131
Kolmogorov-Smirnov 5% Critical Value	0.164

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	132.4
95% Adjusted Gamma UCL	135.3

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	125.7
95% Jackknife UCL	126.8
95% Standard Bootstrap UCL	123.7
95% Bootstrap-t UCL	153.5
95% Hall's Bootstrap UCL	276.2
95% Percentile Bootstrap UCL	130
95% BCA Bootstrap UCL	138.3
95% Chebyshev(Mean, Sd) UCL	183.5
97.5% Chebyshev(Mean, Sd) UCL	223.7
99% Chebyshev(Mean, Sd) UCL	302.7

Potential UCL to Use

Use 95% Approximate Gamma UCL 132.4

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations	31	Number of Distinct Observations	22

Raw Statistics		**Log-transformed Statistics**	
Minimum	6.8	Minimum of Log Data	1.917
Maximum	530	Maximum of Log Data	6.273
Mean	100.7	Mean of log Data	4.068
Median	95	SD of log Data	1.203
SD	103.8		
Std. Error of Mean	18.64		
Coefficient of Variation	1.031		
Skewness	2.568		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.745	Shapiro Wilk Test Statistic	0.885
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	132.3	95% H-UCL	216.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	247.1
95% Adjusted-CLT UCL (Chen-1995)	140.5	97.5% Chebyshev (MVUE) UCL	303.9
95% Modified-t UCL (Johnson-1978)	133.8	99% Chebyshev (MVUE) UCL	415.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.973	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	103.5	
MLE of Mean	100.7	
MLE of Standard Deviation	102.1	
nu star	60.34	
Approximate Chi Square Value (.05)	43.48	**Nonparametric Statistics**
Adjusted Level of Significance	0.0413	95% CLT UCL 131.3
Adjusted Chi Square Value	42.68	95% Jackknife UCL 132.3
		95% Standard Bootstrap UCL 130.1
Anderson-Darling Test Statistic	1.056	95% Bootstrap-t UCL 149
Anderson-Darling 5% Critical Value	0.774	95% Hall's Bootstrap UCL 281.2
Kolmogorov-Smirnov Test Statistic	0.195	95% Percentile Bootstrap UCL 134.4
Kolmogorov-Smirnov 5% Critical Value	0.162	95% BCA Bootstrap UCL 142.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 181.9
		97.5% Chebyshev(Mean, Sd) UCL 217.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 286.1
95% Approximate Gamma UCL	139.7	
95% Adjusted Gamma UCL	142.4	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 181.9

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations 31
Number of Distinct Observations 23

Raw Statistics

Minimum	5.9
Maximum	580
Mean	111.8
Median	100
SD	119.1
Std. Error of Mean	21.39
Coefficient of Variation	1.065
Skewness	2.217

Log-transformed Statistics

Minimum of Log Data	1.775
Maximum of Log Data	6.363
Mean of log Data	4.105
SD of log Data	1.254

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.775
Shapiro Wilk Critical Value	0.929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.908
Shapiro Wilk Critical Value	0.929

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	148.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	156.1
95% Modified-t UCL (Johnson-1978)	149.6

Assuming Lognormal Distribution

95% H-UCL	249.2
95% Chebyshev (MVUE) UCL	279.2
97.5% Chebyshev (MVUE) UCL	344.8
99% Chebyshev (MVUE) UCL	473.7

Gamma Distribution Test

k star (bias corrected)	0.879
Theta Star	127.2
MLE of Mean	111.8
MLE of Standard Deviation	119.3
nu star	54.5
Approximate Chi Square Value (.05)	38.54
Adjusted Level of Significance	0.0413
Adjusted Chi Square Value	37.79
Anderson-Darling Test Statistic	0.883
Anderson-Darling 5% Critical Value	0.778
Kolmogorov-Smirnov Test Statistic	0.158
Kolmogorov-Smirnov 5% Critical Value	0.163

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	158.2
95% Adjusted Gamma UCL	161.3

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	147
95% Jackknife UCL	148.1
95% Standard Bootstrap UCL	147.2
95% Bootstrap-t UCL	162.6
95% Hall's Bootstrap UCL	190.6
95% Percentile Bootstrap UCL	147.7
95% BCA Bootstrap UCL	158.2
95% Chebyshev(Mean, Sd) UCL	205.1
97.5% Chebyshev(Mean, Sd) UCL	245.4
99% Chebyshev(Mean, Sd) UCL	324.7

Potential UCL to Use

Use 95% Approximate Gamma UCL 158.2

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	31	Number of Distinct Observations	22

Raw Statistics		**Log-transformed Statistics**	
Minimum	2	Minimum of Log Data	0.693
Maximum	445	Maximum of Log Data	6.098
Mean	80.63	Mean of log Data	3.804
Median	95	SD of log Data	1.251
SD	88.89		
Std. Error of Mean	15.96		
Coefficient of Variation	1.102		
Skewness	2.627		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.698	Shapiro Wilk Test Statistic	0.908
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	107.7	95% H-UCL	183.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	205.8
95% Adjusted-CLT UCL (Chen-1995)	114.9	97.5% Chebyshev (MVUE) UCL	254.1
95% Modified-t UCL (Johnson-1978)	109	99% Chebyshev (MVUE) UCL	349

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.912	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	88.4	
MLE of Mean	80.63	
MLE of Standard Deviation	84.42	
nu star	56.55	
Approximate Chi Square Value (.05)	40.27	**Nonparametric Statistics**
Adjusted Level of Significance	0.0413	95% CLT UCL 106.9
Adjusted Chi Square Value	39.5	95% Jackknife UCL 107.7
		95% Standard Bootstrap UCL 106.6
Anderson-Darling Test Statistic	1.176	95% Bootstrap-t UCL 123.8
Anderson-Darling 5% Critical Value	0.776	95% Hall's Bootstrap UCL 250
Kolmogorov-Smirnov Test Statistic	0.209	95% Percentile Bootstrap UCL 108.8
Kolmogorov-Smirnov 5% Critical Value	0.163	95% BCA Bootstrap UCL 115
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 150.2
		97.5% Chebyshev(Mean, Sd) UCL 180.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 239.5
95% Approximate Gamma UCL	113.2	
95% Adjusted Gamma UCL	115.4	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 150.2

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations	31	Number of Distinct Observations	21

Raw Statistics		**Log-transformed Statistics**	
Minimum	7.3	Minimum of Log Data	1.988
Maximum	290	Maximum of Log Data	5.67
Mean	95.65	Mean of log Data	4.271
Median	100	SD of log Data	0.908
SD	63.33		
Std. Error of Mean	11.37		
Coefficient of Variation	0.662		
Skewness	1.353		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.849	Shapiro Wilk Test Statistic	0.832
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	115	95% H-UCL	158.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	191.5
95% Adjusted-CLT UCL (Chen-1995)	117.3	97.5% Chebyshev (MVUE) UCL	228.3
95% Modified-t UCL (Johnson-1978)	115.4	99% Chebyshev (MVUE) UCL	300.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.718	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	55.69	
MLE of Mean	95.65	
MLE of Standard Deviation	72.98	
nu star	106.5	
Approximate Chi Square Value (.05)	83.68	**Nonparametric Statistics**
Adjusted Level of Significance	0.0413	95% CLT UCL 114.4
Adjusted Chi Square Value	82.56	95% Jackknife UCL 115
		95% Standard Bootstrap UCL 114.2
Anderson-Darling Test Statistic	1.67	95% Bootstrap-t UCL 119.4
Anderson-Darling 5% Critical Value	0.76	95% Hall's Bootstrap UCL 128.6
Kolmogorov-Smirnov Test Statistic	0.2	95% Percentile Bootstrap UCL 114.8
Kolmogorov-Smirnov 5% Critical Value	0.16	95% BCA Bootstrap UCL 117.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 145.2
		97.5% Chebyshev(Mean, Sd) UCL 166.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 208.8
95% Approximate Gamma UCL	121.7	
95% Adjusted Gamma UCL	123.4	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 145.2

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aroclor 1254

General Statistics

Number of Valid Observations	31	Number of Distinct Observations	21

Raw Statistics		**Log-transformed Statistics**	
Minimum	17.5	Minimum of Log Data	2.862
Maximum	3100	Maximum of Log Data	8.039
Mean	315.7	Mean of log Data	4.126
Median	21.5	SD of log Data	1.621
SD	736		
Std. Error of Mean	132.2		
Coefficient of Variation	2.331		
Skewness	3.06		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.467	Shapiro Wilk Test Statistic	0.764
Shapiro Wilk Critical Value	0.929	Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	540.1	95% H-UCL	602.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	556.2
95% Adjusted-CLT UCL (Chen-1995)	610.8	97.5% Chebyshev (MVUE) UCL	705.7
95% Modified-t UCL (Johnson-1978)	552.2	99% Chebyshev (MVUE) UCL	999.2

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.386	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	818.2	
MLE of Mean	315.7	
MLE of Standard Deviation	508.3	
nu star	23.93	
Approximate Chi Square Value (.05)	13.79	**Nonparametric Statistics**
Adjusted Level of Significance	0.0413	95% CLT UCL 533.2
Adjusted Chi Square Value	13.36	95% Jackknife UCL 540.1
		95% Standard Bootstrap UCL 522.5
Anderson-Darling Test Statistic	4.194	95% Bootstrap-t UCL 919.1
Anderson-Darling 5% Critical Value	0.831	95% Hall's Bootstrap UCL 688.4
Kolmogorov-Smirnov Test Statistic	0.302	95% Percentile Bootstrap UCL 545.9
Kolmogorov-Smirnov 5% Critical Value	0.169	95% BCA Bootstrap UCL 626.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 891.9
		97.5% Chebyshev(Mean, Sd) UCL 1141
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1631
95% Approximate Gamma UCL	547.7	
95% Adjusted Gamma UCL	565.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 891.9

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	220	Number of Distinct Observations	168

Raw Statistics		**Log-transformed Statistics**	
Minimum	271	Minimum of Log Data	5.602
Maximum	8710	Maximum of Log Data	9.072
Mean	2205	Mean of log Data	7.519
Median	1780	SD of log Data	0.598
SD	1431		
Std. Error of Mean	96.48		
Coefficient of Variation	0.649		
Skewness	1.756		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.134	Lilliefors Test Statistic	0.0566
Lilliefors Critical Value	0.0597	Lilliefors Critical Value	0.0597
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2365	95% H-UCL	2377
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2622
95% Adjusted-CLT UCL (Chen-1995)	2376	97.5% Chebyshev (MVUE) UCL	2803
95% Modified-t UCL (Johnson-1978)	2367	99% Chebyshev (MVUE) UCL	3159

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.906	**Data appear Lognormal at 5% Significance Level**
Theta Star	758.8	
MLE of Mean	2205	
MLE of Standard Deviation	1294	
nu star	1279	
Approximate Chi Square Value (.05)	1197	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 2364
Adjusted Chi Square Value	1196	95% Jackknife UCL 2365
		95% Standard Bootstrap UCL 2364
Anderson-Darling Test Statistic	1.869	95% Bootstrap-t UCL 2379
Anderson-Darling 5% Critical Value	0.761	95% Hall's Bootstrap UCL 2370
Kolmogorov-Smirnov Test Statistic	0.0891	95% Percentile Bootstrap UCL 2372
Kolmogorov-Smirnov 5% Critical Value	0.0618	95% BCA Bootstrap UCL 2383
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL **2626**
		97.5% Chebyshev(Mean, Sd) UCL 2808
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3165
95% Approximate Gamma UCL	2357	
95% Adjusted Gamma UCL	2358	

Potential UCL to Use	Use 95% H-UCL 2377

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
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Antimony

General Statistics

Number of Valid Observations	228	Number of Distinct Observations	94

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.075	Minimum of Log Data	-2.59
Maximum	2390	Maximum of Log Data	7.779
Mean	36.87	Mean of log Data	0.701
Median	1.7	SD of log Data	1.649
SD	215.4		
Std. Error of Mean	14.26		
Coefficient of Variation	5.841		
Skewness	8.257		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.465	Lilliefors Test Statistic	0.158
Lilliefors Critical Value	0.0587	Lilliefors Critical Value	0.0587
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	60.43	95% H-UCL	10.64
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.24
95% Adjusted-CLT UCL (Chen-1995)	68.66	97.5% Chebyshev (MVUE) UCL	15.62
95% Modified-t UCL (Johnson-1978)	61.73	99% Chebyshev (MVUE) UCL	20.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.245	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	150.6	
MLE of Mean	36.87	
MLE of Standard Deviation	74.51	
nu star	111.7	
Approximate Chi Square Value (.05)	88.26	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 60.33
Adjusted Chi Square Value	88.13	95% Jackknife UCL 60.43
		95% Standard Bootstrap UCL 60.15
Anderson-Darling Test Statistic	45.91	95% Bootstrap-t UCL 84.03
Anderson-Darling 5% Critical Value	0.894	95% Hall's Bootstrap UCL 73.69
Kolmogorov-Smirnov Test Statistic	0.362	95% Percentile Bootstrap UCL 61.25
Kolmogorov-Smirnov 5% Critical Value	0.0663	95% BCA Bootstrap UCL 72.44
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 99.04
		97.5% Chebyshev(Mean, Sd) UCL 125.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 178.8
95% Approximate Gamma UCL	46.64	
95% Adjusted Gamma UCL	46.71	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 99.04

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	227	Number of Distinct Observations	136

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.73	Minimum of Log Data	-0.315
Maximum	760	Maximum of Log Data	6.633
Mean	17.65	Mean of log Data	2.096
Median	7.1	SD of log Data	0.941
SD	58.62		
Std. Error of Mean	3.891		
Coefficient of Variation	3.321		
Skewness	10.11		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.39	Lilliefors Test Statistic	0.0975
Lilliefors Critical Value	0.0588	Lilliefors Critical Value	0.0588
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	24.08	95% H-UCL	14.44
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	16.72
95% Adjusted-CLT UCL (Chen-1995)	26.84	97.5% Chebyshev (MVUE) UCL	18.49
95% Modified-t UCL (Johnson-1978)	24.51	99% Chebyshev (MVUE) UCL	21.97

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.763	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	23.14	
MLE of Mean	17.65	
MLE of Standard Deviation	20.21	
nu star	346.2	
Approximate Chi Square Value (.05)	304.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 24.05
Adjusted Chi Square Value	303.9	95% Jackknife UCL 24.08
		95% Standard Bootstrap UCL 23.95
Anderson-Darling Test Statistic	23.12	95% Bootstrap-t UCL 32.58
Anderson-Darling 5% Critical Value	0.795	95% Hall's Bootstrap UCL 47.76
Kolmogorov-Smirnov Test Statistic	0.242	95% Percentile Bootstrap UCL 25.06
Kolmogorov-Smirnov 5% Critical Value	0.0629	95% BCA Bootstrap UCL 27.82
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 34.61
		97.5% Chebyshev(Mean, Sd) UCL 41.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 56.36
95% Approximate Gamma UCL	20.1	
95% Adjusted Gamma UCL	20.11	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 34.61

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	15

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.31	Minimum of Log Data	-1.171
Maximum	8.3	Maximum of Log Data	2.116
Mean	1.717	Mean of log Data	-0.165
Median	0.58	SD of log Data	1.046
SD	2.633		
Std. Error of Mean	0.621		
Coefficient of Variation	1.533		
Skewness	2.028		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.545	Shapiro Wilk Test Statistic	0.728
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2.797	95% H-UCL	2.913
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.089
95% Adjusted-CLT UCL (Chen-1995)	3.055	97.5% Chebyshev (MVUE) UCL	3.818
95% Modified-t UCL (Johnson-1978)	2.846	99% Chebyshev (MVUE) UCL	5.25

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.734	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	2.34	
MLE of Mean	1.717	
MLE of Standard Deviation	2.005	
nu star	26.42	
Approximate Chi Square Value (.05)	15.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0357	95% CLT UCL 2.738
Adjusted Chi Square Value	14.91	95% Jackknife UCL 2.797
		95% Standard Bootstrap UCL 2.701
Anderson-Darling Test Statistic	3.032	95% Bootstrap-t UCL 3.496
Anderson-Darling 5% Critical Value	0.774	95% Hall's Bootstrap UCL 2.557
Kolmogorov-Smirnov Test Statistic	0.388	95% Percentile Bootstrap UCL 2.761
Kolmogorov-Smirnov 5% Critical Value	0.211	95% BCA Bootstrap UCL 3.071
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 4.422
		97.5% Chebyshev(Mean, Sd) UCL 5.593
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 7.892
95% Approximate Gamma UCL	2.889	
95% Adjusted Gamma UCL	3.042	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 4.422

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations	230	Number of Distinct Observations	91

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.275	Minimum of Log Data	-1.291
Maximum	9.2	Maximum of Log Data	2.219
Mean	2.063	Mean of log Data	0.491
Median	1.7	SD of log Data	0.714
SD	1.456		
Std. Error of Mean	0.096		
Coefficient of Variation	0.706		
Skewness	1.887		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.122	Lilliefors Test Statistic	0.0615
Lilliefors Critical Value	0.0584	Lilliefors Critical Value	0.0584
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2.222	95% H-UCL	2.311
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.588
95% Adjusted-CLT UCL (Chen-1995)	2.234	97.5% Chebyshev (MVUE) UCL	2.797
95% Modified-t UCL (Johnson-1978)	2.224	99% Chebyshev (MVUE) UCL	3.207

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.271	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	0.908	
MLE of Mean	2.063	
MLE of Standard Deviation	1.369	
nu star	1045	
Approximate Chi Square Value (.05)	970.6	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 2.221
Adjusted Chi Square Value	970.1	95% Jackknife UCL 2.222
		95% Standard Bootstrap UCL 2.219
Anderson-Darling Test Statistic	0.824	95% Bootstrap-t UCL 2.233
Anderson-Darling 5% Critical Value	0.764	95% Hall's Bootstrap UCL 2.235
Kolmogorov-Smirnov Test Statistic	0.0588	95% Percentile Bootstrap UCL 2.223
Kolmogorov-Smirnov 5% Critical Value	0.0608	95% BCA Bootstrap UCL 2.227
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.482
		97.5% Chebyshev(Mean, Sd) UCL 2.663
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3.018
95% Approximate Gamma UCL	2.22	
95% Adjusted Gamma UCL	2.221	

Potential UCL to Use	Use 95% Approximate Gamma UCL 2.22

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	232	Number of Distinct Observations	153

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.5	Minimum of Log Data	0.405
Maximum	1730	Maximum of Log Data	7.456
Mean	43.85	Mean of log Data	2.686
Median	11.6	SD of log Data	1.001
SD	164.4		
Std. Error of Mean	10.79		
Coefficient of Variation	3.749		
Skewness	7.456		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.42	Lilliefors Test Statistic	0.187
Lilliefors Critical Value	0.0582	Lilliefors Critical Value	0.0582
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	61.68	95% H-UCL	27.89
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32.52
95% Adjusted-CLT UCL (Chen-1995)	67.25	97.5% Chebyshev (MVUE) UCL	36.14
95% Modified-t UCL (Johnson-1978)	62.56	99% Chebyshev (MVUE) UCL	43.27

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.564	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	77.7	
MLE of Mean	43.85	
MLE of Standard Deviation	58.37	
nu star	261.9	
Approximate Chi Square Value (.05)	225.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 61.61
Adjusted Chi Square Value	225.2	95% Jackknife UCL 61.68
		95% Standard Bootstrap UCL 61.64
Anderson-Darling Test Statistic	40.35	95% Bootstrap-t UCL 75.39
Anderson-Darling 5% Critical Value	0.814	95% Hall's Bootstrap UCL 70.76
Kolmogorov-Smirnov Test Statistic	0.335	95% Percentile Bootstrap UCL 63.23
Kolmogorov-Smirnov 5% Critical Value	0.0631	95% BCA Bootstrap UCL 68.15
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 90.9
		97.5% Chebyshev(Mean, Sd) UCL 111.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 151.2
95% Approximate Gamma UCL	50.95	
95% Adjusted Gamma UCL	51	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 90.9

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations	229	Number of Distinct Observations	192

Raw Statistics		**Log-transformed Statistics**	
Minimum	2750	Minimum of Log Data	7.919
Maximum	96800	Maximum of Log Data	11.48
Mean	22079	Mean of log Data	9.692
Median	14400	SD of log Data	0.784
SD	18884		
Std. Error of Mean	1248		
Coefficient of Variation	0.855		
Skewness	1.717		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.192	Lilliefors Test Statistic	0.0726
Lilliefors Critical Value	0.0585	Lilliefors Critical Value	0.0585
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	24140	95% H-UCL	24413
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	27632
95% Adjusted-CLT UCL (Chen-1995)	24283	97.5% Chebyshev (MVUE) UCL	30076
95% Modified-t UCL (Johnson-1978)	24164	99% Chebyshev (MVUE) UCL	34876

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.74	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	12686	
MLE of Mean	22079	
MLE of Standard Deviation	16736	
nu star	797.1	
Approximate Chi Square Value (.05)	732.6	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 24132
Adjusted Chi Square Value	732.2	95% Jackknife UCL 24140
		95% Standard Bootstrap UCL 24147
Anderson-Darling Test Statistic	3.787	95% Bootstrap-t UCL 24157
Anderson-Darling 5% Critical Value	0.769	95% Hall's Bootstrap UCL 24312
Kolmogorov-Smirnov Test Statistic	0.122	95% Percentile Bootstrap UCL 24105
Kolmogorov-Smirnov 5% Critical Value	0.0612	95% BCA Bootstrap UCL 24211
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 27519
		97.5% Chebyshev(Mean, Sd) UCL 29872
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 34496
95% Approximate Gamma UCL	24024	
95% Adjusted Gamma UCL	24036	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 27519

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	223	Number of Distinct Observations	196

Raw Statistics		**Log-transformed Statistics**	
Minimum	6.2	Minimum of Log Data	1.825
Maximum	47700	Maximum of Log Data	10.77
Mean	557.3	Mean of log Data	4.13
Median	39.8	SD of log Data	1.515
SD	3412		
Std. Error of Mean	228.5		
Coefficient of Variation	6.122		
Skewness	12.28		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.436	Lilliefors Test Statistic	0.137
Lilliefors Critical Value	0.0593	Lilliefors Critical Value	0.0593
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	934.7	95% H-UCL	256
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	316.3
95% Adjusted-CLT UCL (Chen-1995)	1134	97.5% Chebyshev (MVUE) UCL	369.3
95% Modified-t UCL (Johnson-1978)	966	99% Chebyshev (MVUE) UCL	473.5

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.311	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1791	
MLE of Mean	557.3	
MLE of Standard Deviation	999.1	
nu star	138.8	
Approximate Chi Square Value (.05)	112.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 933.1
Adjusted Chi Square Value	112.4	95% Jackknife UCL 934.7
		95% Standard Bootstrap UCL 926
Anderson-Darling Test Statistic	36.17	95% Bootstrap-t UCL 1696
Anderson-Darling 5% Critical Value	0.867	95% Hall's Bootstrap UCL 2206
Kolmogorov-Smirnov Test Statistic	0.315	95% Percentile Bootstrap UCL 955.1
Kolmogorov-Smirnov 5% Critical Value	0.0661	95% BCA Bootstrap UCL 1262
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1553
		97.5% Chebyshev(Mean, Sd) UCL 1984
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2831
95% Approximate Gamma UCL	687.1	
95% Adjusted Gamma UCL	688.1	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1553

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	231	Number of Distinct Observations	206

Raw Statistics		**Log-transformed Statistics**	
Minimum	6.1	Minimum of Log Data	1.808
Maximum	355	Maximum of Log Data	5.872
Mean	59.8	Mean of log Data	3.765
Median	43	SD of log Data	0.811
SD	53.72		
Std. Error of Mean	3.534		
Coefficient of Variation	0.898		
Skewness	2.172		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.179	Lilliefors Test Statistic	0.0306
Lilliefors Critical Value	0.0583	Lilliefors Critical Value	0.0583
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	65.63	95% H-UCL	66.76
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	75.82
95% Adjusted-CLT UCL (Chen-1995)	66.15	97.5% Chebyshev (MVUE) UCL	82.73
95% Modified-t UCL (Johnson-1978)	65.72	99% Chebyshev (MVUE) UCL	96.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.661	**Data appear Lognormal at 5% Significance Level**
Theta Star	36	
MLE of Mean	59.8	
MLE of Standard Deviation	46.4	
nu star	767.4	
Approximate Chi Square Value (.05)	704.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 65.61
Adjusted Chi Square Value	703.7	95% Jackknife UCL 65.63
		95% Standard Bootstrap UCL 65.64
Anderson-Darling Test Statistic	2.141	95% Bootstrap-t UCL 66.28
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL 66.34
Kolmogorov-Smirnov Test Statistic	0.0828	95% Percentile Bootstrap UCL 65.54
Kolmogorov-Smirnov 5% Critical Value	0.0611	95% BCA Bootstrap UCL 65.8
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 75.2
		97.5% Chebyshev(Mean, Sd) UCL 81.87
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 94.96
95% Approximate Gamma UCL	65.17	
95% Adjusted Gamma UCL	65.21	

Potential UCL to Use	Use 95% H-UCL 66.76

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 C-1
ProUCL Output - Area 1 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	230	Number of Distinct Observations	176

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.55	Minimum of Log Data	0.936
Maximum	118	Maximum of Log Data	4.771
Mean	25.97	Mean of log Data	3.04
Median	19.5	SD of log Data	0.627
SD	20.71		
Std. Error of Mean	1.365		
Coefficient of Variation	0.797		
Skewness	2.374		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.205	Lilliefors Test Statistic	0.0807
Lilliefors Critical Value	0.0584	Lilliefors Critical Value	0.0584
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	28.23	95% H-UCL	27.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	30.41
95% Adjusted-CLT UCL (Chen-1995)	28.45	97.5% Chebyshev (MVUE) UCL	32.57
95% Modified-t UCL (Johnson-1978)	28.26	99% Chebyshev (MVUE) UCL	36.82

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.427	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	10.7	
MLE of Mean	25.97	
MLE of Standard Deviation	16.67	
nu star	1116	
Approximate Chi Square Value (.05)	1040	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 28.22
Adjusted Chi Square Value	1039	95% Jackknife UCL 28.23
		95% Standard Bootstrap UCL 28.17
Anderson-Darling Test Statistic	6.163	95% Bootstrap-t UCL 28.53
Anderson-Darling 5% Critical Value	0.763	95% Hall's Bootstrap UCL 28.42
Kolmogorov-Smirnov Test Statistic	0.128	95% Percentile Bootstrap UCL 28.27
Kolmogorov-Smirnov 5% Critical Value	0.0608	95% BCA Bootstrap UCL 28.39
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 31.93
		97.5% Chebyshev(Mean, Sd) UCL 34.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 39.56
95% Approximate Gamma UCL	27.89	
95% Adjusted Gamma UCL	27.9	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	31.93

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area2_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Number of Valid Observations	93	Number of Distinct Observations	77

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.65	Minimum of Log Data	-0.431
Maximum	190	Maximum of Log Data	5.247
Mean	23.87	Mean of log Data	2.245
Median	9.1	SD of log Data	1.455
SD	37.53		
Std. Error of Mean	3.892		
Coefficient of Variation	1.573		
Skewness	3.034		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.268	Lilliefors Test Statistic	0.0589
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	30.33	95% H-UCL	41.19
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	50.46
95% Adjusted-CLT UCL (Chen-1995)	31.58	97.5% Chebyshev (MVUE) UCL	60.79
95% Modified-t UCL (Johnson-1978)	30.54	99% Chebyshev (MVUE) UCL	81.08

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.643	**Data appear Lognormal at 5% Significance Level**
Theta Star	37.11	
MLE of Mean	23.87	
MLE of Standard Deviation	29.76	
nu star	119.6	
Approximate Chi Square Value (.05)	95.37	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 30.27
Adjusted Chi Square Value	95.03	95% Jackknife UCL 30.33
		95% Standard Bootstrap UCL 30.21
Anderson-Darling Test Statistic	1.408	95% Bootstrap-t UCL 32.31
Anderson-Darling 5% Critical Value	0.803	95% Hall's Bootstrap UCL 31.18
Kolmogorov-Smirnov Test Statistic	0.104	95% Percentile Bootstrap UCL 30.71
Kolmogorov-Smirnov 5% Critical Value	0.0971	95% BCA Bootstrap UCL 31.92
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 40.83
		97.5% Chebyshev(Mean, Sd) UCL 48.17
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 62.59
95% Approximate Gamma UCL	29.93	
95% Adjusted Gamma UCL	30.04	

Potential UCL to Use	Use 95% H-UCL 41.19

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	94	Number of Distinct Observations	77

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.5	Minimum of Log Data	0.405
Maximum	150	Maximum of Log Data	5.011
Mean	18.46	Mean of log Data	2.372
Median	8.4	SD of log Data	0.99
SD	24.29		
Std. Error of Mean	2.505		
Coefficient of Variation	1.316		
Skewness	2.95		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.248	Lilliefors Test Statistic	0.108
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.62	95% H-UCL	22
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26.57
95% Adjusted-CLT UCL (Chen-1995)	23.39	97.5% Chebyshev (MVUE) UCL	30.55
95% Modified-t UCL (Johnson-1978)	22.75	99% Chebyshev (MVUE) UCL	38.39

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.028	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	17.95	
MLE of Mean	18.46	
MLE of Standard Deviation	18.2	
nu star	193.3	
Approximate Chi Square Value (.05)	162.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 22.58
Adjusted Chi Square Value	161.7	95% Jackknife UCL 22.62
		95% Standard Bootstrap UCL 22.51
Anderson-Darling Test Statistic	3.593	95% Bootstrap-t UCL 23.88
Anderson-Darling 5% Critical Value	0.782	95% Hall's Bootstrap UCL 23.88
Kolmogorov-Smirnov Test Statistic	0.174	95% Percentile Bootstrap UCL 22.51
Kolmogorov-Smirnov 5% Critical Value	0.0949	95% BCA Bootstrap UCL 23.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 29.37
		97.5% Chebyshev(Mean, Sd) UCL 34.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 43.38
95% Approximate Gamma UCL	22	
95% Adjusted Gamma UCL	22.06	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 29.37

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	21	Number of Distinct Observations	7

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.05	Minimum of Log Data	-2.996
Maximum	2	Maximum of Log Data	0.693
Mean	0.175	Mean of log Data	-2.546
Median	0.055	SD of log Data	0.925
SD	0.427		
Std. Error of Mean	0.0931		
Coefficient of Variation	2.441		
Skewness	4.32		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.324	Shapiro Wilk Test Statistic	0.561
Shapiro Wilk Critical Value	0.908	Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.335	95% H-UCL	0.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.231
95% Adjusted-CLT UCL (Chen-1995)	0.422	97.5% Chebyshev (MVUE) UCL	0.281
95% Modified-t UCL (Johnson-1978)	0.35	99% Chebyshev (MVUE) UCL	0.378

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.672	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.26	
MLE of Mean	0.175	
MLE of Standard Deviation	0.213	
nu star	28.23	
Approximate Chi Square Value (.05)	17.11	**Nonparametric Statistics**
Adjusted Level of Significance	0.0383	95% CLT UCL 0.328
Adjusted Chi Square Value	16.44	95% Jackknife UCL 0.335
		95% Standard Bootstrap UCL 0.323
Anderson-Darling Test Statistic	4.795	95% Bootstrap-t UCL 1.775
Anderson-Darling 5% Critical Value	0.783	95% Hall's Bootstrap UCL 1.242
Kolmogorov-Smirnov Test Statistic	0.427	95% Percentile Bootstrap UCL 0.354
Kolmogorov-Smirnov 5% Critical Value	0.197	95% BCA Bootstrap UCL 0.466
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.58
		97.5% Chebyshev(Mean, Sd) UCL 0.756
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.101
95% Approximate Gamma UCL	0.288	
95% Adjusted Gamma UCL	0.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 0.58

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations	94	Number of Distinct Observations	50

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.31	Minimum of Log Data	-1.171
Maximum	4	Maximum of Log Data	1.386
Mean	1.363	Mean of log Data	0.106
Median	0.95	SD of log Data	0.645
SD	0.903		
Std. Error of Mean	0.0931		
Coefficient of Variation	0.662		
Skewness	1.11		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.232	Lilliefors Test Statistic	0.129
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.518	95% H-UCL	1.56
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.796
95% Adjusted-CLT UCL (Chen-1995)	1.528	97.5% Chebyshev (MVUE) UCL	1.983
95% Modified-t UCL (Johnson-1978)	1.52	99% Chebyshev (MVUE) UCL	2.349

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.527	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.539	
MLE of Mean	1.363	
MLE of Standard Deviation	0.858	
nu star	475.1	
Approximate Chi Square Value (.05)	425.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 1.516
Adjusted Chi Square Value	424.8	95% Jackknife UCL 1.518
		95% Standard Bootstrap UCL 1.513
Anderson-Darling Test Statistic	2.351	95% Bootstrap-t UCL 1.525
Anderson-Darling 5% Critical Value	0.761	95% Hall's Bootstrap UCL 1.524
Kolmogorov-Smirnov Test Statistic	0.167	95% Percentile Bootstrap UCL 1.513
Kolmogorov-Smirnov 5% Critical Value	0.0932	95% BCA Bootstrap UCL 1.539
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1.769
		97.5% Chebyshev(Mean, Sd) UCL 1.945
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.29
95% Approximate Gamma UCL	1.522	
95% Adjusted Gamma UCL	1.525	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1.769

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	94	Number of Distinct Observations	84

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.8	Minimum of Log Data	1.03
Maximum	330	Maximum of Log Data	5.799
Mean	31.41	Mean of log Data	2.846
Median	14.45	SD of log Data	0.98
SD	50.87		
Std. Error of Mean	5.247		
Coefficient of Variation	1.62		
Skewness	3.882		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.293	Lilliefors Test Statistic	0.138
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	40.13	95% H-UCL	34.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	42.1
95% Adjusted-CLT UCL (Chen-1995)	42.28	97.5% Chebyshev (MVUE) UCL	48.37
95% Modified-t UCL (Johnson-1978)	40.48	99% Chebyshev (MVUE) UCL	60.68

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.941	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	33.39	
MLE of Mean	31.41	
MLE of Standard Deviation	32.39	
nu star	176.8	
Approximate Chi Square Value (.05)	147.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 40.04
Adjusted Chi Square Value	146.7	95% Jackknife UCL 40.13
		95% Standard Bootstrap UCL 40.3
Anderson-Darling Test Statistic	5.566	95% Bootstrap-t UCL 43.98
Anderson-Darling 5% Critical Value	0.784	95% Hall's Bootstrap UCL 45.78
Kolmogorov-Smirnov Test Statistic	0.212	95% Percentile Bootstrap UCL 41.25
Kolmogorov-Smirnov 5% Critical Value	0.0952	95% BCA Bootstrap UCL 42.59
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 54.28
		97.5% Chebyshev(Mean, Sd) UCL 64.18
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 83.61
95% Approximate Gamma UCL	37.76	
95% Adjusted Gamma UCL	37.87	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 54.28

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations	93	Number of Distinct Observations	85

Raw Statistics		**Log-transformed Statistics**	
Minimum	2260	Minimum of Log Data	7.723
Maximum	74800	Maximum of Log Data	11.22
Mean	12658	Mean of log Data	9.199
Median	8730	SD of log Data	0.654
SD	11605		
Std. Error of Mean	1203		
Coefficient of Variation	0.917		
Skewness	3.228		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.233	Lilliefors Test Statistic	0.0953
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	14658	95% H-UCL	14007
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	16157
95% Adjusted-CLT UCL (Chen-1995)	15068	97.5% Chebyshev (MVUE) UCL	17863
95% Modified-t UCL (Johnson-1978)	14725	99% Chebyshev (MVUE) UCL	21215

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.113	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	5990	
MLE of Mean	12658	
MLE of Standard Deviation	8708	
nu star	393	
Approximate Chi Square Value (.05)	348.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 14638
Adjusted Chi Square Value	347.4	95% Jackknife UCL 14658
		95% Standard Bootstrap UCL 14623
Anderson-Darling Test Statistic	3.192	95% Bootstrap-t UCL 15455
Anderson-Darling 5% Critical Value	0.764	95% Hall's Bootstrap UCL 15474
Kolmogorov-Smirnov Test Statistic	0.147	95% Percentile Bootstrap UCL 14808
Kolmogorov-Smirnov 5% Critical Value	0.0939	95% BCA Bootstrap UCL 15204
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 17904
		97.5% Chebyshev(Mean, Sd) UCL 20173
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 24631
95% Approximate Gamma UCL	14293	
95% Adjusted Gamma UCL	14320	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 17904

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	94	Number of Distinct Observations	90

Raw Statistics		**Log-transformed Statistics**	
Minimum	6.7	Minimum of Log Data	1.902
Maximum	3000	Maximum of Log Data	8.006
Mean	485	Mean of log Data	5.445
Median	276.5	SD of log Data	1.34
SD	601.1		
Std. Error of Mean	62		
Coefficient of Variation	1.239		
Skewness	2.146		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.213	Lilliefors Test Statistic	0.0659
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	588.1	95% H-UCL	816.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1003
95% Adjusted-CLT UCL (Chen-1995)	601.7	97.5% Chebyshev (MVUE) UCL	1196
95% Modified-t UCL (Johnson-1978)	590.3	99% Chebyshev (MVUE) UCL	1574

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.784	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	618.9	
MLE of Mean	485	
MLE of Standard Deviation	547.9	
nu star	147.3	
Approximate Chi Square Value (.05)	120.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 587
Adjusted Chi Square Value	119.9	95% Jackknife UCL 588.1
		95% Standard Bootstrap UCL 587.3
Anderson-Darling Test Statistic	0.811	95% Bootstrap-t UCL 604.8
Anderson-Darling 5% Critical Value	0.792	95% Hall's Bootstrap UCL 606.6
Kolmogorov-Smirnov Test Statistic	0.0753	95% Percentile Bootstrap UCL 589.8
Kolmogorov-Smirnov 5% Critical Value	0.0957	95% BCA Bootstrap UCL 604
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 755.3
		97.5% Chebyshev(Mean, Sd) UCL 872.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1102
95% Approximate Gamma UCL	594.1	
95% Adjusted Gamma UCL	596	

Potential UCL to Use	Use 95% Approximate Gamma UCL 594.1

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead (TRW)

General Statistics

Number of Valid Observations	32	Number of Distinct Observations	30

Raw Statistics		**Log-transformed Statistics**	
Minimum	25	Minimum of Log Data	3.219
Maximum	8800	Maximum of Log Data	9.083
Mean	685.4	Mean of log Data	5.144
Median	114.5	SD of log Data	1.506
SD	1698		
Std. Error of Mean	300.2		
Coefficient of Variation	2.478		
Skewness	4.049		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.428	Shapiro Wilk Test Statistic	0.926
Shapiro Wilk Critical Value	0.93	Shapiro Wilk Critical Value	0.93
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1194	95% H-UCL	1233
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1232
95% Adjusted-CLT UCL (Chen-1995)	1409	97.5% Chebyshev (MVUE) UCL	1550
95% Modified-t UCL (Johnson-1978)	1230	99% Chebyshev (MVUE) UCL	2175

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.441	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1554	
MLE of Mean	685.4	
MLE of Standard Deviation	1032	
nu star	28.23	
Approximate Chi Square Value (.05)	17.11	**Nonparametric Statistics**
Adjusted Level of Significance	0.0416	95% CLT UCL 1179
Adjusted Chi Square Value	16.64	95% Jackknife UCL 1194
		95% Standard Bootstrap UCL 1180
Anderson-Darling Test Statistic	2.615	95% Bootstrap-t UCL 2212
Anderson-Darling 5% Critical Value	0.818	95% Hall's Bootstrap UCL 2716
Kolmogorov-Smirnov Test Statistic	0.214	95% Percentile Bootstrap UCL 1235
Kolmogorov-Smirnov 5% Critical Value	0.165	95% BCA Bootstrap UCL 1485
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1994
		97.5% Chebyshev(Mean, Sd) UCL 2560
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3673
95% Approximate Gamma UCL	1131	
95% Adjusted Gamma UCL	1163	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1994

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 C-2
ProUCL Output - Area 2 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	94	Number of Distinct Observations	74

Raw Statistics		**Log-transformed Statistics**	
Minimum	5	Minimum of Log Data	1.609
Maximum	53.9	Maximum of Log Data	3.987
Mean	15.68	Mean of log Data	2.621
Median	12.1	SD of log Data	0.496
SD	9.079		
Std. Error of Mean	0.936		
Coefficient of Variation	0.579		
Skewness	1.704		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.193	Lilliefors Test Statistic	0.116
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17.24	95% H-UCL	17.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	19.18
95% Adjusted-CLT UCL (Chen-1995)	17.4	97.5% Chebyshev (MVUE) UCL	20.76
95% Modified-t UCL (Johnson-1978)	17.27	99% Chebyshev (MVUE) UCL	23.86

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	3.827	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	4.098	
MLE of Mean	15.68	
MLE of Standard Deviation	8.017	
nu star	719.6	
Approximate Chi Square Value (.05)	658.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.0474	95% CLT UCL 17.22
Adjusted Chi Square Value	657.4	95% Jackknife UCL 17.24
		95% Standard Bootstrap UCL 17.16
Anderson-Darling Test Statistic	2.473	95% Bootstrap-t UCL 17.47
Anderson-Darling 5% Critical Value	0.756	95% Hall's Bootstrap UCL 17.43
Kolmogorov-Smirnov Test Statistic	0.143	95% Percentile Bootstrap UCL 17.28
Kolmogorov-Smirnov 5% Critical Value	0.0926	95% BCA Bootstrap UCL 17.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 19.77
		97.5% Chebyshev(Mean, Sd) UCL 21.53
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 25
95% Approximate Gamma UCL	17.14	
95% Adjusted Gamma UCL	17.17	

Potential UCL to Use	Use 95% Student's-t UCL 17.24
	or 95% Modified-t UCL 17.27

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area3_4_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations 50
Number of Distinct Observations 41

Raw Statistics

Minimum	1.9
Maximum	445
Mean	147.6
Median	90
SD	143.5
Std. Error of Mean	20.3
Coefficient of Variation	0.972
Skewness	0.759

Log-transformed Statistics

Minimum of Log Data	0.642
Maximum of Log Data	6.098
Mean of log Data	4.233
SD of log Data	1.529

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.824
Shapiro Wilk Critical Value	0.947

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.899
Shapiro Wilk Critical Value	0.947

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	181.6

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	183.3
95% Modified-t UCL (Johnson-1978)	182

Assuming Lognormal Distribution

95% H-UCL	425.7
95% Chebyshev (MVUE) UCL	478.1
97.5% Chebyshev (MVUE) UCL	593.4
99% Chebyshev (MVUE) UCL	820

Gamma Distribution Test

k star (bias corrected)	0.748
Theta Star	197.3
MLE of Mean	147.6
MLE of Standard Deviation	170.7
nu star	74.81
Approximate Chi Square Value (.05)	55.89
Adjusted Level of Significance	0.0452
Adjusted Chi Square Value	55.4
Anderson-Darling Test Statistic	0.816
Anderson-Darling 5% Critical Value	0.792
Kolmogorov-Smirnov Test Statistic	0.129
Kolmogorov-Smirnov 5% Critical Value	0.13

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	181
95% Jackknife UCL	181.6
95% Standard Bootstrap UCL	180.5
95% Bootstrap-t UCL	182.6
95% Hall's Bootstrap UCL	181.8
95% Percentile Bootstrap UCL	181.1
95% BCA Bootstrap UCL	183.1
95% Chebyshev(Mean, Sd) UCL	236.1
97.5% Chebyshev(Mean, Sd) UCL	274.4
99% Chebyshev(Mean, Sd) UCL	349.6

Assuming Gamma Distribution

95% Approximate Gamma UCL	197.6
95% Adjusted Gamma UCL	199.3

Potential UCL to Use

Use 95% Approximate Gamma UCL 197.6

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations 50
Number of Distinct Observations 41

Raw Statistics

Minimum	1.9
Maximum	445
Mean	146.1
Median	85
SD	142
Std. Error of Mean	20.09
Coefficient of Variation	0.972
Skewness	0.807

Log-transformed Statistics

Minimum of Log Data	0.642
Maximum of Log Data	6.098
Mean of log Data	4.224
SD of log Data	1.546

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.824
Shapiro Wilk Critical Value	0.947

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.891
Shapiro Wilk Critical Value	0.947

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	179.8

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	181.6
95% Modified-t UCL (Johnson-1978)	180.2

Assuming Lognormal Distribution

95% H-UCL	437.6
95% Chebyshev (MVUE) UCL	489
97.5% Chebyshev (MVUE) UCL	607.7
99% Chebyshev (MVUE) UCL	840.8

Gamma Distribution Test

k star (bias corrected)	0.749
Theta Star	195
MLE of Mean	146.1
MLE of Standard Deviation	168.8
nu star	74.93
Approximate Chi Square Value (.05)	55.99
Adjusted Level of Significance	0.0452
Adjusted Chi Square Value	55.5
Anderson-Darling Test Statistic	0.747
Anderson-Darling 5% Critical Value	0.792
Kolmogorov-Smirnov Test Statistic	0.12
Kolmogorov-Smirnov 5% Critical Value	0.13

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	195.6
95% Adjusted Gamma UCL	197.3

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	179.2
95% Jackknife UCL	179.8
95% Standard Bootstrap UCL	180.2
95% Bootstrap-t UCL	182.5
95% Hall's Bootstrap UCL	181.6
95% Percentile Bootstrap UCL	179.2
95% BCA Bootstrap UCL	182
95% Chebyshev(Mean, Sd) UCL	233.7
97.5% Chebyshev(Mean, Sd) UCL	271.6
99% Chebyshev(Mean, Sd) UCL	346

Potential UCL to Use

Use 95% Approximate Gamma UCL 195.6

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations 50
Number of Distinct Observations 43

Raw Statistics

Minimum	1.9
Maximum	445
Mean	149
Median	77.5
SD	141.3
Std. Error of Mean	19.98
Coefficient of Variation	0.948
Skewness	0.814

Log-transformed Statistics

Minimum of Log Data	0.642
Maximum of Log Data	6.098
Mean of log Data	4.338
SD of log Data	1.411

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.816
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-t UCL	182.4

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	184.3
95% Modified-t UCL (Johnson-1978)	182.8

Assuming Lognormal Distribution

95% H-UCL	366.7
95% Chebyshev (MVUE) UCL	425.6
97.5% Chebyshev (MVUE) UCL	523.4
99% Chebyshev (MVUE) UCL	715.5

Gamma Distribution Test

k star (bias corrected)	0.841
Theta Star	177
MLE of Mean	149
MLE of Standard Deviation	162.4
nu star	84.15
Approximate Chi Square Value (.05)	64
Adjusted Level of Significance	0.0452
Adjusted Chi Square Value	63.48
Anderson-Darling Test Statistic	0.939
Anderson-Darling 5% Critical Value	0.786
Kolmogorov-Smirnov Test Statistic	0.121
Kolmogorov-Smirnov 5% Critical Value	0.13

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	195.8
95% Adjusted Gamma UCL	197.4

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	181.8
95% Jackknife UCL	182.4
95% Standard Bootstrap UCL	181.7
95% Bootstrap-t UCL	184.3
95% Hall's Bootstrap UCL	183.1
95% Percentile Bootstrap UCL	182.8
95% BCA Bootstrap UCL	184.7
95% Chebyshev(Mean, Sd) UCL	236
97.5% Chebyshev(Mean, Sd) UCL	273.7
99% Chebyshev(Mean, Sd) UCL	347.7

Potential UCL to Use

Use 95% Approximate Gamma UCL 195.8

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations 91
Number of Distinct Observations 88

Raw Statistics

Minimum	302
Maximum	27600
Mean	3747
Median	2410
SD	3758
Std. Error of Mean	393.9
Coefficient of Variation	1.003
Skewness	3.3

Log-transformed Statistics

Minimum of Log Data	5.71
Maximum of Log Data	10.23
Mean of log Data	7.864
SD of log Data	0.86

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.188
Lilliefors Critical Value	0.0929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0537
Lilliefors Critical Value	0.0929

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	4402

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	4541
95% Modified-t UCL (Johnson-1978)	4425

Assuming Lognormal Distribution

95% H-UCL	4560
95% Chebyshev (MVUE) UCL	5437
97.5% Chebyshev (MVUE) UCL	6169
99% Chebyshev (MVUE) UCL	7608

Gamma Distribution Test

k star (bias corrected)	1.472
Theta Star	2545
MLE of Mean	3747
MLE of Standard Deviation	3088
nu star	268
Approximate Chi Square Value (.05)	231.1
Adjusted Level of Significance	0.0474
Adjusted Chi Square Value	230.5
Anderson-Darling Test Statistic	1.092
Anderson-Darling 5% Critical Value	0.771
Kolmogorov-Smirnov Test Statistic	0.0942
Kolmogorov-Smirnov 5% Critical Value	0.0955

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	4346
95% Adjusted Gamma UCL	4356

Nonparametric Statistics

95% CLT UCL	4395
95% Jackknife UCL	4402
95% Standard Bootstrap UCL	4391
95% Bootstrap-t UCL	4634
95% Hall's Bootstrap UCL	4805
95% Percentile Bootstrap UCL	4438
95% BCA Bootstrap UCL	4588
95% Chebyshev(Mean, Sd) UCL	5464
97.5% Chebyshev(Mean, Sd) UCL	6207
99% Chebyshev(Mean, Sd) UCL	7667

Potential UCL to Use

Use 95% Approximate Gamma UCL 4346

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations 89
Number of Distinct Observations 63

Raw Statistics

Minimum	0.07
Maximum	15.25
Mean	2.574
Median	1.5
SD	2.979
Std. Error of Mean	0.316
Coefficient of Variation	1.157
Skewness	2.214

Log-transformed Statistics

Minimum of Log Data	-2.659
Maximum of Log Data	2.725
Mean of log Data	0.224
SD of log Data	1.353

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.2
Lilliefors Critical Value	0.0939

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.196
Lilliefors Critical Value	0.0939

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.099

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.173
95% Modified-t UCL (Johnson-1978)	3.111

Assuming Lognormal Distribution

95% H-UCL	4.553
95% Chebyshev (MVUE) UCL	5.602
97.5% Chebyshev (MVUE) UCL	6.7
99% Chebyshev (MVUE) UCL	8.856

Gamma Distribution Test

k star (bias corrected)	0.8
Theta Star	3.218
MLE of Mean	2.574
MLE of Standard Deviation	2.878
nu star	142.4
Approximate Chi Square Value (.05)	115.8
Adjusted Level of Significance	0.0473
Adjusted Chi Square Value	115.4
Anderson-Darling Test Statistic	1.978
Anderson-Darling 5% Critical Value	0.791
Kolmogorov-Smirnov Test Statistic	0.145
Kolmogorov-Smirnov 5% Critical Value	0.0982

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.165
95% Adjusted Gamma UCL	3.175

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	3.093
95% Jackknife UCL	3.099
95% Standard Bootstrap UCL	3.085
95% Bootstrap-t UCL	3.176
95% Hall's Bootstrap UCL	3.201
95% Percentile Bootstrap UCL	3.138
95% BCA Bootstrap UCL	3.182
95% Chebyshev(Mean, Sd) UCL	3.951
97.5% Chebyshev(Mean, Sd) UCL	4.546
99% Chebyshev(Mean, Sd) UCL	5.716

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 3.951

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations 90
Number of Distinct Observations 61

Raw Statistics

Minimum	0.16
Maximum	144
Mean	6.332
Median	3.9
SD	15.51
Std. Error of Mean	1.634
Coefficient of Variation	2.449
Skewness	8.126

Log-transformed Statistics

Minimum of Log Data	-1.833
Maximum of Log Data	4.97
Mean of log Data	1.142
SD of log Data	1.135

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.345
Lilliefors Critical Value	0.0934

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0952
Lilliefors Critical Value	0.0934

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	9.048

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	10.52
95% Modified-t UCL (Johnson-1978)	9.282

Assuming Lognormal Distribution

95% H-UCL	7.942
95% Chebyshev (MVUE) UCL	9.723
97.5% Chebyshev (MVUE) UCL	11.38
99% Chebyshev (MVUE) UCL	14.63

Gamma Distribution Test

k star (bias corrected)	0.818
Theta Star	7.737
MLE of Mean	6.332
MLE of Standard Deviation	6.999
nu star	147.3
Approximate Chi Square Value (.05)	120.2
Adjusted Level of Significance	0.0473
Adjusted Chi Square Value	119.9
Anderson-Darling Test Statistic	2.533
Anderson-Darling 5% Critical Value	0.79
Kolmogorov-Smirnov Test Statistic	0.152
Kolmogorov-Smirnov 5% Critical Value	0.0976

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	7.756
95% Adjusted Gamma UCL	7.782

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	9.02
95% Jackknife UCL	9.048
95% Standard Bootstrap UCL	9.099
95% Bootstrap-t UCL	15.52
95% Hall's Bootstrap UCL	19.12
95% Percentile Bootstrap UCL	9.402
95% BCA Bootstrap UCL	11.67
95% Chebyshev(Mean, Sd) UCL	13.46
97.5% Chebyshev(Mean, Sd) UCL	16.54
99% Chebyshev(Mean, Sd) UCL	22.59

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 13.46

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations 30
Number of Distinct Observations 21

Raw Statistics

Minimum	0.31
Maximum	2.4
Mean	0.699
Median	0.6
SD	0.39
Std. Error of Mean	0.0712
Coefficient of Variation	0.557
Skewness	3.103

Log-transformed Statistics

Minimum of Log Data	-1.171
Maximum of Log Data	0.875
Mean of log Data	-0.455
SD of log Data	0.415

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.695
Shapiro Wilk Critical Value	0.927

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.927

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.82

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.859
95% Modified-t UCL (Johnson-1978)	0.827

Assuming Lognormal Distribution

95% H-UCL	0.8
95% Chebyshev (MVUE) UCL	0.925
97.5% Chebyshev (MVUE) UCL	1.026
99% Chebyshev (MVUE) UCL	1.226

Gamma Distribution Test

k star (bias corrected)	4.799
Theta Star	0.146
MLE of Mean	0.699
MLE of Standard Deviation	0.319
nu star	287.9
Approximate Chi Square Value (.05)	249.6
Adjusted Level of Significance	0.041
Adjusted Chi Square Value	247.6
Anderson-Darling Test Statistic	1.033
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.202
Kolmogorov-Smirnov 5% Critical Value	0.16

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.807
95% Adjusted Gamma UCL	0.813

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.816
95% Jackknife UCL	0.82
95% Standard Bootstrap UCL	0.814
95% Bootstrap-t UCL	0.913
95% Hall's Bootstrap UCL	1.375
95% Percentile Bootstrap UCL	0.83
95% BCA Bootstrap UCL	0.868
95% Chebyshev(Mean, Sd) UCL	1.009
97.5% Chebyshev(Mean, Sd) UCL	1.144
99% Chebyshev(Mean, Sd) UCL	1.407

Potential UCL to Use

Use 95% Student's-t UCL 0.82
or 95% Modified-t UCL 0.827
or 95% H-UCL 0.8

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations 82
Number of Distinct Observations 63

Raw Statistics

Minimum	0.13
Maximum	12.7
Mean	2.434
Median	1.75
SD	2.7
Std. Error of Mean	0.298
Coefficient of Variation	1.109
Skewness	2.142

Log-transformed Statistics

Minimum of Log Data	-2.04
Maximum of Log Data	2.542
Mean of log Data	0.331
SD of log Data	1.13

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.23
Lilliefors Critical Value	0.0978

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.173
Lilliefors Critical Value	0.0978

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	2.93

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3
95% Modified-t UCL (Johnson-1978)	2.942

Assuming Lognormal Distribution

95% H-UCL	3.547
95% Chebyshev (MVUE) UCL	4.359
97.5% Chebyshev (MVUE) UCL	5.118
99% Chebyshev (MVUE) UCL	6.61

Gamma Distribution Test

k star (bias corrected)	1
Theta Star	2.434
MLE of Mean	2.434
MLE of Standard Deviation	2.434
nu star	164
Approximate Chi Square Value (.05)	135.4
Adjusted Level of Significance	0.0471
Adjusted Chi Square Value	134.9
Anderson-Darling Test Statistic	1.397
Anderson-Darling 5% Critical Value	0.781
Kolmogorov-Smirnov Test Statistic	0.116
Kolmogorov-Smirnov 5% Critical Value	0.102

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	2.948
95% Adjusted Gamma UCL	2.958

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	2.925
95% Jackknife UCL	2.93
95% Standard Bootstrap UCL	2.923
95% Bootstrap-t UCL	3.029
95% Hall's Bootstrap UCL	3.014
95% Percentile Bootstrap UCL	2.948
95% BCA Bootstrap UCL	3.014
95% Chebyshev(Mean, Sd) UCL	3.734
97.5% Chebyshev(Mean, Sd) UCL	4.296
99% Chebyshev(Mean, Sd) UCL	5.401

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 3.734

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations 91
Number of Distinct Observations 86

Raw Statistics

Minimum	912
Maximum	62800
Mean	13772
Median	11500
SD	9556
Std. Error of Mean	1002
Coefficient of Variation	0.694
Skewness	1.992

Log-transformed Statistics

Minimum of Log Data	6.816
Maximum of Log Data	11.05
Mean of log Data	9.297
SD of log Data	0.734

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.102
Lilliefors Critical Value	0.0929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0955
Lilliefors Critical Value	0.0929

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	15437

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	15644
95% Modified-t UCL (Johnson-1978)	15472

Assuming Lognormal Distribution

95% H-UCL	16717
95% Chebyshev (MVUE) UCL	19537
97.5% Chebyshev (MVUE) UCL	21835
99% Chebyshev (MVUE) UCL	26351

Gamma Distribution Test

k star (bias corrected)	2.225
Theta Star	6190
MLE of Mean	13772
MLE of Standard Deviation	9233
nu star	404.9
Approximate Chi Square Value (.05)	359.3
Adjusted Level of Significance	0.0474
Adjusted Chi Square Value	358.6

Anderson-Darling Test Statistic	0.26
Anderson-Darling 5% Critical Value	0.763
Kolmogorov-Smirnov Test Statistic	0.0617
Kolmogorov-Smirnov 5% Critical Value	0.0948

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	15522
95% Adjusted Gamma UCL	15552

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	15420
95% Jackknife UCL	15437
95% Standard Bootstrap UCL	15441
95% Bootstrap-t UCL	15626
95% Hall's Bootstrap UCL	15957
95% Percentile Bootstrap UCL	15436
95% BCA Bootstrap UCL	15621
95% Chebyshev(Mean, Sd) UCL	18139
97.5% Chebyshev(Mean, Sd) UCL	20028
99% Chebyshev(Mean, Sd) UCL	23740

Potential UCL to Use

Use 95% Approximate Gamma UCL 15522

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.

Manganese

General Statistics

Number of Valid Observations 91
Number of Distinct Observations 88

Raw Statistics

Minimum	3
Maximum	940
Mean	122.4
Median	60.7
SD	139.5
Std. Error of Mean	14.62
Coefficient of Variation	1.14
Skewness	2.696

Log-transformed Statistics

Minimum of Log Data	1.099
Maximum of Log Data	6.846
Mean of log Data	4.191
SD of log Data	1.223

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.205
Lilliefors Critical Value	0.0929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0868
Lilliefors Critical Value	0.0929

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	146.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	150.9
95% Modified-t UCL (Johnson-1978)	147.4

Assuming Lognormal Distribution

95% H-UCL	192.2
95% Chebyshev (MVUE) UCL	236
97.5% Chebyshev (MVUE) UCL	278.6
99% Chebyshev (MVUE) UCL	362.1

Gamma Distribution Test

k star (bias corrected)	0.92
Theta Star	133.1
MLE of Mean	122.4
MLE of Standard Deviation	127.6
nu star	167.4
Approximate Chi Square Value (.05)	138.5
Adjusted Level of Significance	0.0474
Adjusted Chi Square Value	138
Anderson-Darling Test Statistic	0.932
Anderson-Darling 5% Critical Value	0.785
Kolmogorov-Smirnov Test Statistic	0.121
Kolmogorov-Smirnov 5% Critical Value	0.0967

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	148
95% Adjusted Gamma UCL	148.4

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	146.5
95% Jackknife UCL	146.7
95% Standard Bootstrap UCL	145.9
95% Bootstrap-t UCL	153.2
95% Hall's Bootstrap UCL	158.8
95% Percentile Bootstrap UCL	146.6
95% BCA Bootstrap UCL	150.7
95% Chebyshev(Mean, Sd) UCL	186.1
97.5% Chebyshev(Mean, Sd) UCL	213.7
99% Chebyshev(Mean, Sd) UCL	267.9

Potential UCL to Use

Use 95% H-UCL 192.2

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 C-3
ProUCL Output - Areas 3 and 4 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations 91
Number of Distinct Observations 82

Raw Statistics

Minimum	0.65
Maximum	112
Mean	18.95
Median	14.1
SD	15.77
Std. Error of Mean	1.653
Coefficient of Variation	0.832
Skewness	2.649

Log-transformed Statistics

Minimum of Log Data	-0.431
Maximum of Log Data	4.718
Mean of log Data	2.645
SD of log Data	0.816

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.16
Lilliefors Critical Value	0.0929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.07
Lilliefors Critical Value	0.0929

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	21.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	22.16
95% Modified-t UCL (Johnson-1978)	21.78

Assuming Lognormal Distribution

95% H-UCL	23.49
95% Chebyshev (MVUE) UCL	27.85
97.5% Chebyshev (MVUE) UCL	31.43
99% Chebyshev (MVUE) UCL	38.48

Gamma Distribution Test

k star (bias corrected)	1.779
Theta Star	10.66
MLE of Mean	18.95
MLE of Standard Deviation	14.21
nu star	323.7
Approximate Chi Square Value (.05)	283
Adjusted Level of Significance	0.0474
Adjusted Chi Square Value	282.4
Anderson-Darling Test Statistic	0.622
Anderson-Darling 5% Critical Value	0.767
Kolmogorov-Smirnov Test Statistic	0.083
Kolmogorov-Smirnov 5% Critical Value	0.0951

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	21.68
95% Adjusted Gamma UCL	21.73

Nonparametric Statistics

95% CLT UCL	21.67
95% Jackknife UCL	21.7
95% Standard Bootstrap UCL	21.61
95% Bootstrap-t UCL	22.29
95% Hall's Bootstrap UCL	22.58
95% Percentile Bootstrap UCL	21.7
95% BCA Bootstrap UCL	22.05
95% Chebyshev(Mean, Sd) UCL	26.16
97.5% Chebyshev(Mean, Sd) UCL	29.28
99% Chebyshev(Mean, Sd) UCL	35.4

Potential UCL to Use

Use 95% Approximate Gamma UCL 21.68

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.

Zinc

General Statistics

Number of Valid Observations 91

Number of Distinct Observations 84

Raw Statistics

Minimum	2.1
Maximum	5160
Mean	91.53
Median	27.2
SD	538
Std. Error of Mean	56.39
Coefficient of Variation	5.878
Skewness	9.499

Log-transformed Statistics

Minimum of Log Data	0.742
Maximum of Log Data	8.549
Mean of log Data	3.222
SD of log Data	1.151

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.461
Lilliefors Critical Value	0.0929

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.121
Lilliefors Critical Value	0.0929

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	185.3

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	244.3
95% Modified-t UCL (Johnson-1978)	194.6

Assuming Lognormal Distribution

95% H-UCL	65.01
95% Chebyshev (MVUE) UCL	79.62
97.5% Chebyshev (MVUE) UCL	93.28
99% Chebyshev (MVUE) UCL	120.1

Gamma Distribution Test

k star (bias corrected)	0.483
Theta Star	189.5
MLE of Mean	91.53
MLE of Standard Deviation	131.7
nu star	87.91
Approximate Chi Square Value (.05)	67.29
Adjusted Level of Significance	0.0474
Adjusted Chi Square Value	67.01
Anderson-Darling Test Statistic	10.55
Anderson-Darling 5% Critical Value	0.82
Kolmogorov-Smirnov Test Statistic	0.295
Kolmogorov-Smirnov 5% Critical Value	0.0992

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	119.6
95% Adjusted Gamma UCL	120.1

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	184.3
95% Jackknife UCL	185.3
95% Standard Bootstrap UCL	185.8
95% Bootstrap-t UCL	1362
95% Hall's Bootstrap UCL	617
95% Percentile Bootstrap UCL	202.5
95% BCA Bootstrap UCL	263.3
95% Chebyshev(Mean, Sd) UCL	337.3
97.5% Chebyshev(Mean, Sd) UCL	443.7
99% Chebyshev(Mean, Sd) UCL	652.6

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 337.3

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 C-4

ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil

Raritan Bay Slag Site

Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area5_6_9_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Number of Valid Observations	11	Number of Distinct Observations	8

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	110	Maximum of Log Data	4.7
Mean	39.68	Mean of log Data	2.781
Median	21	SD of log Data	1.578
SD	46.52		
Std. Error of Mean	14.02		
Coefficient of Variation	1.172		
Skewness	0.989		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.733	Shapiro Wilk Test Statistic	0.906
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	65.1	95% H-UCL	456.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	148
95% Adjusted-CLT UCL (Chen-1995)	67.21	97.5% Chebyshev (MVUE) UCL	192.3
95% Modified-t UCL (Johnson-1978)	65.79	99% Chebyshev (MVUE) UCL	279.2

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.552	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	71.92	
MLE of Mean	39.68	
MLE of Standard Deviation	53.42	
nu star	12.14	
Approximate Chi Square Value (.05)	5.317	**Nonparametric Statistics**
Adjusted Level of Significance	0.0278	95% CLT UCL 62.75
Adjusted Chi Square Value	4.603	95% Jackknife UCL 65.1
		95% Standard Bootstrap UCL 61.92
Anderson-Darling Test Statistic	0.512	95% Bootstrap-t UCL 70.53
Anderson-Darling 5% Critical Value	0.768	95% Hall's Bootstrap UCL 56.77
Kolmogorov-Smirnov Test Statistic	0.19	95% Percentile Bootstrap UCL 63.81
Kolmogorov-Smirnov 5% Critical Value	0.266	95% BCA Bootstrap UCL 65.18
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 100.8
		97.5% Chebyshev(Mean, Sd) UCL 127.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 179.2
95% Approximate Gamma UCL	90.57	
95% Adjusted Gamma UCL	104.6	

Potential UCL to Use	Use 95% Approximate Gamma UCL 90.57

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	309	Number of Distinct Observations	221
Number of Missing Values	1		

Raw Statistics		**Log-transformed Statistics**	
Minimum	160	Minimum of Log Data	5.075
Maximum	11600	Maximum of Log Data	9.359
Mean	1298	Mean of log Data	6.956
Median	1060	SD of log Data	0.652
SD	1059		
Std. Error of Mean	60.27		
Coefficient of Variation	0.816		
Skewness	4.439		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.189	Lilliefors Test Statistic	0.0986
Lilliefors Critical Value	0.0504	Lilliefors Critical Value	0.0504
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1397	95% H-UCL	1391
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1527
95% Adjusted-CLT UCL (Chen-1995)	1413	97.5% Chebyshev (MVUE) UCL	1627
95% Modified-t UCL (Johnson-1978)	1400	99% Chebyshev (MVUE) UCL	1822

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.482	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	523	
MLE of Mean	1298	
MLE of Standard Deviation	823.9	
nu star	1534	
Approximate Chi Square Value (.05)	1444	**Nonparametric Statistics**
Adjusted Level of Significance	0.0492	95% CLT UCL 1397
Adjusted Chi Square Value	1443	95% Jackknife UCL 1397
		95% Standard Bootstrap UCL 1397
Anderson-Darling Test Statistic	5.069	95% Bootstrap-t UCL 1419
Anderson-Darling 5% Critical Value	0.763	95% Hall's Bootstrap UCL 1427
Kolmogorov-Smirnov Test Statistic	0.104	95% Percentile Bootstrap UCL 1403
Kolmogorov-Smirnov 5% Critical Value	0.052	95% BCA Bootstrap UCL 1417
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1561
		97.5% Chebyshev(Mean, Sd) UCL 1674
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1898
95% Approximate Gamma UCL	1379	
95% Adjusted Gamma UCL	1379	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1561

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	448	Number of Distinct Observations	127
Number of Missing Values	10		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.07	Minimum of Log Data	-2.659
Maximum	210	Maximum of Log Data	5.347
Mean	4.417	Mean of log Data	0.818
Median	3.1	SD of log Data	1.044
SD	11.76		
Std. Error of Mean	0.556		
Coefficient of Variation	2.663		
Skewness	12.88		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.367	Lilliefors Test Statistic	0.206
Lilliefors Critical Value	0.0419	Lilliefors Critical Value	0.0419
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5.333	95% H-UCL	4.341
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.934
95% Adjusted-CLT UCL (Chen-1995)	5.693	97.5% Chebyshev (MVUE) UCL	5.382
95% Modified-t UCL (Johnson-1978)	5.39	99% Chebyshev (MVUE) UCL	6.262

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.874	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	5.054	
MLE of Mean	4.417	
MLE of Standard Deviation	4.725	
nu star	783.2	
Approximate Chi Square Value (.05)	719.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0495	95% CLT UCL 5.331
Adjusted Chi Square Value	719	95% Jackknife UCL 5.333
		95% Standard Bootstrap UCL 5.335
Anderson-Darling Test Statistic	2.232E+28	95% Bootstrap-t UCL 6.197
Anderson-Darling 5% Critical Value	0.791	95% Hall's Bootstrap UCL 9.195
Kolmogorov-Smirnov Test Statistic	0.23	95% Percentile Bootstrap UCL 5.466
Kolmogorov-Smirnov 5% Critical Value	0.0444	95% BCA Bootstrap UCL 5.806
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 6.84
		97.5% Chebyshev(Mean, Sd) UCL 7.888
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 9.948
95% Approximate Gamma UCL	4.81	
95% Adjusted Gamma UCL	4.811	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 6.84

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	453	Number of Distinct Observations	143
Number of Missing Values	12		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.51	Minimum of Log Data	-0.673
Maximum	54	Maximum of Log Data	3.989
Mean	5.703	Mean of log Data	1.402
Median	3.7	SD of log Data	0.796
SD	5.853		
Std. Error of Mean	0.275		
Coefficient of Variation	1.026		
Skewness	3.392		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.189	Lilliefors Test Statistic	0.057
Lilliefors Critical Value	0.0416	Lilliefors Critical Value	0.0416
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	6.156	95% H-UCL	6.003
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	6.613
95% Adjusted-CLT UCL (Chen-1995)	6.202	97.5% Chebyshev (MVUE) UCL	7.063
95% Modified-t UCL (Johnson-1978)	6.163	99% Chebyshev (MVUE) UCL	7.947

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.613	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	3.536	
MLE of Mean	5.703	
MLE of Standard Deviation	4.49	
nu star	1461	
Approximate Chi Square Value (.05)	1373	**Nonparametric Statistics**
Adjusted Level of Significance	0.0495	95% CLT UCL 6.155
Adjusted Chi Square Value	1373	95% Jackknife UCL 6.156
		95% Standard Bootstrap UCL 6.15
Anderson-Darling Test Statistic	7.868	95% Bootstrap-t UCL 6.227
Anderson-Darling 5% Critical Value	0.771	95% Hall's Bootstrap UCL 6.214
Kolmogorov-Smirnov Test Statistic	0.109	95% Percentile Bootstrap UCL 6.175
Kolmogorov-Smirnov 5% Critical Value	0.0434	95% BCA Bootstrap UCL 6.185
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 6.901
		97.5% Chebyshev(Mean, Sd) UCL 7.42
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 8.439
95% Approximate Gamma UCL	6.067	
95% Adjusted Gamma UCL	6.068	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 6.901

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations 28
Number of Distinct Observations 14

Raw Statistics

Minimum	0.37
Maximum	1.1
Mean	0.611
Median	0.575
SD	0.142
Std. Error of Mean	0.0268
Coefficient of Variation	0.232
Skewness	1.622

Log-transformed Statistics

Minimum of Log Data	-0.994
Maximum of Log Data	0.0953
Mean of log Data	-0.515
SD of log Data	0.214

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.853
Shapiro Wilk Critical Value	0.924

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.921
Shapiro Wilk Critical Value	0.924

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.657

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.664
95% Modified-t UCL (Johnson-1978)	0.658

Assuming Lognormal Distribution

95% H-UCL	0.657
95% Chebyshev (MVUE) UCL	0.719
97.5% Chebyshev (MVUE) UCL	0.766
99% Chebyshev (MVUE) UCL	0.858

Gamma Distribution Test

k star (bias corrected)	19.65
Theta Star	0.0311
MLE of Mean	0.611
MLE of Standard Deviation	0.138
nu star	1101
Approximate Chi Square Value (.05)	1025
Adjusted Level of Significance	0.0404
Adjusted Chi Square Value	1020
Anderson-Darling Test Statistic	1.133
Anderson-Darling 5% Critical Value	0.744
Kolmogorov-Smirnov Test Statistic	0.181
Kolmogorov-Smirnov 5% Critical Value	0.165

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.657
95% Adjusted Gamma UCL	0.66

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.655
95% Jackknife UCL	0.657
95% Standard Bootstrap UCL	0.656
95% Bootstrap-t UCL	0.669
95% Hall's Bootstrap UCL	0.687
95% Percentile Bootstrap UCL	0.658
95% BCA Bootstrap UCL	0.669
95% Chebyshev(Mean, Sd) UCL	0.728
97.5% Chebyshev(Mean, Sd) UCL	0.779
99% Chebyshev(Mean, Sd) UCL	0.878

Potential UCL to Use

Use 95% Student's-t UCL 0.657
or 95% Modified-t UCL 0.658

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.

Cobalt

General Statistics

Number of Valid Observations	352	Number of Distinct Observations	110

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.12	Minimum of Log Data	-2.12
Maximum	11.1	Maximum of Log Data	2.407
Mean	1.791	Mean of log Data	0.259
Median	1.5	SD of log Data	0.895
SD	1.309		
Std. Error of Mean	0.0698		
Coefficient of Variation	0.731		
Skewness	1.608		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.159	Lilliefors Test Statistic	0.217
Lilliefors Critical Value	0.0472	Lilliefors Critical Value	0.0472
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.906	95% H-UCL	2.132
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.404
95% Adjusted-CLT UCL (Chen-1995)	1.912	97.5% Chebyshev (MVUE) UCL	2.609
95% Modified-t UCL (Johnson-1978)	1.907	99% Chebyshev (MVUE) UCL	3.011

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.678	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1.067	
MLE of Mean	1.791	
MLE of Standard Deviation	1.383	
nu star	1182	
Approximate Chi Square Value (.05)	1103	**Nonparametric Statistics**
Adjusted Level of Significance	0.0493	95% CLT UCL 1.906
Adjusted Chi Square Value	1103	95% Jackknife UCL 1.906
		95% Standard Bootstrap UCL 1.903
Anderson-Darling Test Statistic	11.13	95% Bootstrap-t UCL 1.91
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL 1.909
Kolmogorov-Smirnov Test Statistic	0.21	95% Percentile Bootstrap UCL 1.902
Kolmogorov-Smirnov 5% Critical Value	0.0493	95% BCA Bootstrap UCL 1.907
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.095
		97.5% Chebyshev(Mean, Sd) UCL 2.227
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.486
95% Approximate Gamma UCL	1.919	
95% Adjusted Gamma UCL	1.92	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2.095

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
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Iron

General Statistics

Number of Valid Observations 310
Number of Distinct Observations 255

Raw Statistics

Minimum	1670
Maximum	77000
Mean	13381
Median	10000
SD	10727
Std. Error of Mean	609.2
Coefficient of Variation	0.802
Skewness	2.062

Log-transformed Statistics

Minimum of Log Data	7.421
Maximum of Log Data	11.25
Mean of log Data	9.236
SD of log Data	0.731

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.144
Lilliefors Critical Value	0.0503

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0448
Lilliefors Critical Value	0.0503

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	14387

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	14460
95% Modified-t UCL (Johnson-1978)	14399

Assuming Lognormal Distribution

95% H-UCL	14511
95% Chebyshev (MVUE) UCL	16098
97.5% Chebyshev (MVUE) UCL	17273
99% Chebyshev (MVUE) UCL	19582

Gamma Distribution Test

k star (bias corrected)	2.013
Theta Star	6648
MLE of Mean	13381
MLE of Standard Deviation	9432
nu star	1248
Approximate Chi Square Value (.05)	1167
Adjusted Level of Significance	0.0492
Adjusted Chi Square Value	1167
Anderson-Darling Test Statistic	2.446
Anderson-Darling 5% Critical Value	0.766
Kolmogorov-Smirnov Test Statistic	0.0671
Kolmogorov-Smirnov 5% Critical Value	0.052

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	14311
95% Adjusted Gamma UCL	14315

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	14384
95% Jackknife UCL	14387
95% Standard Bootstrap UCL	14387
95% Bootstrap-t UCL	14463
95% Hall's Bootstrap UCL	14469
95% Percentile Bootstrap UCL	14356
95% BCA Bootstrap UCL	14430
95% Chebyshev(Mean, Sd) UCL	16037
97.5% Chebyshev(Mean, Sd) UCL	17186
99% Chebyshev(Mean, Sd) UCL	19443

Potential UCL to Use

Use 95% H-UCL 14511

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
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Lead

General Statistics

Number of Valid Observations	447	Number of Distinct Observations	282
Number of Missing Values	18		

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	1090	Maximum of Log Data	6.994
Mean	67.96	Mean of log Data	2.99
Median	19	SD of log Data	1.549
SD	142.8		
Std. Error of Mean	6.754		
Coefficient of Variation	2.101		
Skewness	4.154		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.32	Lilliefors Test Statistic	0.0609
Lilliefors Critical Value	0.0419	Lilliefors Critical Value	0.0419
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	79.09	95% H-UCL	79.94
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	96.41
95% Adjusted-CLT UCL (Chen-1995)	80.48	97.5% Chebyshev (MVUE) UCL	109.7
95% Modified-t UCL (Johnson-1978)	79.31	99% Chebyshev (MVUE) UCL	135.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.513	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	132.5	
MLE of Mean	67.96	
MLE of Standard Deviation	94.9	
nu star	458.4	
Approximate Chi Square Value (.05)	409.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0495	95% CLT UCL 79.06
Adjusted Chi Square Value	409.6	95% Jackknife UCL 79.09
		95% Standard Bootstrap UCL 79.3
Anderson-Darling Test Statistic	17.94	95% Bootstrap-t UCL 81.65
Anderson-Darling 5% Critical Value	0.821	95% Hall's Bootstrap UCL 80.44
Kolmogorov-Smirnov Test Statistic	0.158	95% Percentile Bootstrap UCL 79.15
Kolmogorov-Smirnov 5% Critical Value	0.0454	95% BCA Bootstrap UCL 80.93
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 97.39
		97.5% Chebyshev(Mean, Sd) UCL 110.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 135.2
95% Approximate Gamma UCL	76.02	
95% Adjusted Gamma UCL	76.05	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 97.39

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	352	Number of Distinct Observations	277
Number of Missing Values	3		

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.3	Minimum of Log Data	0.833
Maximum	3470	Maximum of Log Data	8.152
Mean	51.6	Mean of log Data	3.452
Median	30.75	SD of log Data	0.742
SD	190.8		
Std. Error of Mean	10.17		
Coefficient of Variation	3.697		
Skewness	16.66		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.398	Lilliefors Test Statistic	0.069
Lilliefors Critical Value	0.0472	Lilliefors Critical Value	0.0472
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	68.37	95% H-UCL	44.91
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	49.62
95% Adjusted-CLT UCL (Chen-1995)	77.98	97.5% Chebyshev (MVUE) UCL	53.12
95% Modified-t UCL (Johnson-1978)	69.88	99% Chebyshev (MVUE) UCL	59.97

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.148	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	44.93	
MLE of Mean	51.6	
MLE of Standard Deviation	48.15	
nu star	808.5	
Approximate Chi Square Value (.05)	743.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0493	95% CLT UCL 68.33
Adjusted Chi Square Value	743.2	95% Jackknife UCL 68.37
		95% Standard Bootstrap UCL 68.26
Anderson-Darling Test Statistic	2.841E+28	95% Bootstrap-t UCL 113.9
Anderson-Darling 5% Critical Value	0.781	95% Hall's Bootstrap UCL 126.1
Kolmogorov-Smirnov Test Statistic	0.189	95% Percentile Bootstrap UCL 70.27
Kolmogorov-Smirnov 5% Critical Value	0.0498	95% BCA Bootstrap UCL 84.47
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 95.92
		97.5% Chebyshev(Mean, Sd) UCL 115.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 152.8
95% Approximate Gamma UCL	56.11	
95% Adjusted Gamma UCL	56.13	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 95.92

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 C-4
ProUCL Output - Areas 5, 6 and Beach Area of Area 9 Surface Soil
Raritan Bay Slag Site
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Vanadium

General Statistics

Number of Valid Observations	351	Number of Distinct Observations	221
Number of Missing Values	1		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.52	Minimum of Log Data	-0.654
Maximum	125	Maximum of Log Data	4.828
Mean	17.53	Mean of log Data	2.599
Median	13.8	SD of log Data	0.743
SD	14.27		
Std. Error of Mean	0.762		
Coefficient of Variation	0.814		
Skewness	2.82		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.144	Lilliefors Test Statistic	0.025
Lilliefors Critical Value	0.0473	Lilliefors Critical Value	0.0473
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	18.79	95% H-UCL	19.14
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	21.15
95% Adjusted-CLT UCL (Chen-1995)	18.9	97.5% Chebyshev (MVUE) UCL	22.64
95% Modified-t UCL (Johnson-1978)	18.8	99% Chebyshev (MVUE) UCL	25.57

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.023	**Data appear Lognormal at 5% Significance Level**
Theta Star	8.666	
MLE of Mean	17.53	
MLE of Standard Deviation	12.32	
nu star	1420	
Approximate Chi Square Value (.05)	1334	
Adjusted Level of Significance	0.0493	
Adjusted Chi Square Value	1333	
Anderson-Darling Test Statistic	1.527	
Anderson-Darling 5% Critical Value	0.766	
Kolmogorov-Smirnov Test Statistic	0.0585	
Kolmogorov-Smirnov 5% Critical Value	0.0492	
Data not Gamma Distributed at 5% Significance Level		
Assuming Gamma Distribution		
95% Approximate Gamma UCL	18.67	
95% Adjusted Gamma UCL	18.67	

Nonparametric Statistics	
95% CLT UCL	18.78
95% Jackknife UCL	18.79
95% Standard Bootstrap UCL	18.79
95% Bootstrap-t UCL	18.91
95% Hall's Bootstrap UCL	18.97
95% Percentile Bootstrap UCL	18.79
95% BCA Bootstrap UCL	18.93
95% Chebyshev(Mean, Sd) UCL	20.85
97.5% Chebyshev(Mean, Sd) UCL	22.29
99% Chebyshev(Mean, Sd) UCL	25.11

Potential UCL to Use	Use 95% H-UCL 19.14

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area9_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations	128	Number of Distinct Observations	65

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.8	Minimum of Log Data	0.588
Maximum	3000	Maximum of Log Data	8.006
Mean	65.92	Mean of log Data	2.28
Median	7.65	SD of log Data	1.637
SD	285.5		
Std. Error of Mean	25.23		
Coefficient of Variation	4.331		
Skewness	8.944		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.411	Lilliefors Test Statistic	0.155
Lilliefors Critical Value	0.0783	Lilliefors Critical Value	0.0783
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	107.7	95% H-UCL	56.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	69.98
95% Adjusted-CLT UCL (Chen-1995)	128.7	97.5% Chebyshev (MVUE) UCL	84.48
95% Modified-t UCL (Johnson-1978)	111.1	99% Chebyshev (MVUE) UCL	113

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.349	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	188.9	
MLE of Mean	65.92	
MLE of Standard Deviation	111.6	
nu star	89.34	
Approximate Chi Square Value (.05)	68.55	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 107.4
Adjusted Chi Square Value	68.34	95% Jackknife UCL 107.7
		95% Standard Bootstrap UCL 107.1
Anderson-Darling Test Statistic	13.75	95% Bootstrap-t UCL 182.3
Anderson-Darling 5% Critical Value	0.855	95% Hall's Bootstrap UCL 245.8
Kolmogorov-Smirnov Test Statistic	0.269	95% Percentile Bootstrap UCL 112.2
Kolmogorov-Smirnov 5% Critical Value	0.0887	95% BCA Bootstrap UCL 144
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 175.9
		97.5% Chebyshev(Mean, Sd) UCL 223.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 317
95% Approximate Gamma UCL	85.92	
95% Adjusted Gamma UCL	86.18	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 175.9

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations	128	Number of Distinct Observations	64

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.8	Minimum of Log Data	0.588
Maximum	2200	Maximum of Log Data	7.696
Mean	49.79	Mean of log Data	2.082
Median	6.1	SD of log Data	1.575
SD	211.9		
Std. Error of Mean	18.73		
Coefficient of Variation	4.257		
Skewness	8.707		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.41	Lilliefors Test Statistic	0.2
Lilliefors Critical Value	0.0783	Lilliefors Critical Value	0.0783
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	80.83	95% H-UCL	40.86
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	50.76
95% Adjusted-CLT UCL (Chen-1995)	96.01	97.5% Chebyshev (MVUE) UCL	60.98
95% Modified-t UCL (Johnson-1978)	83.24	99% Chebyshev (MVUE) UCL	81.04

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.362	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	137.4	
MLE of Mean	49.79	
MLE of Standard Deviation	82.72	
nu star	92.75	
Approximate Chi Square Value (.05)	71.54	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 80.61
Adjusted Chi Square Value	71.33	95% Jackknife UCL 80.83
		95% Standard Bootstrap UCL 79.71
Anderson-Darling Test Statistic	14.58	95% Bootstrap-t UCL 136.1
Anderson-Darling 5% Critical Value	0.852	95% Hall's Bootstrap UCL 186.7
Kolmogorov-Smirnov Test Statistic	0.252	95% Percentile Bootstrap UCL 84.14
Kolmogorov-Smirnov 5% Critical Value	0.0885	95% BCA Bootstrap UCL 106.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 131.5
		97.5% Chebyshev(Mean, Sd) UCL 166.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 236.2
95% Approximate Gamma UCL	64.55	
95% Adjusted Gamma UCL	64.75	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 131.5

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations	128	Number of Distinct Observations	74

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.8	Minimum of Log Data	0.588
Maximum	2100	Maximum of Log Data	7.65
Mean	72.77	Mean of log Data	2.515
Median	11.5	SD of log Data	1.695
SD	237.8		
Std. Error of Mean	21.02		
Coefficient of Variation	3.267		
Skewness	6.166		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.383	Lilliefors Test Statistic	0.13
Lilliefors Critical Value	0.0783	Lilliefors Critical Value	0.0783
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	107.6	95% H-UCL	80.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	99.65
95% Adjusted-CLT UCL (Chen-1995)	119.6	97.5% Chebyshev (MVUE) UCL	120.8
95% Modified-t UCL (Johnson-1978)	109.5	99% Chebyshev (MVUE) UCL	162.5

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.372	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	195.8	
MLE of Mean	72.77	
MLE of Standard Deviation	119.4	
nu star	95.13	
Approximate Chi Square Value (.05)	73.63	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 107.3
Adjusted Chi Square Value	73.42	95% Jackknife UCL 107.6
		95% Standard Bootstrap UCL 106.9
Anderson-Darling Test Statistic	10.58	95% Bootstrap-t UCL 135.4
Anderson-Darling 5% Critical Value	0.85	95% Hall's Bootstrap UCL 139.4
Kolmogorov-Smirnov Test Statistic	0.215	95% Percentile Bootstrap UCL 109.1
Kolmogorov-Smirnov 5% Critical Value	0.0884	95% BCA Bootstrap UCL 126.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 164.4
		97.5% Chebyshev(Mean, Sd) UCL 204
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 281.9
95% Approximate Gamma UCL	94.02	
95% Adjusted Gamma UCL	94.29	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 164.4

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	127	Number of Distinct Observations	43

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	520	Maximum of Log Data	6.254
Mean	11.44	Mean of log Data	1.229
Median	2.05	SD of log Data	1.067
SD	48.85		
Std. Error of Mean	4.335		
Coefficient of Variation	4.27		
Skewness	9.322		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.421	Lilliefors Test Statistic	0.322
Lilliefors Critical Value	0.0786	Lilliefors Critical Value	0.0786
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	18.62	95% H-UCL	7.485
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.046
95% Adjusted-CLT UCL (Chen-1995)	22.4	97.5% Chebyshev (MVUE) UCL	10.36
95% Modified-t UCL (Johnson-1978)	19.22	99% Chebyshev (MVUE) UCL	12.95

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.515	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	22.2	
MLE of Mean	11.44	
MLE of Standard Deviation	15.94	
nu star	130.9	
Approximate Chi Square Value (.05)	105.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 18.57
Adjusted Chi Square Value	105.2	95% Jackknife UCL 18.62
		95% Standard Bootstrap UCL 18.59
Anderson-Darling Test Statistic	25.06	95% Bootstrap-t UCL 34.84
Anderson-Darling 5% Critical Value	0.817	95% Hall's Bootstrap UCL 40.94
Kolmogorov-Smirnov Test Statistic	0.359	95% Percentile Bootstrap UCL 19.39
Kolmogorov-Smirnov 5% Critical Value	0.0871	95% BCA Bootstrap UCL 24.73
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 30.34
		97.5% Chebyshev(Mean, Sd) UCL 38.51
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 54.57
95% Approximate Gamma UCL	14.2	
95% Adjusted Gamma UCL	14.23	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	30.34

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations	127	Number of Distinct Observations	60

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.8	Minimum of Log Data	0.588
Maximum	1200	Maximum of Log Data	7.09
Mean	27.88	Mean of log Data	1.723
Median	2.5	SD of log Data	1.398
SD	116.2		
Std. Error of Mean	10.31		
Coefficient of Variation	4.166		
Skewness	8.661		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.411	Lilliefors Test Statistic	0.224
Lilliefors Critical Value	0.0786	Lilliefors Critical Value	0.0786
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	44.96	95% H-UCL	20.52
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	25.44
95% Adjusted-CLT UCL (Chen-1995)	53.3	97.5% Chebyshev (MVUE) UCL	30.11
95% Modified-t UCL (Johnson-1978)	46.28	99% Chebyshev (MVUE) UCL	39.27

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.404	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	69	
MLE of Mean	27.88	
MLE of Standard Deviation	43.86	
nu star	102.6	
Approximate Chi Square Value (.05)	80.26	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 44.84
Adjusted Chi Square Value	80.04	95% Jackknife UCL 44.96
		95% Standard Bootstrap UCL 44.52
Anderson-Darling Test Statistic	17.35	95% Bootstrap-t UCL 74.41
Anderson-Darling 5% Critical Value	0.841	95% Hall's Bootstrap UCL 99.79
Kolmogorov-Smirnov Test Statistic	0.253	95% Percentile Bootstrap UCL 45.89
Kolmogorov-Smirnov 5% Critical Value	0.0883	95% BCA Bootstrap UCL 59.41
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 72.82
		97.5% Chebyshev(Mean, Sd) UCL 92.26
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 130.4
95% Approximate Gamma UCL	35.66	
95% Adjusted Gamma UCL	35.76	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 72.82

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aroclor 1254

General Statistics

Number of Valid Observations	128	Number of Distinct Observations	37

Raw Statistics		**Log-transformed Statistics**	
Minimum	17	Minimum of Log Data	2.833
Maximum	62000	Maximum of Log Data	11.03
Mean	713.6	Mean of log Data	3.393
Median	19.5	SD of log Data	1.234
SD	5796		
Std. Error of Mean	512.3		
Coefficient of Variation	8.122		
Skewness	9.852		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.478	Lilliefors Test Statistic	0.376
Lilliefors Critical Value	0.0783	Lilliefors Critical Value	0.0783
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1562	95% H-UCL	82.99
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	101.9
95% Adjusted-CLT UCL (Chen-1995)	2033	97.5% Chebyshev (MVUE) UCL	118.6
95% Modified-t UCL (Johnson-1978)	1637	99% Chebyshev (MVUE) UCL	151.6

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.227	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	3145	
MLE of Mean	713.6	
MLE of Standard Deviation	1498	
nu star	58.08	
Approximate Chi Square Value (.05)	41.56	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 1556
Adjusted Chi Square Value	41.4	95% Jackknife UCL 1562
		95% Standard Bootstrap UCL 1571
Anderson-Darling Test Statistic	42.11	95% Bootstrap-t UCL 28552
Anderson-Darling 5% Critical Value	0.901	95% Hall's Bootstrap UCL 19064
Kolmogorov-Smirnov Test Statistic	0.466	95% Percentile Bootstrap UCL 1662
Kolmogorov-Smirnov 5% Critical Value	0.0906	95% BCA Bootstrap UCL 2509
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2947
		97.5% Chebyshev(Mean, Sd) UCL 3913
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 5811
95% Approximate Gamma UCL	997.3	
95% Adjusted Gamma UCL	1001	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2947

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	135	Number of Distinct Observations	121

Raw Statistics		**Log-transformed Statistics**	
Minimum	187	Minimum of Log Data	5.231
Maximum	13500	Maximum of Log Data	9.51
Mean	3297	Mean of log Data	7.814
Median	2470	SD of log Data	0.795
SD	2581		
Std. Error of Mean	222.2		
Coefficient of Variation	0.783		
Skewness	1.587		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.143	Lilliefors Test Statistic	0.0647
Lilliefors Critical Value	0.0763	Lilliefors Critical Value	0.0763
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3665	95% H-UCL	3899
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4529
95% Adjusted-CLT UCL (Chen-1995)	3695	97.5% Chebyshev (MVUE) UCL	5025
95% Modified-t UCL (Johnson-1978)	3670	99% Chebyshev (MVUE) UCL	5999

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.854	**Data appear Lognormal at 5% Significance Level**
Theta Star	1778	
MLE of Mean	3297	
MLE of Standard Deviation	2421	
nu star	500.6	
Approximate Chi Square Value (.05)	449.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 3662
Adjusted Chi Square Value	449.2	95% Jackknife UCL 3665
		95% Standard Bootstrap UCL 3659
Anderson-Darling Test Statistic	0.796	95% Bootstrap-t UCL 3717
Anderson-Darling 5% Critical Value	0.767	95% Hall's Bootstrap UCL 3709
Kolmogorov-Smirnov Test Statistic	0.0823	95% Percentile Bootstrap UCL 3678
Kolmogorov-Smirnov 5% Critical Value	0.0816	95% BCA Bootstrap UCL 3690
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 4265
		97.5% Chebyshev(Mean, Sd) UCL 4684
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 5507
95% Approximate Gamma UCL	3670	
95% Adjusted Gamma UCL	3674	

Potential UCL to Use	Use 95% H-UCL 3899

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	134	Number of Distinct Observations	63

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.065	Minimum of Log Data	-2.733
Maximum	2200	Maximum of Log Data	7.696
Mean	22.31	Mean of log Data	-1.195
Median	0.103	SD of log Data	2.048
SD	191.2		
Std. Error of Mean	16.52		
Coefficient of Variation	8.571		
Skewness	11.29		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.467	Lilliefors Test Statistic	0.226
Lilliefors Critical Value	0.0765	Lilliefors Critical Value	0.0765
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	49.66	95% H-UCL	4.454
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.314
95% Adjusted-CLT UCL (Chen-1995)	66.68	97.5% Chebyshev (MVUE) UCL	6.595
95% Modified-t UCL (Johnson-1978)	52.35	99% Chebyshev (MVUE) UCL	9.111

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.176	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	126.9	
MLE of Mean	22.31	
MLE of Standard Deviation	53.2	
nu star	47.11	
Approximate Chi Square Value (.05)	32.36	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 49.47
Adjusted Chi Square Value	32.23	95% Jackknife UCL 49.66
		95% Standard Bootstrap UCL 49.62
Anderson-Darling Test Statistic	30.11	95% Bootstrap-t UCL 230.4
Anderson-Darling 5% Critical Value	0.947	95% Hall's Bootstrap UCL 161.1
Kolmogorov-Smirnov Test Statistic	0.344	95% Percentile Bootstrap UCL 55.15
Kolmogorov-Smirnov 5% Critical Value	0.0904	95% BCA Bootstrap UCL 76.95
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 94.3
		97.5% Chebyshev(Mean, Sd) UCL 125.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 186.6
95% Approximate Gamma UCL	32.47	
95% Adjusted Gamma UCL	32.61	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 94.3

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	134	Number of Distinct Observations	89

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.09	Minimum of Log Data	-2.408
Maximum	594	Maximum of Log Data	6.387
Mean	13.26	Mean of log Data	0.767
Median	1.75	SD of log Data	1.606
SD	56.71		
Std. Error of Mean	4.899		
Coefficient of Variation	4.278		
Skewness	8.685		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.408	Lilliefors Test Statistic	0.088
Lilliefors Critical Value	0.0765	Lilliefors Critical Value	0.0765
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21.37	95% H-UCL	11.56
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	14.34
95% Adjusted-CLT UCL (Chen-1995)	25.24	97.5% Chebyshev (MVUE) UCL	17.24
95% Modified-t UCL (Johnson-1978)	21.98	99% Chebyshev (MVUE) UCL	22.93

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.364	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	36.44	
MLE of Mean	13.26	
MLE of Standard Deviation	21.98	
nu star	97.5	
Approximate Chi Square Value (.05)	75.72	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 21.31
Adjusted Chi Square Value	75.51	95% Jackknife UCL 21.37
		95% Standard Bootstrap UCL 21.28
Anderson-Darling Test Statistic	13.41	95% Bootstrap-t UCL 33.76
Anderson-Darling 5% Critical Value	0.852	95% Hall's Bootstrap UCL 47.4
Kolmogorov-Smirnov Test Statistic	0.263	95% Percentile Bootstrap UCL 21.78
Kolmogorov-Smirnov 5% Critical Value	0.0868	95% BCA Bootstrap UCL 27.61
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 34.61
		97.5% Chebyshev(Mean, Sd) UCL 43.85
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 62
95% Approximate Gamma UCL	17.07	
95% Adjusted Gamma UCL	17.12	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 34.61

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cadmium

General Statistics

Number of Valid Observations	135	Number of Distinct Observations	83

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.0095	Minimum of Log Data	-4.656
Maximum	12.5	Maximum of Log Data	2.526
Mean	0.258	Mean of log Data	-2.583
Median	0.072	SD of log Data	1.238
SD	1.124		
Std. Error of Mean	0.0968		
Coefficient of Variation	4.365		
Skewness	9.939		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.414	Lilliefors Test Statistic	0.0728
Lilliefors Critical Value	0.0763	Lilliefors Critical Value	0.0763
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.418	95% H-UCL	0.211
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.258
95% Adjusted-CLT UCL (Chen-1995)	0.505	97.5% Chebyshev (MVUE) UCL	0.3
95% Modified-t UCL (Johnson-1978)	0.432	99% Chebyshev (MVUE) UCL	0.382

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.509	**Data appear Lognormal at 5% Significance Level**
Theta Star	0.506	
MLE of Mean	0.258	
MLE of Standard Deviation	0.361	
nu star	137.4	
Approximate Chi Square Value (.05)	111.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 0.417
Adjusted Chi Square Value	111.1	95% Jackknife UCL 0.418
		95% Standard Bootstrap UCL 0.418
Anderson-Darling Test Statistic	12.35	95% Bootstrap-t UCL 0.791
Anderson-Darling 5% Critical Value	0.818	95% Hall's Bootstrap UCL 0.926
Kolmogorov-Smirnov Test Statistic	0.23	95% Percentile Bootstrap UCL 0.439
Kolmogorov-Smirnov 5% Critical Value	0.085	95% BCA Bootstrap UCL 0.548
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.679
		97.5% Chebyshev(Mean, Sd) UCL 0.862
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.22
95% Approximate Gamma UCL	0.318	
95% Adjusted Gamma UCL	0.319	

Potential UCL to Use	Use 95% H-UCL 0.211

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	121	Number of Distinct Observations	51

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.195	Minimum of Log Data	-1.635
Maximum	3.4	Maximum of Log Data	1.224
Mean	0.665	Mean of log Data	-0.556
Median	0.55	SD of log Data	0.493
SD	0.488		
Std. Error of Mean	0.0443		
Coefficient of Variation	0.733		
Skewness	3.356		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.306	Lilliefors Test Statistic	0.185
Lilliefors Critical Value	0.0805	Lilliefors Critical Value	0.0805
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.739	95% H-UCL	0.703
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.781
95% Adjusted-CLT UCL (Chen-1995)	0.753	97.5% Chebyshev (MVUE) UCL	0.838
95% Modified-t UCL (Johnson-1978)	0.741	99% Chebyshev (MVUE) UCL	0.952

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	3.453	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.193	
MLE of Mean	0.665	
MLE of Standard Deviation	0.358	
nu star	835.7	
Approximate Chi Square Value (.05)	769.6	**Nonparametric Statistics**
Adjusted Level of Significance	0.048	95% CLT UCL 0.738
Adjusted Chi Square Value	768.8	95% Jackknife UCL 0.739
		95% Standard Bootstrap UCL 0.737
Anderson-Darling Test Statistic	7.869	95% Bootstrap-t UCL 0.766
Anderson-Darling 5% Critical Value	0.758	95% Hall's Bootstrap UCL 0.76
Kolmogorov-Smirnov Test Statistic	0.231	95% Percentile Bootstrap UCL 0.744
Kolmogorov-Smirnov 5% Critical Value	0.0845	95% BCA Bootstrap UCL 0.75
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.859
		97.5% Chebyshev(Mean, Sd) UCL 0.942
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.106
95% Approximate Gamma UCL	0.722	
95% Adjusted Gamma UCL	0.723	

Potential UCL to Use	Use 95% Student's-t UCL 0.739
	or 95% Modified-t UCL 0.741

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations	135	Number of Distinct Observations	80

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.115	Minimum of Log Data	-2.163
Maximum	12.7	Maximum of Log Data	2.542
Mean	1.659	Mean of log Data	-0.145
Median	0.89	SD of log Data	1.218
SD	1.935		
Std. Error of Mean	0.167		
Coefficient of Variation	1.167		
Skewness	2.345		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.212	Lilliefors Test Statistic	0.0968
Lilliefors Critical Value	0.0763	Lilliefors Critical Value	0.0763
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.935	95% H-UCL	2.338
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.859
95% Adjusted-CLT UCL (Chen-1995)	1.969	97.5% Chebyshev (MVUE) UCL	3.317
95% Modified-t UCL (Johnson-1978)	1.94	99% Chebyshev (MVUE) UCL	4.217

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.883	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1.878	
MLE of Mean	1.659	
MLE of Standard Deviation	1.765	
nu star	238.4	
Approximate Chi Square Value (.05)	203.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 1.933
Adjusted Chi Square Value	203.3	95% Jackknife UCL 1.935
		95% Standard Bootstrap UCL 1.934
Anderson-Darling Test Statistic	1.835	95% Bootstrap-t UCL 1.969
Anderson-Darling 5% Critical Value	0.788	95% Hall's Bootstrap UCL 1.968
Kolmogorov-Smirnov Test Statistic	0.0984	95% Percentile Bootstrap UCL 1.931
Kolmogorov-Smirnov 5% Critical Value	0.0831	95% BCA Bootstrap UCL 1.983
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.385
		97.5% Chebyshev(Mean, Sd) UCL 2.699
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3.316
95% Approximate Gamma UCL	1.942	
95% Adjusted Gamma UCL	1.945	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2.385

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	127	Number of Distinct Observations	101

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.3	Minimum of Log Data	0.262
Maximum	1170	Maximum of Log Data	7.065
Mean	43.28	Mean of log Data	2.551
Median	10.8	SD of log Data	1.219
SD	137.7		
Std. Error of Mean	12.22		
Coefficient of Variation	3.182		
Skewness	5.939		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.406	Lilliefors Test Statistic	0.109
Lilliefors Critical Value	0.0786	Lilliefors Critical Value	0.0786
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	63.53	95% H-UCL	34.96
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	42.88
95% Adjusted-CLT UCL (Chen-1995)	70.26	97.5% Chebyshev (MVUE) UCL	49.88
95% Modified-t UCL (Johnson-1978)	64.6	99% Chebyshev (MVUE) UCL	63.65

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.512	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	84.54	
MLE of Mean	43.28	
MLE of Standard Deviation	60.49	
nu star	130	
Approximate Chi Square Value (.05)	104.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 63.38
Adjusted Chi Square Value	104.4	95% Jackknife UCL 63.53
		95% Standard Bootstrap UCL 63.24
Anderson-Darling Test Statistic	14.5	95% Bootstrap-t UCL 80.62
Anderson-Darling 5% Critical Value	0.817	95% Hall's Bootstrap UCL 70.96
Kolmogorov-Smirnov Test Statistic	0.272	95% Percentile Bootstrap UCL 65.5
Kolmogorov-Smirnov 5% Critical Value	0.0871	95% BCA Bootstrap UCL 73.53
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 96.55
		97.5% Chebyshev(Mean, Sd) UCL 119.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 164.9
95% Approximate Gamma UCL	53.76	
95% Adjusted Gamma UCL	53.89	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 96.55

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations	135	Number of Distinct Observations	114

Raw Statistics		**Log-transformed Statistics**	
Minimum	2150	Minimum of Log Data	7.673
Maximum	70300	Maximum of Log Data	11.16
Mean	19851	Mean of log Data	9.701
Median	17500	SD of log Data	0.653
SD	12571		
Std. Error of Mean	1082		
Coefficient of Variation	0.633		
Skewness	1.393		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.148	Lilliefors Test Statistic	0.0739
Lilliefors Critical Value	0.0763	Lilliefors Critical Value	0.0763
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21643	95% H-UCL	22535
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	25592
95% Adjusted-CLT UCL (Chen-1995)	21769	97.5% Chebyshev (MVUE) UCL	27933
95% Modified-t UCL (Johnson-1978)	21665	99% Chebyshev (MVUE) UCL	32531

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.668	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	7440	
MLE of Mean	19851	
MLE of Standard Deviation	12153	
nu star	720.4	
Approximate Chi Square Value (.05)	659.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 21631
Adjusted Chi Square Value	658.5	95% Jackknife UCL 21643
		95% Standard Bootstrap UCL 21648
Anderson-Darling Test Statistic	0.539	95% Bootstrap-t UCL 21790
Anderson-Darling 5% Critical Value	0.761	95% Hall's Bootstrap UCL 21857
Kolmogorov-Smirnov Test Statistic	0.0725	95% Percentile Bootstrap UCL 21694
Kolmogorov-Smirnov 5% Critical Value	0.0811	95% BCA Bootstrap UCL 21776
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 24567
		97.5% Chebyshev(Mean, Sd) UCL 26607
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 30616
95% Approximate Gamma UCL	21696	
95% Adjusted Gamma UCL	21717	

Potential UCL to Use	Use 95% Approximate Gamma UCL 21696

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	125	Number of Distinct Observations	115

Raw Statistics		**Log-transformed Statistics**	
Minimum	5.3	Minimum of Log Data	1.668
Maximum	10200	Maximum of Log Data	9.23
Mean	250.6	Mean of log Data	3.965
Median	47.6	SD of log Data	1.424
SD	1091		
Std. Error of Mean	97.59		
Coefficient of Variation	4.353		
Skewness	7.858		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.411	Lilliefors Test Statistic	0.0704
Lilliefors Critical Value	0.0792	Lilliefors Critical Value	0.0792
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	412.4	95% H-UCL	202.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	251.5
95% Adjusted-CLT UCL (Chen-1995)	484.5	97.5% Chebyshev (MVUE) UCL	298.5
95% Modified-t UCL (Johnson-1978)	423.8	99% Chebyshev (MVUE) UCL	390.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.414	**Data appear Lognormal at 5% Significance Level**
Theta Star	605.2	
MLE of Mean	250.6	
MLE of Standard Deviation	389.5	
nu star	103.5	
Approximate Chi Square Value (.05)	81.06	**Nonparametric Statistics**
Adjusted Level of Significance	0.0481	95% CLT UCL 411.2
Adjusted Chi Square Value	80.83	95% Jackknife UCL 412.4
		95% Standard Bootstrap UCL 413.9
Anderson-Darling Test Statistic	11.66	95% Bootstrap-t UCL 1064
Anderson-Darling 5% Critical Value	0.839	95% Hall's Bootstrap UCL 1083
Kolmogorov-Smirnov Test Statistic	0.236	95% Percentile Bootstrap UCL 418.4
Kolmogorov-Smirnov 5% Critical Value	0.0887	95% BCA Bootstrap UCL 528.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 676
		97.5% Chebyshev(Mean, Sd) UCL 860.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1222
95% Approximate Gamma UCL	320.2	
95% Adjusted Gamma UCL	321.1	

Potential UCL to Use	Use 95% H-UCL 202.6

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	135	Number of Distinct Observations	121

Raw Statistics		**Log-transformed Statistics**	
Minimum	2	Minimum of Log Data	0.693
Maximum	1020	Maximum of Log Data	6.928
Mean	62.2	Mean of log Data	3.279
Median	20.3	SD of log Data	1.272
SD	112.4		
Std. Error of Mean	9.677		
Coefficient of Variation	1.808		
Skewness	5.322		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.296	Lilliefors Test Statistic	0.0904
Lilliefors Critical Value	0.0763	Lilliefors Critical Value	0.0763
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	78.23	95% H-UCL	78.16
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	95.96
95% Adjusted-CLT UCL (Chen-1995)	82.85	97.5% Chebyshev (MVUE) UCL	111.9
95% Modified-t UCL (Johnson-1978)	78.96	99% Chebyshev (MVUE) UCL	143.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.698	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	89.1	
MLE of Mean	62.2	
MLE of Standard Deviation	74.44	
nu star	188.5	
Approximate Chi Square Value (.05)	157.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 78.11
Adjusted Chi Square Value	157.4	95% Jackknife UCL 78.23
		95% Standard Bootstrap UCL 78.58
Anderson-Darling Test Statistic	4.499	95% Bootstrap-t UCL 85.83
Anderson-Darling 5% Critical Value	0.799	95% Hall's Bootstrap UCL 142.9
Kolmogorov-Smirnov Test Statistic	0.159	95% Percentile Bootstrap UCL 79
Kolmogorov-Smirnov 5% Critical Value	0.0838	95% BCA Bootstrap UCL 83.68
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 104.4
		97.5% Chebyshev(Mean, Sd) UCL 122.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 158.5
95% Approximate Gamma UCL	74.33	
95% Adjusted Gamma UCL	74.47	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	104.4

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 C-5
ProUCL Output - Upland Area of Area 9 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	135	Number of Distinct Observations	113

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.2	Minimum of Log Data	0.788
Maximum	202	Maximum of Log Data	5.308
Mean	18.81	Mean of log Data	2.635
Median	13.9	SD of log Data	0.721
SD	22.05		
Std. Error of Mean	1.898		
Coefficient of Variation	1.172		
Skewness	5.612		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.229	Lilliefors Test Statistic	0.0542
Lilliefors Critical Value	0.0763	Lilliefors Critical Value	0.0763
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21.95	95% H-UCL	20.44
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.48
95% Adjusted-CLT UCL (Chen-1995)	22.91	97.5% Chebyshev (MVUE) UCL	25.83
95% Modified-t UCL (Johnson-1978)	22.1	99% Chebyshev (MVUE) UCL	30.45

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.785	**Data appear Lognormal at 5% Significance Level**
Theta Star	10.54	
MLE of Mean	18.81	
MLE of Standard Deviation	14.08	
nu star	481.9	
Approximate Chi Square Value (.05)	432	**Nonparametric Statistics**
Adjusted Level of Significance	0.0482	95% CLT UCL 21.93
Adjusted Chi Square Value	431.5	95% Jackknife UCL 21.95
		95% Standard Bootstrap UCL 21.94
Anderson-Darling Test Statistic	2.946	95% Bootstrap-t UCL 24.26
Anderson-Darling 5% Critical Value	0.767	95% Hall's Bootstrap UCL 35.61
Kolmogorov-Smirnov Test Statistic	0.116	95% Percentile Bootstrap UCL 22.18
Kolmogorov-Smirnov 5% Critical Value	0.0816	95% BCA Bootstrap UCL 23.3
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 27.08
		97.5% Chebyshev(Mean, Sd) UCL 30.66
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 37.69
95% Approximate Gamma UCL	20.98	
95% Adjusted Gamma UCL	21.01	

Potential UCL to Use	Use 95% H-UCL 20.44

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 C-6

ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil

Raritan Bay Slag Site

Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	AllArea_exc_2_8_11_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations 224

Number of Distinct Observations 110

Raw Statistics

Minimum	1.75
Maximum	3000
Mean	84.3
Median	13.5
SD	233
Std. Error of Mean	15.57
Coefficient of Variation	2.764
Skewness	9.263

Log-transformed Statistics

Minimum of Log Data	0.56
Maximum of Log Data	8.006
Mean of log Data	2.902
SD of log Data	1.78

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.362
Lilliefors Critical Value	0.0592

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.106
Lilliefors Critical Value	0.0592

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	110

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	120.2
95% Modified-t UCL (Johnson-1978)	111.6

Assuming Lognormal Distribution

95% H-UCL	125.8
95% Chebyshev (MVUE) UCL	157.6
97.5% Chebyshev (MVUE) UCL	188
99% Chebyshev (MVUE) UCL	247.7

Gamma Distribution Test

k star (bias corrected)	0.423
Theta Star	199.5
MLE of Mean	84.3
MLE of Standard Deviation	129.7
nu star	189.3
Approximate Chi Square Value (.05)	158.5
Adjusted Level of Significance	0.0489
Adjusted Chi Square Value	158.3
Anderson-Darling Test Statistic	9.433
Anderson-Darling 5% Critical Value	0.839
Kolmogorov-Smirnov Test Statistic	0.164
Kolmogorov-Smirnov 5% Critical Value	0.065

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	100.7
95% Adjusted Gamma UCL	100.8

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	109.9
95% Jackknife UCL	110
95% Standard Bootstrap UCL	110
95% Bootstrap-t UCL	131.1
95% Hall's Bootstrap UCL	221.9
95% Percentile Bootstrap UCL	111.4
95% BCA Bootstrap UCL	126
95% Chebyshev(Mean, Sd) UCL	152.2
97.5% Chebyshev(Mean, Sd) UCL	181.5
99% Chebyshev(Mean, Sd) UCL	239.2

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 152.2

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations	224	Number of Distinct Observations	113

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	2200	Maximum of Log Data	7.696
Mean	76.99	Mean of log Data	2.844
Median	13.5	SD of log Data	1.817
SD	182.5		
Std. Error of Mean	12.19		
Coefficient of Variation	2.37		
Skewness	7.686		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.34	Lilliefors Test Statistic	0.143
Lilliefors Critical Value	0.0592	Lilliefors Critical Value	0.0592
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	97.13	95% H-UCL	128.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	160.7
95% Adjusted-CLT UCL (Chen-1995)	103.7	97.5% Chebyshev (MVUE) UCL	192.2
95% Modified-t UCL (Johnson-1978)	98.17	99% Chebyshev (MVUE) UCL	254.2

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.43	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	178.9	
MLE of Mean	76.99	
MLE of Standard Deviation	117.4	
nu star	192.8	
Approximate Chi Square Value (.05)	161.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 97.05
Adjusted Chi Square Value	161.5	95% Jackknife UCL 97.13
		95% Standard Bootstrap UCL 96.99
Anderson-Darling Test Statistic	8.895	95% Bootstrap-t UCL 107.2
Anderson-Darling 5% Critical Value	0.837	95% Hall's Bootstrap UCL 187.2
Kolmogorov-Smirnov Test Statistic	0.152	95% Percentile Bootstrap UCL 99.49
Kolmogorov-Smirnov 5% Critical Value	0.065	95% BCA Bootstrap UCL 104
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 130.1
		97.5% Chebyshev(Mean, Sd) UCL 153.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 198.3
95% Approximate Gamma UCL	91.81	
95% Adjusted Gamma UCL	91.92	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 130.1

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations	224	Number of Distinct Observations	120

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	2100	Maximum of Log Data	7.65
Mean	93.77	Mean of log Data	3.194
Median	23	SD of log Data	1.756
SD	199.3		
Std. Error of Mean	13.32		
Coefficient of Variation	2.126		
Skewness	5.893		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.322	Lilliefors Test Statistic	0.0852
Lilliefors Critical Value	0.0592	Lilliefors Critical Value	0.0592
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	115.8	95% H-UCL	160
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	200.2
95% Adjusted-CLT UCL (Chen-1995)	121.3	97.5% Chebyshev (MVUE) UCL	238.4
95% Modified-t UCL (Johnson-1978)	116.6	99% Chebyshev (MVUE) UCL	313.4

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.472	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	198.7	
MLE of Mean	93.77	
MLE of Standard Deviation	136.5	
nu star	211.4	
Approximate Chi Square Value (.05)	178.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 115.7
Adjusted Chi Square Value	178.5	95% Jackknife UCL 115.8
		95% Standard Bootstrap UCL 115.3
Anderson-Darling Test Statistic	5.463	95% Bootstrap-t UCL 123.9
Anderson-Darling 5% Critical Value	0.827	95% Hall's Bootstrap UCL 136.6
Kolmogorov-Smirnov Test Statistic	0.126	95% Percentile Bootstrap UCL 116.1
Kolmogorov-Smirnov 5% Critical Value	0.0646	95% BCA Bootstrap UCL 121.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 151.8
		97.5% Chebyshev(Mean, Sd) UCL 176.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 226.3
95% Approximate Gamma UCL	110.9	
95% Adjusted Gamma UCL	111	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 151.8

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.

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	223	Number of Distinct Observations	82

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	520	Maximum of Log Data	6.254
Mean	53.54	Mean of log Data	2.28
Median	2.9	SD of log Data	1.887
SD	100.1		
Std. Error of Mean	6.701		
Coefficient of Variation	1.869		
Skewness	2.602		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.302	Lilliefors Test Statistic	0.242
Lilliefors Critical Value	0.0593	Lilliefors Critical Value	0.0593
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	64.61	95% H-UCL	85.17
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	106.8
95% Adjusted-CLT UCL (Chen-1995)	65.81	97.5% Chebyshev (MVUE) UCL	128.5
95% Modified-t UCL (Johnson-1978)	64.8	99% Chebyshev (MVUE) UCL	171.1

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.386	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	138.5	
MLE of Mean	53.54	
MLE of Standard Deviation	86.12	
nu star	172.4	
Approximate Chi Square Value (.05)	143	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 64.56
Adjusted Chi Square Value	142.8	95% Jackknife UCL 64.61
		95% Standard Bootstrap UCL 64.46
Anderson-Darling Test Statistic	20.88	95% Bootstrap-t UCL 66.71
Anderson-Darling 5% Critical Value	0.848	95% Hall's Bootstrap UCL 66.25
Kolmogorov-Smirnov Test Statistic	0.256	95% Percentile Bootstrap UCL 65.12
Kolmogorov-Smirnov 5% Critical Value	0.0655	95% BCA Bootstrap UCL 65.97
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 82.75
		97.5% Chebyshev(Mean, Sd) UCL 95.38
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 120.2
95% Approximate Gamma UCL	64.53	
95% Adjusted Gamma UCL	64.61	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 82.75

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations	223	Number of Distinct Observations	106

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	1200	Maximum of Log Data	7.09
Mean	65.34	Mean of log Data	2.721
Median	11	SD of log Data	1.835
SD	122.9		
Std. Error of Mean	8.227		
Coefficient of Variation	1.88		
Skewness	4.595		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.302	Lilliefors Test Statistic	0.152
Lilliefors Critical Value	0.0593	Lilliefors Critical Value	0.0593
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	78.93	95% H-UCL	118.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	148.2
95% Adjusted-CLT UCL (Chen-1995)	81.58	97.5% Chebyshev (MVUE) UCL	177.5
95% Modified-t UCL (Johnson-1978)	79.35	99% Chebyshev (MVUE) UCL	235.2

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.441	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	148.2	
MLE of Mean	65.34	
MLE of Standard Deviation	98.41	
nu star	196.6	
Approximate Chi Square Value (.05)	165.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 78.87
Adjusted Chi Square Value	165	95% Jackknife UCL 78.93
		95% Standard Bootstrap UCL 78.91
Anderson-Darling Test Statistic	10.47	95% Bootstrap-t UCL 83.17
Anderson-Darling 5% Critical Value	0.835	95% Hall's Bootstrap UCL 84.68
Kolmogorov-Smirnov Test Statistic	0.162	95% Percentile Bootstrap UCL 78.65
Kolmogorov-Smirnov 5% Critical Value	0.065	95% BCA Bootstrap UCL 81.11
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 101.2
		97.5% Chebyshev(Mean, Sd) UCL 116.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 147.2
95% Approximate Gamma UCL	77.78	
95% Adjusted Gamma UCL	77.87	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 101.2

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aroclor 1254

General Statistics

Number of Valid Observations	224	Number of Distinct Observations	59

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.75	Minimum of Log Data	1.322
Maximum	62000	Maximum of Log Data	11.03
Mean	460.8	Mean of log Data	3.435
Median	19.5	SD of log Data	1.213
SD	4393		
Std. Error of Mean	293.5		
Coefficient of Variation	9.533		
Skewness	12.97		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.465	Lilliefors Test Statistic	0.321
Lilliefors Critical Value	0.0592	Lilliefors Critical Value	0.0592
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	945.6	95% H-UCL	78.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	93.92
95% Adjusted-CLT UCL (Chen-1995)	1215	97.5% Chebyshev (MVUE) UCL	106.7
95% Modified-t UCL (Johnson-1978)	988	99% Chebyshev (MVUE) UCL	131.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.261	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1767	
MLE of Mean	460.8	
MLE of Standard Deviation	902.2	
nu star	116.9	
Approximate Chi Square Value (.05)	92.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 943.6
Adjusted Chi Square Value	92.76	95% Jackknife UCL 945.6
		95% Standard Bootstrap UCL 925
Anderson-Darling Test Statistic	4.46E+28	95% Bootstrap-t UCL 6899
Anderson-Darling 5% Critical Value	0.887	95% Hall's Bootstrap UCL 4411
Kolmogorov-Smirnov Test Statistic	0.397	95% Percentile Bootstrap UCL 1004
Kolmogorov-Smirnov 5% Critical Value	0.0666	95% BCA Bootstrap UCL 1373
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1740
		97.5% Chebyshev(Mean, Sd) UCL 2294
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3381
95% Approximate Gamma UCL	579.6	
95% Adjusted Gamma UCL	580.5	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1740

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	777	Number of Distinct Observations	478

Raw Statistics		**Log-transformed Statistics**	
Minimum	149	Minimum of Log Data	5.004
Maximum	27600	Maximum of Log Data	10.23
Mean	2180	Mean of log Data	7.357
Median	1450	SD of log Data	0.801
SD	2174		
Std. Error of Mean	78		
Coefficient of Variation	0.998		
Skewness	3.799		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.196	Lilliefors Test Statistic	0.0462
Lilliefors Critical Value	0.0318	Lilliefors Critical Value	0.0318
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2308	95% H-UCL	2284
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2468
95% Adjusted-CLT UCL (Chen-1995)	2319	97.5% Chebyshev (MVUE) UCL	2602
95% Modified-t UCL (Johnson-1978)	2310	99% Chebyshev (MVUE) UCL	2865

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.657	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1315	
MLE of Mean	2180	
MLE of Standard Deviation	1693	
nu star	2576	
Approximate Chi Square Value (.05)	2459	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 2308
Adjusted Chi Square Value	2458	95% Jackknife UCL 2308
		95% Standard Bootstrap UCL 2307
Anderson-Darling Test Statistic	13.27	95% Bootstrap-t UCL 2321
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL 2324
Kolmogorov-Smirnov Test Statistic	0.104	95% Percentile Bootstrap UCL 2307
Kolmogorov-Smirnov 5% Critical Value	0.0345	95% BCA Bootstrap UCL 2329
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2520
		97.5% Chebyshev(Mean, Sd) UCL 2667
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2956
95% Approximate Gamma UCL	2283	
95% Adjusted Gamma UCL	2283	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2520

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	923	Number of Distinct Observations	231

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.065	Minimum of Log Data	-2.733
Maximum	2390	Maximum of Log Data	7.779
Mean	14.81	Mean of log Data	0.439
Median	2.1	SD of log Data	1.573
SD	130.2		
Std. Error of Mean	4.287		
Coefficient of Variation	8.794		
Skewness	14.62		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.455	Lilliefors Test Statistic	0.115
Lilliefors Critical Value	0.0292	Lilliefors Critical Value	0.0292
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21.87	95% H-UCL	6.117
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	7.115
95% Adjusted-CLT UCL (Chen-1995)	24.06	97.5% Chebyshev (MVUE) UCL	7.888
95% Modified-t UCL (Johnson-1978)	22.21	99% Chebyshev (MVUE) UCL	9.407

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.305	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	48.61	
MLE of Mean	14.81	
MLE of Standard Deviation	26.83	
nu star	562.3	
Approximate Chi Square Value (.05)	508.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 21.86
Adjusted Chi Square Value	508.2	95% Jackknife UCL 21.87
		95% Standard Bootstrap UCL 21.87
Anderson-Darling Test Statistic	1.08E+28	95% Bootstrap-t UCL 27.9
Anderson-Darling 5% Critical Value	0.87	95% Hall's Bootstrap UCL 24.42
Kolmogorov-Smirnov Test Statistic	0.336	95% Percentile Bootstrap UCL 22.54
Kolmogorov-Smirnov 5% Critical Value	0.0331	95% BCA Bootstrap UCL 26.03
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 33.49
		97.5% Chebyshev(Mean, Sd) UCL 41.58
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 57.46
95% Approximate Gamma UCL	16.38	
95% Adjusted Gamma UCL	16.38	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 33.49

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	920	Number of Distinct Observations	256

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.09	Minimum of Log Data	-2.408
Maximum	760	Maximum of Log Data	6.633
Mean	9.746	Mean of log Data	1.44
Median	4.3	SD of log Data	1.107
SD	37.12		
Std. Error of Mean	1.224		
Coefficient of Variation	3.809		
Skewness	14.69		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.397	Lilliefors Test Statistic	0.0561
Lilliefors Critical Value	0.0292	Lilliefors Critical Value	0.0292
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	11.76	95% H-UCL	8.442
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.356
95% Adjusted-CLT UCL (Chen-1995)	12.39	97.5% Chebyshev (MVUE) UCL	10.03
95% Modified-t UCL (Johnson-1978)	11.86	99% Chebyshev (MVUE) UCL	11.37

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.718	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	13.57	
MLE of Mean	9.746	
MLE of Standard Deviation	11.5	
nu star	1321	
Approximate Chi Square Value (.05)	1238	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 11.76
Adjusted Chi Square Value	1238	95% Jackknife UCL 11.76
		95% Standard Bootstrap UCL 11.77
Anderson-Darling Test Statistic	1.09E+28	95% Bootstrap-t UCL 13.39
Anderson-Darling 5% Critical Value	0.8	95% Hall's Bootstrap UCL 16.38
Kolmogorov-Smirnov Test Statistic	0.174	95% Percentile Bootstrap UCL 11.87
Kolmogorov-Smirnov 5% Critical Value	0.0318	95% BCA Bootstrap UCL 12.33
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 15.08
		97.5% Chebyshev(Mean, Sd) UCL 17.39
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 21.92
95% Approximate Gamma UCL	10.4	
95% Adjusted Gamma UCL	10.4	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 15.08

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cadmium

General Statistics

Number of Valid Observations	828	Number of Distinct Observations	199

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.007	Minimum of Log Data	-4.962
Maximum	12.5	Maximum of Log Data	2.526
Mean	0.322	Mean of log Data	-1.768
Median	0.188	SD of log Data	1.121
SD	0.64		
Std. Error of Mean	0.0222		
Coefficient of Variation	1.986		
Skewness	10.53		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.32	Lilliefors Test Statistic	0.104
Lilliefors Critical Value	0.0308	Lilliefors Critical Value	0.0308
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.359	95% H-UCL	0.348
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.389
95% Adjusted-CLT UCL (Chen-1995)	0.367	97.5% Chebyshev (MVUE) UCL	0.418
95% Modified-t UCL (Johnson-1978)	0.36	99% Chebyshev (MVUE) UCL	0.477

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.915	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.352	
MLE of Mean	0.322	
MLE of Standard Deviation	0.337	
nu star	1520	
Approximate Chi Square Value (.05)	1430	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 0.359
Adjusted Chi Square Value	1430	95% Jackknife UCL 0.359
		95% Standard Bootstrap UCL 0.358
Anderson-Darling Test Statistic	23.55	95% Bootstrap-t UCL 0.372
Anderson-Darling 5% Critical Value	0.789	95% Hall's Bootstrap UCL 0.385
Kolmogorov-Smirnov Test Statistic	0.172	95% Percentile Bootstrap UCL 0.361
Kolmogorov-Smirnov 5% Critical Value	0.0338	95% BCA Bootstrap UCL 0.37
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.419
		97.5% Chebyshev(Mean, Sd) UCL 0.461
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.543
95% Approximate Gamma UCL	0.342	
95% Adjusted Gamma UCL	0.342	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	0.419

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	210	Number of Distinct Observations	68

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.195	Minimum of Log Data	-1.635
Maximum	8.3	Maximum of Log Data	2.116
Mean	0.746	Mean of log Data	-0.515
Median	0.55	SD of log Data	0.539
SD	0.908		
Std. Error of Mean	0.0627		
Coefficient of Variation	1.217		
Skewness	6.206		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.332	Lilliefors Test Statistic	0.209
Lilliefors Critical Value	0.0611	Lilliefors Critical Value	0.0611
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.85	95% H-UCL	0.74
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.81
95% Adjusted-CLT UCL (Chen-1995)	0.878	97.5% Chebyshev (MVUE) UCL	0.862
95% Modified-t UCL (Johnson-1978)	0.854	99% Chebyshev (MVUE) UCL	0.963

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.373	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.314	
MLE of Mean	0.746	
MLE of Standard Deviation	0.484	
nu star	996.5	
Approximate Chi Square Value (.05)	924.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0489	95% CLT UCL 0.849
Adjusted Chi Square Value	923.8	95% Jackknife UCL 0.85
		95% Standard Bootstrap UCL 0.85
Anderson-Darling Test Statistic	19.68	95% Bootstrap-t UCL 0.921
Anderson-Darling 5% Critical Value	0.764	95% Hall's Bootstrap UCL 0.926
Kolmogorov-Smirnov Test Statistic	0.268	95% Percentile Bootstrap UCL 0.858
Kolmogorov-Smirnov 5% Critical Value	0.0631	95% BCA Bootstrap UCL 0.89
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1.019
		97.5% Chebyshev(Mean, Sd) UCL 1.138
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.37
95% Approximate Gamma UCL	0.805	
95% Adjusted Gamma UCL	0.805	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1.019

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.

Cobalt

General Statistics

Number of Valid Observations	820	Number of Distinct Observations	173
Number of Missing Values	8		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.115	Minimum of Log Data	-2.163
Maximum	12.7	Maximum of Log Data	2.542
Mean	1.914	Mean of log Data	0.271
Median	1.5	SD of log Data	0.954
SD	1.655		
Std. Error of Mean	0.0578		
Coefficient of Variation	0.865		
Skewness	2.349		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.138	Lilliefors Test Statistic	0.14
Lilliefors Critical Value	0.0309	Lilliefors Critical Value	0.0309
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2.009	95% H-UCL	2.213
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.425
95% Adjusted-CLT UCL (Chen-1995)	2.014	97.5% Chebyshev (MVUE) UCL	2.581
95% Modified-t UCL (Johnson-1978)	2.01	99% Chebyshev (MVUE) UCL	2.887

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.46	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1.311	
MLE of Mean	1.914	
MLE of Standard Deviation	1.584	
nu star	2395	
Approximate Chi Square Value (.05)	2283	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 2.009
Adjusted Chi Square Value	2282	95% Jackknife UCL 2.009
		95% Standard Bootstrap UCL 2.01
Anderson-Darling Test Statistic	8.351	95% Bootstrap-t UCL 2.019
Anderson-Darling 5% Critical Value	0.772	95% Hall's Bootstrap UCL 2.016
Kolmogorov-Smirnov Test Statistic	0.118	95% Percentile Bootstrap UCL 2.016
Kolmogorov-Smirnov 5% Critical Value	0.0335	95% BCA Bootstrap UCL 2.016
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.166
		97.5% Chebyshev(Mean, Sd) UCL 2.275
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.489
95% Approximate Gamma UCL	2.009	
95% Adjusted Gamma UCL	2.009	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2.166

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	929	Number of Distinct Observations	318

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.44	Minimum of Log Data	-0.821
Maximum	1730	Maximum of Log Data	7.456
Mean	22.33	Mean of log Data	2.043
Median	8.2	SD of log Data	1.165
SD	98.31		
Std. Error of Mean	3.225		
Coefficient of Variation	4.403		
Skewness	11.44		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.412	Lilliefors Test Statistic	0.0723
Lilliefors Critical Value	0.0291	Lilliefors Critical Value	0.0291
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	27.64	95% H-UCL	16.57
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18.47
95% Adjusted-CLT UCL (Chen-1995)	28.93	97.5% Chebyshev (MVUE) UCL	19.88
95% Modified-t UCL (Johnson-1978)	27.84	99% Chebyshev (MVUE) UCL	22.66

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.583	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	38.32	
MLE of Mean	22.33	
MLE of Standard Deviation	29.25	
nu star	1083	
Approximate Chi Square Value (.05)	1007	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 27.63
Adjusted Chi Square Value	1007	95% Jackknife UCL 27.64
		95% Standard Bootstrap UCL 27.6
Anderson-Darling Test Statistic	1.08E+28	95% Bootstrap-t UCL 29.81
Anderson-Darling 5% Critical Value	0.815	95% Hall's Bootstrap UCL 29.2
Kolmogorov-Smirnov Test Statistic	0.225	95% Percentile Bootstrap UCL 27.74
Kolmogorov-Smirnov 5% Critical Value	0.0319	95% BCA Bootstrap UCL 28.89
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 36.39
		97.5% Chebyshev(Mean, Sd) UCL 42.47
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 54.42
95% Approximate Gamma UCL	24	
95% Adjusted Gamma UCL	24	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	36.39

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations 793
Number of Distinct Observations 511

Raw Statistics

Minimum 912
Maximum 96800
Mean 16875
Median 13000
SD 14264
Std. Error of Mean 506.5
Coefficient of Variation 0.845
Skewness 2.144

Log-transformed Statistics

Minimum of Log Data 6.816
Maximum of Log Data 11.48
Mean of log Data 9.442
SD of log Data 0.768

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.154
Lilliefors Critical Value 0.0315
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0198
Lilliefors Critical Value 0.0315
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 17709

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 17750
95% Modified-t UCL (Johnson-1978) 17716

Assuming Lognormal Distribution

95% H-UCL 17843
95% Chebyshev (MVUE) UCL 19205
97.5% Chebyshev (MVUE) UCL 20194
99% Chebyshev (MVUE) UCL 22135

Gamma Distribution Test

k star (bias corrected) 1.858
Theta Star 9082
MLE of Mean 16875
MLE of Standard Deviation 12380
nu star 2947
Approximate Chi Square Value (.05) 2822
Adjusted Level of Significance 0.0497
Adjusted Chi Square Value 2822

Anderson-Darling Test Statistic 6.113
Anderson-Darling 5% Critical Value 0.769
Kolmogorov-Smirnov Test Statistic 0.0611
Kolmogorov-Smirnov 5% Critical Value 0.034
Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 17623
95% Adjusted Gamma UCL 17625

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL 17708
95% Jackknife UCL 17709
95% Standard Bootstrap UCL 17706
95% Bootstrap-t UCL 17737
95% Hall's Bootstrap UCL 17754
95% Percentile Bootstrap UCL 17712
95% BCA Bootstrap UCL 17812
95% Chebyshev(Mean, Sd) UCL 19083
97.5% Chebyshev(Mean, Sd) UCL 20039
99% Chebyshev(Mean, Sd) UCL 21915

Potential UCL to Use

Use 95% H-UCL 17843

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	911	Number of Distinct Observations	542

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	47700	Maximum of Log Data	10.77
Mean	208.4	Mean of log Data	3.389
Median	27	SD of log Data	1.563
SD	1748		
Std. Error of Mean	57.93		
Coefficient of Variation	8.388		
Skewness	22.93		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.453	Lilliefors Test Statistic	0.0709
Lilliefors Critical Value	0.0294	Lilliefors Critical Value	0.0294
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	303.8	95% H-UCL	115
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	133.7
95% Adjusted-CLT UCL (Chen-1995)	350.7	97.5% Chebyshev (MVUE) UCL	148.2
95% Modified-t UCL (Johnson-1978)	311.2	99% Chebyshev (MVUE) UCL	176.6

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.345	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	604.1	
MLE of Mean	208.4	
MLE of Standard Deviation	354.9	
nu star	628.7	
Approximate Chi Square Value (.05)	571.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 303.7
Adjusted Chi Square Value	571.4	95% Jackknife UCL 303.8
		95% Standard Bootstrap UCL 305
Anderson-Darling Test Statistic	1.1E+28	95% Bootstrap-t UCL 450.7
Anderson-Darling 5% Critical Value	0.86	95% Hall's Bootstrap UCL 645.4
Kolmogorov-Smirnov Test Statistic	0.248	95% Percentile Bootstrap UCL 315.2
Kolmogorov-Smirnov 5% Critical Value	0.0332	95% BCA Bootstrap UCL 377.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 460.9
		97.5% Chebyshev(Mean, Sd) UCL 570.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 784.8
95% Approximate Gamma UCL	229.3	
95% Adjusted Gamma UCL	229.3	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	460.9

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	829	Number of Distinct Observations	547

Raw Statistics		**Log-transformed Statistics**	
Minimum	2	Minimum of Log Data	0.693
Maximum	3470	Maximum of Log Data	8.152
Mean	63.16	Mean of log Data	3.591
Median	33.4	SD of log Data	0.962
SD	144.7		
Std. Error of Mean	5.026		
Coefficient of Variation	2.291		
Skewness	16.77		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.336	Lilliefors Test Statistic	0.0482
Lilliefors Critical Value	0.0308	Lilliefors Critical Value	0.0308
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	71.43	95% H-UCL	61.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	67.64
95% Adjusted-CLT UCL (Chen-1995)	74.55	97.5% Chebyshev (MVUE) UCL	72.02
95% Modified-t UCL (Johnson-1978)	71.92	99% Chebyshev (MVUE) UCL	80.61

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.033	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	61.15	
MLE of Mean	63.16	
MLE of Standard Deviation	62.14	
nu star	1713	
Approximate Chi Square Value (.05)	1617	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 71.42
Adjusted Chi Square Value	1617	95% Jackknife UCL 71.43
		95% Standard Bootstrap UCL 71.42
Anderson-Darling Test Statistic	1.21E+28	95% Bootstrap-t UCL 77.36
Anderson-Darling 5% Critical Value	0.784	95% Hall's Bootstrap UCL 109.6
Kolmogorov-Smirnov Test Statistic	0.138	95% Percentile Bootstrap UCL 72.45
Kolmogorov-Smirnov 5% Critical Value	0.0337	95% BCA Bootstrap UCL 76.24
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 85.06
		97.5% Chebyshev(Mean, Sd) UCL 94.54
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 113.2
95% Approximate Gamma UCL	66.87	
95% Adjusted Gamma UCL	66.88	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 85.06

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 C-6
ProUCL Output - All Areas (except Areas 2, 8, and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	828	Number of Distinct Observations	379

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.52	Minimum of Log Data	-0.654
Maximum	202	Maximum of Log Data	5.308
Mean	20.01	Mean of log Data	2.717
Median	15.1	SD of log Data	0.747
SD	18.09		
Std. Error of Mean	0.629		
Coefficient of Variation	0.904		
Skewness	3.562		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.166	Lilliefors Test Statistic	0.0269
Lilliefors Critical Value	0.0308	Lilliefors Critical Value	0.0308
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21.05	95% H-UCL	21.03
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22.56
95% Adjusted-CLT UCL (Chen-1995)	21.13	97.5% Chebyshev (MVUE) UCL	23.66
95% Modified-t UCL (Johnson-1978)	21.06	99% Chebyshev (MVUE) UCL	25.84

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.934	**Data appear Lognormal at 5% Significance Level**
Theta Star	10.35	
MLE of Mean	20.01	
MLE of Standard Deviation	14.39	
nu star	3202	
Approximate Chi Square Value (.05)	3071	
Adjusted Level of Significance	0.0497	
Adjusted Chi Square Value	3071	
Anderson-Darling Test Statistic	6.461	
Anderson-Darling 5% Critical Value	0.768	
Kolmogorov-Smirnov Test Statistic	0.0676	
Kolmogorov-Smirnov 5% Critical Value	0.0332	
Data not Gamma Distributed at 5% Significance Level		
Assuming Gamma Distribution		
95% Approximate Gamma UCL	20.86	
95% Adjusted Gamma UCL	20.87	

Nonparametric Statistics	
95% CLT UCL	21.05
95% Jackknife UCL	21.05
95% Standard Bootstrap UCL	21.05
95% Bootstrap-t UCL	21.15
95% Hall's Bootstrap UCL	21.12
95% Percentile Bootstrap UCL	21.07
95% BCA Bootstrap UCL	21.2
95% Chebyshev(Mean, Sd) UCL	22.75
97.5% Chebyshev(Mean, Sd) UCL	23.94
99% Chebyshev(Mean, Sd) UCL	26.27

Potential UCL to Use	Use 95% H-UCL 21.03

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.

Zinc

General Statistics

Number of Valid Observations	814	Number of Distinct Observations	486
Number of Missing Values	33		

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	5160	Maximum of Log Data	8.549
Mean	41.03	Mean of log Data	3.127
Median	25.4	SD of log Data	0.964
SD	184.7		
Std. Error of Mean	6.475		
Coefficient of Variation	4.502		
Skewness	26.31		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.414	Lilliefors Test Statistic	0.0616
Lilliefors Critical Value	0.0311	Lilliefors Critical Value	0.0311
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	51.69	95% H-UCL	38.93
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	42.73
95% Adjusted-CLT UCL (Chen-1995)	58.06	97.5% Chebyshev (MVUE) UCL	45.52
95% Modified-t UCL (Johnson-1978)	52.69	99% Chebyshev (MVUE) UCL	51

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.982	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	41.76	
MLE of Mean	41.03	
MLE of Standard Deviation	41.4	
nu star	1599	
Approximate Chi Square Value (.05)	1507	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 51.68
Adjusted Chi Square Value	1507	95% Jackknife UCL 51.69
		95% Standard Bootstrap UCL 51.7
Anderson-Darling Test Statistic	1.23E+28	95% Bootstrap-t UCL 79.67
Anderson-Darling 5% Critical Value	0.786	95% Hall's Bootstrap UCL 91.63
Kolmogorov-Smirnov Test Statistic	0.104	95% Percentile Bootstrap UCL 53.33
Kolmogorov-Smirnov 5% Critical Value	0.0341	95% BCA Bootstrap UCL 61.06
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 69.25
		97.5% Chebyshev(Mean, Sd) UCL 81.46
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 105.5
95% Approximate Gamma UCL	43.53	
95% Adjusted Gamma UCL	43.53	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 69.25

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 C-7

ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil

Raritan Bay Slag Site

Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	AllArea_exc_8_11_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations	237	Number of Distinct Observations	112

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	3000	Maximum of Log Data	8.006
Mean	83.02	Mean of log Data	2.965
Median	16	SD of log Data	1.753
SD	226.6		
Std. Error of Mean	14.72		
Coefficient of Variation	2.729		
Skewness	9.528		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.36	Lilliefors Test Statistic	0.104
Lilliefors Critical Value	0.0576	Lilliefors Critical Value	0.0576
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	107.3	95% H-UCL	125.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	156.6
95% Adjusted-CLT UCL (Chen-1995)	117	97.5% Chebyshev (MVUE) UCL	186
95% Modified-t UCL (Johnson-1978)	108.8	99% Chebyshev (MVUE) UCL	243.7

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.442	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	187.8	
MLE of Mean	83.02	
MLE of Standard Deviation	124.9	
nu star	209.5	
Approximate Chi Square Value (.05)	177	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 107.2
Adjusted Chi Square Value	176.8	95% Jackknife UCL 107.3
		95% Standard Bootstrap UCL 106.8
Anderson-Darling Test Statistic	8.368	95% Bootstrap-t UCL 125.8
Anderson-Darling 5% Critical Value	0.835	95% Hall's Bootstrap UCL 214.4
Kolmogorov-Smirnov Test Statistic	0.146	95% Percentile Bootstrap UCL 109.4
Kolmogorov-Smirnov 5% Critical Value	0.0633	95% BCA Bootstrap UCL 125.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 147.2
		97.5% Chebyshev(Mean, Sd) UCL 174.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 229.5
95% Approximate Gamma UCL	98.27	
95% Adjusted Gamma UCL	98.37	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 147.2

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations	237	Number of Distinct Observations	115

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	2200	Maximum of Log Data	7.696
Mean	76.13	Mean of log Data	2.91
Median	16	SD of log Data	1.79
SD	177.5		
Std. Error of Mean	11.53		
Coefficient of Variation	2.332		
Skewness	7.906		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.338	Lilliefors Test Statistic	0.139
Lilliefors Critical Value	0.0576	Lilliefors Critical Value	0.0576
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	95.16	95% H-UCL	128.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	160.3
95% Adjusted-CLT UCL (Chen-1995)	101.4	97.5% Chebyshev (MVUE) UCL	190.9
95% Modified-t UCL (Johnson-1978)	96.15	99% Chebyshev (MVUE) UCL	251.1

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.451	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	169	
MLE of Mean	76.13	
MLE of Standard Deviation	113.4	
nu star	213.5	
Approximate Chi Square Value (.05)	180.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 95.09
Adjusted Chi Square Value	180.5	95% Jackknife UCL 95.16
		95% Standard Bootstrap UCL 95.18
Anderson-Darling Test Statistic	7.83	95% Bootstrap-t UCL 105.6
Anderson-Darling 5% Critical Value	0.832	95% Hall's Bootstrap UCL 180.2
Kolmogorov-Smirnov Test Statistic	0.142	95% Percentile Bootstrap UCL 95.6
Kolmogorov-Smirnov 5% Critical Value	0.0632	95% BCA Bootstrap UCL 105.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 126.4
		97.5% Chebyshev(Mean, Sd) UCL 148.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 190.8
95% Approximate Gamma UCL	89.95	
95% Adjusted Gamma UCL	90.04	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 126.4

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations	237	Number of Distinct Observations	120

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	2100	Maximum of Log Data	7.65
Mean	91.99	Mean of log Data	3.241
Median	25	SD of log Data	1.72
SD	193.9		
Std. Error of Mean	12.6		
Coefficient of Variation	2.108		
Skewness	6.069		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.321	Lilliefors Test Statistic	0.0993
Lilliefors Critical Value	0.0576	Lilliefors Critical Value	0.0576
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	112.8	95% H-UCL	154.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	192.9
95% Adjusted-CLT UCL (Chen-1995)	118	97.5% Chebyshev (MVUE) UCL	228.5
95% Modified-t UCL (Johnson-1978)	113.6	99% Chebyshev (MVUE) UCL	298.5

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.493	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	186.6	
MLE of Mean	91.99	
MLE of Standard Deviation	131	
nu star	233.7	
Approximate Chi Square Value (.05)	199.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 112.7
Adjusted Chi Square Value	199.1	95% Jackknife UCL 112.8
		95% Standard Bootstrap UCL 112.6
Anderson-Darling Test Statistic	4.96	95% Bootstrap-t UCL 123.3
Anderson-Darling 5% Critical Value	0.822	95% Hall's Bootstrap UCL 129.9
Kolmogorov-Smirnov Test Statistic	0.111	95% Percentile Bootstrap UCL 113.7
Kolmogorov-Smirnov 5% Critical Value	0.0628	95% BCA Bootstrap UCL 120.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 146.9
		97.5% Chebyshev(Mean, Sd) UCL 170.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 217.3
95% Approximate Gamma UCL	107.9	
95% Adjusted Gamma UCL	108	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 146.9

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.

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	236	Number of Distinct Observations	84

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	520	Maximum of Log Data	6.254
Mean	54.36	Mean of log Data	2.386
Median	4.25	SD of log Data	1.887
SD	97.41		
Std. Error of Mean	6.341		
Coefficient of Variation	1.792		
Skewness	2.64		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.294	Lilliefors Test Statistic	0.233
Lilliefors Critical Value	0.0577	Lilliefors Critical Value	0.0577
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	64.83	95% H-UCL	93.66
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	117.3
95% Adjusted-CLT UCL (Chen-1995)	65.95	97.5% Chebyshev (MVUE) UCL	140.8
95% Modified-t UCL (Johnson-1978)	65.01	99% Chebyshev (MVUE) UCL	186.9

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.405	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	134.2	
MLE of Mean	54.36	
MLE of Standard Deviation	85.41	
nu star	191.2	
Approximate Chi Square Value (.05)	160.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 64.79
Adjusted Chi Square Value	160.1	95% Jackknife UCL 64.83
		95% Standard Bootstrap UCL 65.01
Anderson-Darling Test Statistic	18.74	95% Bootstrap-t UCL 66.29
Anderson-Darling 5% Critical Value	0.844	95% Hall's Bootstrap UCL 66.02
Kolmogorov-Smirnov Test Statistic	0.242	95% Percentile Bootstrap UCL 65.03
Kolmogorov-Smirnov 5% Critical Value	0.0637	95% BCA Bootstrap UCL 66.29
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 82
		97.5% Chebyshev(Mean, Sd) UCL 93.96
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 117.4
95% Approximate Gamma UCL	64.87	
95% Adjusted Gamma UCL	64.94	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 82

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.

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations	236	Number of Distinct Observations	107

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.75	Minimum of Log Data	0.56
Maximum	1200	Maximum of Log Data	7.09
Mean	65.51	Mean of log Data	2.803
Median	14.5	SD of log Data	1.816
SD	119.5		
Std. Error of Mean	7.778		
Coefficient of Variation	1.824		
Skewness	4.713		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.297	Lilliefors Test Statistic	0.148
Lilliefors Critical Value	0.0577	Lilliefors Critical Value	0.0577
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	78.36	95% H-UCL	121.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	152.6
95% Adjusted-CLT UCL (Chen-1995)	80.86	97.5% Chebyshev (MVUE) UCL	182.1
95% Modified-t UCL (Johnson-1978)	78.75	99% Chebyshev (MVUE) UCL	240.1

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.463	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	141.6	
MLE of Mean	65.51	
MLE of Standard Deviation	96.33	
nu star	218.3	
Approximate Chi Square Value (.05)	185.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 78.31
Adjusted Chi Square Value	184.9	95% Jackknife UCL 78.36
		95% Standard Bootstrap UCL 78.24
Anderson-Darling Test Statistic	9.336	95% Bootstrap-t UCL 81.91
Anderson-Darling 5% Critical Value	0.83	95% Hall's Bootstrap UCL 82.79
Kolmogorov-Smirnov Test Statistic	0.147	95% Percentile Bootstrap UCL 79.47
Kolmogorov-Smirnov 5% Critical Value	0.0632	95% BCA Bootstrap UCL 79.85
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 99.41
		97.5% Chebyshev(Mean, Sd) UCL 114.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 142.9
95% Approximate Gamma UCL	77.26	
95% Adjusted Gamma UCL	77.34	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 99.41

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aroclor 1254

General Statistics

Number of Valid Observations	237	Number of Distinct Observations	63

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.75	Minimum of Log Data	1.322
Maximum	62000	Maximum of Log Data	11.03
Mean	438.5	Mean of log Data	3.417
Median	19.5	SD of log Data	1.201
SD	4271		
Std. Error of Mean	277.4		
Coefficient of Variation	9.742		
Skewness	13.35		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.462	Lilliefors Test Statistic	0.321
Lilliefors Critical Value	0.0576	Lilliefors Critical Value	0.0576
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	896.6	95% H-UCL	75.24
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	89.83
95% Adjusted-CLT UCL (Chen-1995)	1152	97.5% Chebyshev (MVUE) UCL	101.7
95% Modified-t UCL (Johnson-1978)	936.7	99% Chebyshev (MVUE) UCL	125

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.263	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1664	
MLE of Mean	438.5	
MLE of Standard Deviation	854.2	
nu star	124.9	
Approximate Chi Square Value (.05)	100.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.049	95% CLT UCL 894.8
Adjusted Chi Square Value	99.95	95% Jackknife UCL 896.6
		95% Standard Bootstrap UCL 892.1
Anderson-Darling Test Statistic	4.22E+28	95% Bootstrap-t UCL 6408
Anderson-Darling 5% Critical Value	0.886	95% Hall's Bootstrap UCL 4189
Kolmogorov-Smirnov Test Statistic	0.395	95% Percentile Bootstrap UCL 960.2
Kolmogorov-Smirnov 5% Critical Value	0.0649	95% BCA Bootstrap UCL 1481
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1648
		97.5% Chebyshev(Mean, Sd) UCL 2171
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3199
95% Approximate Gamma UCL	547.1	
95% Adjusted Gamma UCL	547.9	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1648

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	870	Number of Distinct Observations	505

Raw Statistics		**Log-transformed Statistics**	
Minimum	149	Minimum of Log Data	5.004
Maximum	27600	Maximum of Log Data	10.23
Mean	2114	Mean of log Data	7.339
Median	1420	SD of log Data	0.779
SD	2092		
Std. Error of Mean	70.94		
Coefficient of Variation	0.99		
Skewness	3.903		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.198	Lilliefors Test Statistic	0.051
Lilliefors Critical Value	0.03	Lilliefors Critical Value	0.03
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2231	95% H-UCL	2195
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2357
95% Adjusted-CLT UCL (Chen-1995)	2241	97.5% Chebyshev (MVUE) UCL	2476
95% Modified-t UCL (Johnson-1978)	2232	99% Chebyshev (MVUE) UCL	2708

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.72	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1229	
MLE of Mean	2114	
MLE of Standard Deviation	1612	
nu star	2993	
Approximate Chi Square Value (.05)	2867	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 2231
Adjusted Chi Square Value	2867	95% Jackknife UCL 2231
		95% Standard Bootstrap UCL 2232
Anderson-Darling Test Statistic	16.55	95% Bootstrap-t UCL 2239
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL 2247
Kolmogorov-Smirnov Test Statistic	0.108	95% Percentile Bootstrap UCL 2231
Kolmogorov-Smirnov 5% Critical Value	0.0323	95% BCA Bootstrap UCL 2236
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2423
		97.5% Chebyshev(Mean, Sd) UCL 2557
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2820
95% Approximate Gamma UCL	2207	
95% Adjusted Gamma UCL	2207	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2423

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	1013	Number of Distinct Observations	273

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.065	Minimum of Log Data	-2.733
Maximum	2390	Maximum of Log Data	7.779
Mean	15.68	Mean of log Data	0.606
Median	2.6	SD of log Data	1.648
SD	124.8		
Std. Error of Mean	3.923		
Coefficient of Variation	7.963		
Skewness	15.1		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.45	Lilliefors Test Statistic	0.107
Lilliefors Critical Value	0.0278	Lilliefors Critical Value	0.0278
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.14	95% H-UCL	N/A
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.551
95% Adjusted-CLT UCL (Chen-1995)	24.12	97.5% Chebyshev (MVUE) UCL	10.61
95% Modified-t UCL (Johnson-1978)	22.45	99% Chebyshev (MVUE) UCL	12.69

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.318	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	49.32	
MLE of Mean	15.68	
MLE of Standard Deviation	27.81	
nu star	644	
Approximate Chi Square Value (.05)	586.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0498	95% CLT UCL 22.13
Adjusted Chi Square Value	586.1	95% Jackknife UCL 22.14
		95% Standard Bootstrap UCL 22.26
Anderson-Darling Test Statistic	9.87E+27	95% Bootstrap-t UCL 26.68
Anderson-Darling 5% Critical Value	0.867	95% Hall's Bootstrap UCL 24.22
Kolmogorov-Smirnov Test Statistic	0.301	95% Percentile Bootstrap UCL 22.67
Kolmogorov-Smirnov 5% Critical Value	0.0309	95% BCA Bootstrap UCL 24.65
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 32.78
		97.5% Chebyshev(Mean, Sd) UCL 40.18
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 54.71
95% Approximate Gamma UCL	17.23	
95% Adjusted Gamma UCL	17.23	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 32.78

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	1013	Number of Distinct Observations	285

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.09	Minimum of Log Data	-2.408
Maximum	760	Maximum of Log Data	6.633
Mean	10.56	Mean of log Data	1.528
Median	4.6	SD of log Data	1.13
SD	36.22		
Std. Error of Mean	1.138		
Coefficient of Variation	3.429		
Skewness	14.4		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.386	Lilliefors Test Statistic	0.0548
Lilliefors Critical Value	0.0278	Lilliefors Critical Value	0.0278
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.44	95% H-UCL	N/A
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	10.43
95% Adjusted-CLT UCL (Chen-1995)	12.98	97.5% Chebyshev (MVUE) UCL	11.17
95% Modified-t UCL (Johnson-1978)	12.52	99% Chebyshev (MVUE) UCL	12.64

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.723	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	14.6	
MLE of Mean	10.56	
MLE of Standard Deviation	12.42	
nu star	1466	
Approximate Chi Square Value (.05)	1378	**Nonparametric Statistics**
Adjusted Level of Significance	0.0498	95% CLT UCL 12.43
Adjusted Chi Square Value	1378	95% Jackknife UCL 12.44
		95% Standard Bootstrap UCL 12.41
Anderson-Darling Test Statistic	9.87E+27	95% Bootstrap-t UCL 13.4
Anderson-Darling 5% Critical Value	0.799	95% Hall's Bootstrap UCL 19.46
Kolmogorov-Smirnov Test Statistic	0.173	95% Percentile Bootstrap UCL 12.58
Kolmogorov-Smirnov 5% Critical Value	0.0298	95% BCA Bootstrap UCL 13.18
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 15.52
		97.5% Chebyshev(Mean, Sd) UCL 17.67
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 21.88
95% Approximate Gamma UCL	11.24	
95% Adjusted Gamma UCL	11.24	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 15.52

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cadmium

General Statistics

Number of Valid Observations	923	Number of Distinct Observations	202

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.007	Minimum of Log Data	-4.962
Maximum	12.5	Maximum of Log Data	2.526
Mean	0.314	Mean of log Data	-1.76
Median	0.18	SD of log Data	1.088
SD	0.612		
Std. Error of Mean	0.0201		
Coefficient of Variation	1.95		
Skewness	10.9		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.319	Lilliefors Test Statistic	0.115
Lilliefors Critical Value	0.0292	Lilliefors Critical Value	0.0292
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.347	95% H-UCL	0.336
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.372
95% Adjusted-CLT UCL (Chen-1995)	0.355	97.5% Chebyshev (MVUE) UCL	0.398
95% Modified-t UCL (Johnson-1978)	0.348	99% Chebyshev (MVUE) UCL	0.45

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.963	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.326	
MLE of Mean	0.314	
MLE of Standard Deviation	0.32	
nu star	1778	
Approximate Chi Square Value (.05)	1681	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 0.347
Adjusted Chi Square Value	1681	95% Jackknife UCL 0.347
		95% Standard Bootstrap UCL 0.347
Anderson-Darling Test Statistic	1.08E+28	95% Bootstrap-t UCL 0.359
Anderson-Darling 5% Critical Value	0.786	95% Hall's Bootstrap UCL 0.368
Kolmogorov-Smirnov Test Statistic	0.169	95% Percentile Bootstrap UCL 0.349
Kolmogorov-Smirnov 5% Critical Value	0.0314	95% BCA Bootstrap UCL 0.357
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.402
		97.5% Chebyshev(Mean, Sd) UCL 0.439
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.514
95% Approximate Gamma UCL	0.332	
95% Adjusted Gamma UCL	0.332	

Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	0.402

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations 231
Number of Distinct Observations 74

Raw Statistics

Minimum	0.05
Maximum	8.3
Mean	0.694
Median	0.55
SD	0.89
Std. Error of Mean	0.0586
Coefficient of Variation	1.283
Skewness	6.135

Log-transformed Statistics

Minimum of Log Data	-2.996
Maximum of Log Data	2.116
Mean of log Data	-0.7
SD of log Data	0.825

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.32
Lilliefors Critical Value	0.0583

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.185
Lilliefors Critical Value	0.0583

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.791

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.816
95% Modified-t UCL (Johnson-1978)	0.795

Assuming Lognormal Distribution

95% H-UCL	0.779
95% Chebyshev (MVUE) UCL	0.887
97.5% Chebyshev (MVUE) UCL	0.969
99% Chebyshev (MVUE) UCL	1.13

Gamma Distribution Test

k star (bias corrected)	1.622
Theta Star	0.428
MLE of Mean	0.694
MLE of Standard Deviation	0.545
nu star	749.6
Approximate Chi Square Value (.05)	687
Adjusted Level of Significance	0.049
Adjusted Chi Square Value	686.7
Anderson-Darling Test Statistic	15.21
Anderson-Darling 5% Critical Value	0.77
Kolmogorov-Smirnov Test Statistic	0.216
Kolmogorov-Smirnov 5% Critical Value	0.0611

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.757
95% Adjusted Gamma UCL	0.758

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.791
95% Jackknife UCL	0.791
95% Standard Bootstrap UCL	0.792
95% Bootstrap-t UCL	0.842
95% Hall's Bootstrap UCL	0.861
95% Percentile Bootstrap UCL	0.801
95% BCA Bootstrap UCL	0.822
95% Chebyshev(Mean, Sd) UCL	0.95
97.5% Chebyshev(Mean, Sd) UCL	1.06
99% Chebyshev(Mean, Sd) UCL	1.277

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 0.95

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations	914	Number of Distinct Observations	174

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.115	Minimum of Log Data	-2.163
Maximum	12.7	Maximum of Log Data	2.542
Mean	1.857	Mean of log Data	0.254
Median	1.4	SD of log Data	0.928
SD	1.602		
Std. Error of Mean	0.053		
Coefficient of Variation	0.863		
Skewness	2.409		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.138	Lilliefors Test Statistic	0.132
Lilliefors Critical Value	0.0293	Lilliefors Critical Value	0.0293
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.945	95% H-UCL	2.11
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.297
95% Adjusted-CLT UCL (Chen-1995)	1.949	97.5% Chebyshev (MVUE) UCL	2.434
95% Modified-t UCL (Johnson-1978)	1.945	99% Chebyshev (MVUE) UCL	2.703

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.509	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1.231	
MLE of Mean	1.857	
MLE of Standard Deviation	1.512	
nu star	2758	
Approximate Chi Square Value (.05)	2637	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 1.945
Adjusted Chi Square Value	2637	95% Jackknife UCL 1.945
		95% Standard Bootstrap UCL 1.945
Anderson-Darling Test Statistic	8.654	95% Bootstrap-t UCL 1.946
Anderson-Darling 5% Critical Value	0.771	95% Hall's Bootstrap UCL 1.952
Kolmogorov-Smirnov Test Statistic	0.113	95% Percentile Bootstrap UCL 1.947
Kolmogorov-Smirnov 5% Critical Value	0.0313	95% BCA Bootstrap UCL 1.955
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.089
		97.5% Chebyshev(Mean, Sd) UCL 2.188
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.385
95% Approximate Gamma UCL	1.943	
95% Adjusted Gamma UCL	1.943	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2.089

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	1023	Number of Distinct Observations	345

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.44	Minimum of Log Data	-0.821
Maximum	1730	Maximum of Log Data	7.456
Mean	23.17	Mean of log Data	2.119
Median	8.7	SD of log Data	1.171
SD	94.96		
Std. Error of Mean	2.969		
Coefficient of Variation	4.099		
Skewness	11.56		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.405	Lilliefors Test Statistic	0.0749
Lilliefors Critical Value	0.0277	Lilliefors Critical Value	0.0277
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	28.05	95% H-UCL	N/A
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	19.9
95% Adjusted-CLT UCL (Chen-1995)	29.2	97.5% Chebyshev (MVUE) UCL	21.37
95% Modified-t UCL (Johnson-1978)	28.23	99% Chebyshev (MVUE) UCL	24.27

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.602	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	38.5	
MLE of Mean	23.17	
MLE of Standard Deviation	29.87	
nu star	1231	
Approximate Chi Square Value (.05)	1151	**Nonparametric Statistics**
Adjusted Level of Significance	0.0498	95% CLT UCL 28.05
Adjusted Chi Square Value	1151	95% Jackknife UCL 28.05
		95% Standard Bootstrap UCL 28.07
Anderson-Darling Test Statistic	9.78E+27	95% Bootstrap-t UCL 29.95
Anderson-Darling 5% Critical Value	0.813	95% Hall's Bootstrap UCL 29.5
Kolmogorov-Smirnov Test Statistic	0.221	95% Percentile Bootstrap UCL 28.17
Kolmogorov-Smirnov 5% Critical Value	0.0299	95% BCA Bootstrap UCL 30.05
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 36.11
		97.5% Chebyshev(Mean, Sd) UCL 41.71
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 52.71
95% Approximate Gamma UCL	24.79	
95% Adjusted Gamma UCL	24.79	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 36.11

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations	886	Number of Distinct Observations	550

Raw Statistics		**Log-transformed Statistics**	
Minimum	912	Minimum of Log Data	6.816
Maximum	96800	Maximum of Log Data	11.48
Mean	16433	Mean of log Data	9.417
Median	12100	SD of log Data	0.76
SD	14063		
Std. Error of Mean	472.4		
Coefficient of Variation	0.856		
Skewness	2.215		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.161	Lilliefors Test Statistic	0.0257
Lilliefors Critical Value	0.0298	Lilliefors Critical Value	0.0298
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17210	95% H-UCL	17232
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18467
95% Adjusted-CLT UCL (Chen-1995)	17247	97.5% Chebyshev (MVUE) UCL	19362
95% Modified-t UCL (Johnson-1978)	17216	99% Chebyshev (MVUE) UCL	21120

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.865	**Data appear Lognormal at 5% Significance Level**
Theta Star	8811	
MLE of Mean	16433	
MLE of Standard Deviation	12032	
nu star	3305	
Approximate Chi Square Value (.05)	3172	
Adjusted Level of Significance	0.0497	
Adjusted Chi Square Value	3172	
Anderson-Darling Test Statistic	8.288	
Anderson-Darling 5% Critical Value	0.769	
Kolmogorov-Smirnov Test Statistic	0.0677	
Kolmogorov-Smirnov 5% Critical Value	0.0318	
Data not Gamma Distributed at 5% Significance Level		
Assuming Gamma Distribution		
95% Approximate Gamma UCL	17119	
95% Adjusted Gamma UCL	17120	

Nonparametric Statistics	
95% CLT UCL	17210
95% Jackknife UCL	17210
95% Standard Bootstrap UCL	17201
95% Bootstrap-t UCL	17269
95% Hall's Bootstrap UCL	17271
95% Percentile Bootstrap UCL	17213
95% BCA Bootstrap UCL	17233
95% Chebyshev(Mean, Sd) UCL	18492
97.5% Chebyshev(Mean, Sd) UCL	19383
99% Chebyshev(Mean, Sd) UCL	21133

Potential UCL to Use	Use 95% H-UCL 17232

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	1001	Number of Distinct Observations	610
Number of Missing Values	44		

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	47700	Maximum of Log Data	10.77
Mean	234.2	Mean of log Data	3.588
Median	30	SD of log Data	1.643
SD	1680		
Std. Error of Mean	53.09		
Coefficient of Variation	7.17		
Skewness	23.5		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.445	Lilliefors Test Statistic	0.0706
Lilliefors Critical Value	0.028	Lilliefors Critical Value	0.028
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	321.7	95% H-UCL	159.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	186.9
95% Adjusted-CLT UCL (Chen-1995)	363.7	97.5% Chebyshev (MVUE) UCL	207.6
95% Modified-t UCL (Johnson-1978)	328.2	99% Chebyshev (MVUE) UCL	248.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.358	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	654.1	
MLE of Mean	234.2	
MLE of Standard Deviation	391.4	
nu star	717	
Approximate Chi Square Value (.05)	655.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0498	95% CLT UCL 321.6
Adjusted Chi Square Value	655.8	95% Jackknife UCL 321.7
		95% Standard Bootstrap UCL 323.3
Anderson-Darling Test Statistic	9.99E+27	95% Bootstrap-t UCL 446.1
Anderson-Darling 5% Critical Value	0.857	95% Hall's Bootstrap UCL 648.3
Kolmogorov-Smirnov Test Statistic	0.222	95% Percentile Bootstrap UCL 330.9
Kolmogorov-Smirnov 5% Critical Value	0.0309	95% BCA Bootstrap UCL 373.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 465.7
		97.5% Chebyshev(Mean, Sd) UCL 565.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 762.5
95% Approximate Gamma UCL	256.1	
95% Adjusted Gamma UCL	256.1	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 465.7

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.

Manganese

General Statistics

Number of Valid Observations	930	Number of Distinct Observations	580

Raw Statistics		**Log-transformed Statistics**	
Minimum	2	Minimum of Log Data	0.693
Maximum	3470	Maximum of Log Data	8.152
Mean	60.86	Mean of log Data	3.582
Median	33.35	SD of log Data	0.937
SD	137		
Std. Error of Mean	4.491		
Coefficient of Variation	2.251		
Skewness	17.67		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.334	Lilliefors Test Statistic	0.0455
Lilliefors Critical Value	0.0291	Lilliefors Critical Value	0.0291
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	68.25	95% H-UCL	59.43
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	64.7
95% Adjusted-CLT UCL (Chen-1995)	71.02	97.5% Chebyshev (MVUE) UCL	68.57
95% Modified-t UCL (Johnson-1978)	68.68	99% Chebyshev (MVUE) UCL	76.17

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.084	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	56.15	
MLE of Mean	60.86	
MLE of Standard Deviation	58.45	
nu star	2016	
Approximate Chi Square Value (.05)	1913	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 68.24
Adjusted Chi Square Value	1913	95% Jackknife UCL 68.25
		95% Standard Bootstrap UCL 68.34
Anderson-Darling Test Statistic	1.08E+28	95% Bootstrap-t UCL 73.38
Anderson-Darling 5% Critical Value	0.782	95% Hall's Bootstrap UCL 101.6
Kolmogorov-Smirnov Test Statistic	0.132	95% Percentile Bootstrap UCL 69.23
Kolmogorov-Smirnov 5% Critical Value	0.0312	95% BCA Bootstrap UCL 72.76
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 80.43
		97.5% Chebyshev(Mean, Sd) UCL 88.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 105.5
95% Approximate Gamma UCL	64.14	
95% Adjusted Gamma UCL	64.15	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 80.43

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 C-7
ProUCL Output - All Areas (except Areas 8 and 11) Surface Soil
Raritan Bay Slag Site
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Vanadium

General Statistics

Number of Valid Observations	922	Number of Distinct Observations	388

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.52	Minimum of Log Data	-0.654
Maximum	202	Maximum of Log Data	5.308
Mean	19.57	Mean of log Data	2.707
Median	14.9	SD of log Data	0.726
SD	17.44		
Std. Error of Mean	0.574		
Coefficient of Variation	0.891		
Skewness	3.651		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.167	Lilliefors Test Statistic	0.0282
Lilliefors Critical Value	0.0292	Lilliefors Critical Value	0.0292
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20.52	95% H-UCL	20.42
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	21.78
95% Adjusted-CLT UCL (Chen-1995)	20.59	97.5% Chebyshev (MVUE) UCL	22.77
95% Modified-t UCL (Johnson-1978)	20.53	99% Chebyshev (MVUE) UCL	24.71

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.018	**Data appear Lognormal at 5% Significance Level**
Theta Star	9.698	
MLE of Mean	19.57	
MLE of Standard Deviation	13.78	
nu star	3722	
Approximate Chi Square Value (.05)	3581	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 20.52
Adjusted Chi Square Value	3581	95% Jackknife UCL 20.52
		95% Standard Bootstrap UCL 20.53
Anderson-Darling Test Statistic	8.144	95% Bootstrap-t UCL 20.64
Anderson-Darling 5% Critical Value	0.768	95% Hall's Bootstrap UCL 20.62
Kolmogorov-Smirnov Test Statistic	0.0694	95% Percentile Bootstrap UCL 20.51
Kolmogorov-Smirnov 5% Critical Value	0.0309	95% BCA Bootstrap UCL 20.59
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 22.08
		97.5% Chebyshev(Mean, Sd) UCL 23.16
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 25.29
95% Approximate Gamma UCL	20.34	
95% Adjusted Gamma UCL	20.34	

Potential UCL to Use	Use 95% H-UCL 20.42

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.

Zinc

General Statistics

Number of Valid Observations	909	Number of Distinct Observations	520
Number of Missing Values	33		

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.1	Minimum of Log Data	0.0953
Maximum	5160	Maximum of Log Data	8.549
Mean	40.65	Mean of log Data	3.154
Median	26	SD of log Data	0.942
SD	175.1		
Std. Error of Mean	5.807		
Coefficient of Variation	4.307		
Skewness	27.68		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.411	Lilliefors Test Statistic	0.0576
Lilliefors Critical Value	0.0294	Lilliefors Critical Value	0.0294
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	50.21	95% H-UCL	38.91
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	42.42
95% Adjusted-CLT UCL (Chen-1995)	55.89	97.5% Chebyshev (MVUE) UCL	44.99
95% Modified-t UCL (Johnson-1978)	51.1	99% Chebyshev (MVUE) UCL	50.05

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.04	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	39.09	
MLE of Mean	40.65	
MLE of Standard Deviation	39.86	
nu star	1890	
Approximate Chi Square Value (.05)	1790	
Adjusted Level of Significance	0.0497	
Adjusted Chi Square Value	1790	
Anderson-Darling Test Statistic	1.1E+28	
Anderson-Darling 5% Critical Value	0.784	
Kolmogorov-Smirnov Test Statistic	0.0985	
Kolmogorov-Smirnov 5% Critical Value	0.0317	
Data not Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
95% CLT UCL	50.2
95% Jackknife UCL	50.21
95% Standard Bootstrap UCL	50.19
95% Bootstrap-t UCL	75.6
95% Hall's Bootstrap UCL	86.27
95% Percentile Bootstrap UCL	51.71
95% BCA Bootstrap UCL	63.15
95% Chebyshev(Mean, Sd) UCL	65.96
97.5% Chebyshev(Mean, Sd) UCL	76.91
99% Chebyshev(Mean, Sd) UCL	98.42

Assuming Gamma Distribution	
95% Approximate Gamma UCL	42.92
95% Adjusted Gamma UCL	42.92

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 65.96

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area8_11_SS
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations 26
Number of Distinct Observations 24

Raw Statistics

Minimum	2.05
Maximum	1900
Mean	242.8
Median	120
SD	393.3
Std. Error of Mean	77.14
Coefficient of Variation	1.62
Skewness	3.266

Log-transformed Statistics

Minimum of Log Data	0.718
Maximum of Log Data	7.55
Mean of log Data	4.313
SD of log Data	1.827

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.614
Shapiro Wilk Critical Value	0.92

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.961
Shapiro Wilk Critical Value	0.92

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	374.6

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	422.5
95% Modified-t UCL (Johnson-1978)	382.8

Assuming Lognormal Distribution

95% H-UCL	1548
95% Chebyshev (MVUE) UCL	1030
97.5% Chebyshev (MVUE) UCL	1328
99% Chebyshev (MVUE) UCL	1913

Gamma Distribution Test

k star (bias corrected)	0.497
Theta Star	488.3
MLE of Mean	242.8
MLE of Standard Deviation	344.4
nu star	25.86
Approximate Chi Square Value (.05)	15.27
Adjusted Level of Significance	0.0398
Adjusted Chi Square Value	14.73
Anderson-Darling Test Statistic	0.294
Anderson-Darling 5% Critical Value	0.805
Kolmogorov-Smirnov Test Statistic	0.131
Kolmogorov-Smirnov 5% Critical Value	0.181

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	411.2
95% Adjusted Gamma UCL	426.2

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	369.7
95% Jackknife UCL	374.6
95% Standard Bootstrap UCL	367.9
95% Bootstrap-t UCL	495.2
95% Hall's Bootstrap UCL	874.7
95% Percentile Bootstrap UCL	374
95% BCA Bootstrap UCL	433.8
95% Chebyshev(Mean, Sd) UCL	579.1
97.5% Chebyshev(Mean, Sd) UCL	724.6
99% Chebyshev(Mean, Sd) UCL	1010

Potential UCL to Use

Use 95% Approximate Gamma UCL 411.2

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations 26
Number of Distinct Observations 25

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.05	Minimum of Log Data	0.718
Maximum	1400	Maximum of Log Data	7.244
Mean	199.3	Mean of log Data	4.173
Median	100	SD of log Data	1.781
SD	298.2		
Std. Error of Mean	58.49		
Coefficient of Variation	1.497		
Skewness	2.885		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.664	Shapiro Wilk Test Statistic	0.956
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	299.2	95% H-UCL	1166
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	816.8
95% Adjusted-CLT UCL (Chen-1995)	330.8	97.5% Chebyshev (MVUE) UCL	1051
95% Modified-t UCL (Johnson-1978)	304.7	99% Chebyshev (MVUE) UCL	1510

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.518	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	384.5	
MLE of Mean	199.3	
MLE of Standard Deviation	276.8	
nu star	26.95	
Approximate Chi Square Value (.05)	16.11	**Nonparametric Statistics**
Adjusted Level of Significance	0.0398	95% CLT UCL 295.5
Adjusted Chi Square Value	15.56	95% Jackknife UCL 299.2
		95% Standard Bootstrap UCL 293.8
Anderson-Darling Test Statistic	0.311	95% Bootstrap-t UCL 365.7
Anderson-Darling 5% Critical Value	0.803	95% Hall's Bootstrap UCL 694.2
Kolmogorov-Smirnov Test Statistic	0.112	95% Percentile Bootstrap UCL 301.3
Kolmogorov-Smirnov 5% Critical Value	0.181	95% BCA Bootstrap UCL 341.5
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 454.2
		97.5% Chebyshev(Mean, Sd) UCL 564.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 781.2
95% Approximate Gamma UCL	333.3	
95% Adjusted Gamma UCL	345.1	

Potential UCL to Use Use 95% Approximate Gamma UCL 333.3

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations 26 | Number of Distinct Observations 20

Raw Statistics

Minimum	2.05
Maximum	1900
Mean	284.6
Median	140
SD	376.4
Std. Error of Mean	73.82
Coefficient of Variation	1.323
Skewness	3.408

Log-transformed Statistics

Minimum of Log Data	0.718
Maximum of Log Data	7.55
Mean of log Data	5.061
SD of log Data	1.252

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.604
Shapiro Wilk Critical Value	0.92

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.876
Shapiro Wilk Critical Value	0.92

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	410.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	458.8
95% Modified-t UCL (Johnson-1978)	418.9

Assuming Lognormal Distribution

95% H-UCL	705.5
95% Chebyshev (MVUE) UCL	748.4
97.5% Chebyshev (MVUE) UCL	930
99% Chebyshev (MVUE) UCL	1287

Gamma Distribution Test

k star (bias corrected)	0.893
Theta Star	318.6
MLE of Mean	284.6
MLE of Standard Deviation	301.1
nu star	46.45
Approximate Chi Square Value (.05)	31.81
Adjusted Level of Significance	0.0398
Adjusted Chi Square Value	31.01
Anderson-Darling Test Statistic	0.874
Anderson-Darling 5% Critical Value	0.774
Kolmogorov-Smirnov Test Statistic	0.152
Kolmogorov-Smirnov 5% Critical Value	0.176

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	415.6
95% Adjusted Gamma UCL	426.3

Nonparametric Statistics

95% CLT UCL	406
95% Jackknife UCL	410.7
95% Standard Bootstrap UCL	402.7
95% Bootstrap-t UCL	540.7
95% Hall's Bootstrap UCL	883.6
95% Percentile Bootstrap UCL	413.9
95% BCA Bootstrap UCL	478
95% Chebyshev(Mean, Sd) UCL	606.4
97.5% Chebyshev(Mean, Sd) UCL	745.6
99% Chebyshev(Mean, Sd) UCL	1019

Potential UCL to Use | Use 95% Approximate Gamma UCL 415.6

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.

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	26	Number of Distinct Observations	22

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.9	Minimum of Log Data	0.642
Maximum	260	Maximum of Log Data	5.561
Mean	45.41	Mean of log Data	2.786
Median	16.5	SD of log Data	1.596
SD	63.86		
Std. Error of Mean	12.52		
Coefficient of Variation	1.406		
Skewness	2.049		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.717	Shapiro Wilk Test Statistic	0.92
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	66.81	95% H-UCL	169.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	142.5
95% Adjusted-CLT UCL (Chen-1995)	71.39	97.5% Chebyshev (MVUE) UCL	181.4
95% Modified-t UCL (Johnson-1978)	67.64	99% Chebyshev (MVUE) UCL	257.9

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.556	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	81.64	
MLE of Mean	45.41	
MLE of Standard Deviation	60.89	
nu star	28.93	
Approximate Chi Square Value (.05)	17.65	**Nonparametric Statistics**
Adjusted Level of Significance	0.0398	95% CLT UCL 66.01
Adjusted Chi Square Value	17.07	95% Jackknife UCL 66.81
		95% Standard Bootstrap UCL 65.38
Anderson-Darling Test Statistic	0.7	95% Bootstrap-t UCL 77.55
Anderson-Darling 5% Critical Value	0.799	95% Hall's Bootstrap UCL 73.55
Kolmogorov-Smirnov Test Statistic	0.133	95% Percentile Bootstrap UCL 67.73
Kolmogorov-Smirnov 5% Critical Value	0.18	95% BCA Bootstrap UCL 72.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 100
		97.5% Chebyshev(Mean, Sd) UCL 123.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 170
95% Approximate Gamma UCL	74.42	
95% Adjusted Gamma UCL	76.96	

Potential UCL to Use	Use 95% Approximate Gamma UCL 74.42

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.

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations 26 | Number of Distinct Observations 21

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.05	Minimum of Log Data	0.718
Maximum	840	Maximum of Log Data	6.733
Mean	152	Mean of log Data	4.615
Median	107.5	SD of log Data	1.071
SD	161.4		
Std. Error of Mean	31.66		
Coefficient of Variation	1.062		
Skewness	3.338		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.64	Shapiro Wilk Test Statistic	0.845
Shapiro Wilk Critical Value	0.92	Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	206.1	95% H-UCL	312.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	356.4
95% Adjusted-CLT UCL (Chen-1995)	226.2	97.5% Chebyshev (MVUE) UCL	435.6
95% Modified-t UCL (Johnson-1978)	209.5	99% Chebyshev (MVUE) UCL	591.2

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.233	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	123.3	
MLE of Mean	152	
MLE of Standard Deviation	136.9	
nu star	64.1	
Approximate Chi Square Value (.05)	46.68	**Nonparametric Statistics**
Adjusted Level of Significance	0.0398	95% CLT UCL 204.1
Adjusted Chi Square Value	45.7	95% Jackknife UCL 206.1
		95% Standard Bootstrap UCL 204.3
Anderson-Darling Test Statistic	0.865	95% Bootstrap-t UCL 253.9
Anderson-Darling 5% Critical Value	0.765	95% Hall's Bootstrap UCL 424.6
Kolmogorov-Smirnov Test Statistic	0.153	95% Percentile Bootstrap UCL 207.7
Kolmogorov-Smirnov 5% Critical Value	0.175	95% BCA Bootstrap UCL 235
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 290
		97.5% Chebyshev(Mean, Sd) UCL 349.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 467
95% Approximate Gamma UCL	208.7	
95% Adjusted Gamma UCL	213.2	

Potential UCL to Use | Use 95% Approximate Gamma UCL 208.7

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aroclor 1254

General Statistics

Number of Valid Observations 25
Number of Distinct Observations 21

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.8	Minimum of Log Data	1.335
Maximum	720	Maximum of Log Data	6.579
Mean	74.12	Mean of log Data	2.852
Median	18	SD of log Data	1.57
SD	170		
Std. Error of Mean	33.99		
Coefficient of Variation	2.293		
Skewness	3.209		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.462	Shapiro Wilk Test Statistic	0.849
Shapiro Wilk Critical Value	0.918	Shapiro Wilk Critical Value	0.918
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	132.3	95% H-UCL	171.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	145.7
95% Adjusted-CLT UCL (Chen-1995)	153.3	97.5% Chebyshev (MVUE) UCL	185.4
95% Modified-t UCL (Johnson-1978)	135.9	99% Chebyshev (MVUE) UCL	263.5

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.418	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	177.2	
MLE of Mean	74.12	
MLE of Standard Deviation	114.6	
nu star	20.91	
Approximate Chi Square Value (.05)	11.53	**Nonparametric Statistics**
Adjusted Level of Significance	0.0395	95% CLT UCL 130
Adjusted Chi Square Value	11.05	95% Jackknife UCL 132.3
		95% Standard Bootstrap UCL 130.1
Anderson-Darling Test Statistic	2.556	95% Bootstrap-t UCL 301.8
Anderson-Darling 5% Critical Value	0.819	95% Hall's Bootstrap UCL 367.7
Kolmogorov-Smirnov Test Statistic	0.288	95% Percentile Bootstrap UCL 133.9
Kolmogorov-Smirnov 5% Critical Value	0.186	95% BCA Bootstrap UCL 155.7
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 222.3
		97.5% Chebyshev(Mean, Sd) UCL 286.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 412.3
95% Approximate Gamma UCL	134.5	
95% Adjusted Gamma UCL	140.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 222.3

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	182	Number of Distinct Observations	144

Raw Statistics		**Log-transformed Statistics**	
Minimum	732	Minimum of Log Data	6.596
Maximum	13500	Maximum of Log Data	9.51
Mean	2784	Mean of log Data	7.747
Median	2165	SD of log Data	0.566
SD	2125		
Std. Error of Mean	157.5		
Coefficient of Variation	0.763		
Skewness	2.76		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.214	Lilliefors Test Statistic	0.0768
Lilliefors Critical Value	0.0657	Lilliefors Critical Value	0.0657
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3044	95% H-UCL	2936
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3246
95% Adjusted-CLT UCL (Chen-1995)	3077	97.5% Chebyshev (MVUE) UCL	3476
95% Modified-t UCL (Johnson-1978)	3049	99% Chebyshev (MVUE) UCL	3929

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.815	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	988.7	
MLE of Mean	2784	
MLE of Standard Deviation	1659	
nu star	1025	
Approximate Chi Square Value (.05)	951.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 3043
Adjusted Chi Square Value	950.9	95% Jackknife UCL 3044
		95% Standard Bootstrap UCL 3045
Anderson-Darling Test Statistic	5.573	95% Bootstrap-t UCL 3091
Anderson-Darling 5% Critical Value	0.761	95% Hall's Bootstrap UCL 3076
Kolmogorov-Smirnov Test Statistic	0.126	95% Percentile Bootstrap UCL 3042
Kolmogorov-Smirnov 5% Critical Value	0.0688	95% BCA Bootstrap UCL 3078
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 3470
		97.5% Chebyshev(Mean, Sd) UCL 3767
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 4351
95% Approximate Gamma UCL	2998	
95% Adjusted Gamma UCL	3000	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 3470

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	186	Number of Distinct Observations	82

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.07	Minimum of Log Data	-2.659
Maximum	3270	Maximum of Log Data	8.093
Mean	80.41	Mean of log Data	0.606
Median	0.65	SD of log Data	1.99
SD	407.3		
Std. Error of Mean	29.87		
Coefficient of Variation	5.066		
Skewness	6.252		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.464	Lilliefors Test Statistic	0.223
Lilliefors Critical Value	0.065	Lilliefors Critical Value	0.065
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	129.8	95% H-UCL	21.22
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26.3
95% Adjusted-CLT UCL (Chen-1995)	144.2	97.5% Chebyshev (MVUE) UCL	32.11
95% Modified-t UCL (Johnson-1978)	132.1	99% Chebyshev (MVUE) UCL	43.51

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.196	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	410.7	
MLE of Mean	80.41	
MLE of Standard Deviation	181.7	
nu star	72.84	
Approximate Chi Square Value (.05)	54.19	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 129.5
Adjusted Chi Square Value	54.06	95% Jackknife UCL 129.8
		95% Standard Bootstrap UCL 129.4
Anderson-Darling Test Statistic	40.98	95% Bootstrap-t UCL 164.7
Anderson-Darling 5% Critical Value	0.922	95% Hall's Bootstrap UCL 142
Kolmogorov-Smirnov Test Statistic	0.382	95% Percentile Bootstrap UCL 133
Kolmogorov-Smirnov 5% Critical Value	0.0747	95% BCA Bootstrap UCL 144.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 210.6
		97.5% Chebyshev(Mean, Sd) UCL 266.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 377.6
95% Approximate Gamma UCL	108.1	
95% Adjusted Gamma UCL	108.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 210.6

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	184	Number of Distinct Observations	126

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.62	Minimum of Log Data	-0.478
Maximum	2470	Maximum of Log Data	7.812
Mean	62.73	Mean of log Data	2.193
Median	7.65	SD of log Data	1.366
SD	287.3		
Std. Error of Mean	21.18		
Coefficient of Variation	4.58		
Skewness	6.481		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.448	Lilliefors Test Statistic	0.169
Lilliefors Critical Value	0.0653	Lilliefors Critical Value	0.0653
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	97.75	95% H-UCL	29.39
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	36.05
95% Adjusted-CLT UCL (Chen-1995)	108.4	97.5% Chebyshev (MVUE) UCL	41.88
95% Modified-t UCL (Johnson-1978)	99.43	99% Chebyshev (MVUE) UCL	53.32

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.344	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	182.3	
MLE of Mean	62.73	
MLE of Standard Deviation	106.9	
nu star	126.7	
Approximate Chi Square Value (.05)	101.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 97.57
Adjusted Chi Square Value	101.5	95% Jackknife UCL 97.75
		95% Standard Bootstrap UCL 97.2
Anderson-Darling Test Statistic	33.51	95% Bootstrap-t UCL 128
Anderson-Darling 5% Critical Value	0.858	95% Hall's Bootstrap UCL 106.5
Kolmogorov-Smirnov Test Statistic	0.361	95% Percentile Bootstrap UCL 100.2
Kolmogorov-Smirnov 5% Critical Value	0.0732	95% BCA Bootstrap UCL 115.7
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 155.1
		97.5% Chebyshev(Mean, Sd) UCL 195
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 273.5
95% Approximate Gamma UCL	78.16	
95% Adjusted Gamma UCL	78.29	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 155.1

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cadmium

General Statistics

Number of Valid Observations	170	Number of Distinct Observations	83

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.0105	Minimum of Log Data	-4.556
Maximum	22.1	Maximum of Log Data	3.096
Mean	0.638	Mean of log Data	-1.295
Median	0.288	SD of log Data	1.099
SD	1.99		
Std. Error of Mean	0.153		
Coefficient of Variation	3.122		
Skewness	8.712		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.376	Lilliefors Test Statistic	0.155
Lilliefors Critical Value	0.068	Lilliefors Critical Value	0.068
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.89	95% H-UCL	0.606
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.727
95% Adjusted-CLT UCL (Chen-1995)	0.998	97.5% Chebyshev (MVUE) UCL	0.826
95% Modified-t UCL (Johnson-1978)	0.907	99% Chebyshev (MVUE) UCL	1.02

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.705	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.904	
MLE of Mean	0.638	
MLE of Standard Deviation	0.759	
nu star	239.7	
Approximate Chi Square Value (.05)	204.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0486	95% CLT UCL 0.889
Adjusted Chi Square Value	204.6	95% Jackknife UCL 0.89
		95% Standard Bootstrap UCL 0.891
Anderson-Darling Test Statistic	14.81	95% Bootstrap-t UCL 1.273
Anderson-Darling 5% Critical Value	0.799	95% Hall's Bootstrap UCL 1.949
Kolmogorov-Smirnov Test Statistic	0.236	95% Percentile Bootstrap UCL 0.915
Kolmogorov-Smirnov 5% Critical Value	0.0744	95% BCA Bootstrap UCL 1.064
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1.303
		97.5% Chebyshev(Mean, Sd) UCL 1.591
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.156
95% Approximate Gamma UCL	0.746	
95% Adjusted Gamma UCL	0.747	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1.303

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	56	Number of Distinct Observations	24

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.31	Minimum of Log Data	-1.171
Maximum	2.2	Maximum of Log Data	0.788
Mean	0.602	Mean of log Data	-0.568
Median	0.56	SD of log Data	0.322
SD	0.273		
Std. Error of Mean	0.0364		
Coefficient of Variation	0.453		
Skewness	4.074		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.269	Lilliefors Test Statistic	0.179
Lilliefors Critical Value	0.118	Lilliefors Critical Value	0.118
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.663	95% H-UCL	0.643
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.71
95% Adjusted-CLT UCL (Chen-1995)	0.683	97.5% Chebyshev (MVUE) UCL	0.76
95% Modified-t UCL (Johnson-1978)	0.666	99% Chebyshev (MVUE) UCL	0.857

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	7.95	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.0757	
MLE of Mean	0.602	
MLE of Standard Deviation	0.213	
nu star	890.4	
Approximate Chi Square Value (.05)	822.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0457	95% CLT UCL 0.662
Adjusted Chi Square Value	820.4	95% Jackknife UCL 0.663
		95% Standard Bootstrap UCL 0.66
Anderson-Darling Test Statistic	2.74	95% Bootstrap-t UCL 0.707
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL 0.966
Kolmogorov-Smirnov Test Statistic	0.208	95% Percentile Bootstrap UCL 0.669
Kolmogorov-Smirnov 5% Critical Value	0.119	95% BCA Bootstrap UCL 0.692
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.761
		97.5% Chebyshev(Mean, Sd) UCL 0.83
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.965
95% Approximate Gamma UCL	0.652	
95% Adjusted Gamma UCL	0.653	

Potential UCL to Use	Use 95% Student's-t UCL 0.663
	or 95% Modified-t UCL 0.666

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations	186	Number of Distinct Observations	77

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.14	Minimum of Log Data	-1.966
Maximum	24.1	Maximum of Log Data	3.182
Mean	3.105	Mean of log Data	0.785
Median	2.05	SD of log Data	0.774
SD	3.727		
Std. Error of Mean	0.273		
Coefficient of Variation	1.2		
Skewness	3.863		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.28	Lilliefors Test Statistic	0.103
Lilliefors Critical Value	0.065	Lilliefors Critical Value	0.065
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3.557	95% H-UCL	3.312
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.778
95% Adjusted-CLT UCL (Chen-1995)	3.638	97.5% Chebyshev (MVUE) UCL	4.135
95% Modified-t UCL (Johnson-1978)	3.57	99% Chebyshev (MVUE) UCL	4.838

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.56	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1.99	
MLE of Mean	3.105	
MLE of Standard Deviation	2.486	
nu star	580.5	
Approximate Chi Square Value (.05)	525.6	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 3.555
Adjusted Chi Square Value	525.2	95% Jackknife UCL 3.557
		95% Standard Bootstrap UCL 3.553
Anderson-Darling Test Statistic	7.702	95% Bootstrap-t UCL 3.664
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL 3.652
Kolmogorov-Smirnov Test Statistic	0.17	95% Percentile Bootstrap UCL 3.537
Kolmogorov-Smirnov 5% Critical Value	0.0685	95% BCA Bootstrap UCL 3.703
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 4.297
		97.5% Chebyshev(Mean, Sd) UCL 4.812
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 5.825
95% Approximate Gamma UCL	3.43	
95% Adjusted Gamma UCL	3.432	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 4.297

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	184	Number of Distinct Observations	162

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.4	Minimum of Log Data	0.875
Maximum	4630	Maximum of Log Data	8.44
Mean	133.5	Mean of log Data	3.543
Median	27	SD of log Data	1.318
SD	465.3		
Std. Error of Mean	34.3		
Coefficient of Variation	3.486		
Skewness	6.928		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.389	Lilliefors Test Statistic	0.108
Lilliefors Critical Value	0.0653	Lilliefors Critical Value	0.0653
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	190.2	95% H-UCL	104.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	128
95% Adjusted-CLT UCL (Chen-1995)	208.6	97.5% Chebyshev (MVUE) UCL	148
95% Modified-t UCL (Johnson-1978)	193.1	99% Chebyshev (MVUE) UCL	187.4

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.47	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	284	
MLE of Mean	133.5	
MLE of Standard Deviation	194.7	
nu star	172.9	
Approximate Chi Square Value (.05)	143.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 189.9
Adjusted Chi Square Value	143.3	95% Jackknife UCL 190.2
		95% Standard Bootstrap UCL 191.7
Anderson-Darling Test Statistic	19.2	95% Bootstrap-t UCL 226.8
Anderson-Darling 5% Critical Value	0.827	95% Hall's Bootstrap UCL 231.1
Kolmogorov-Smirnov Test Statistic	0.25	95% Percentile Bootstrap UCL 194.6
Kolmogorov-Smirnov 5% Critical Value	0.0719	95% BCA Bootstrap UCL 209.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 283
		97.5% Chebyshev(Mean, Sd) UCL 347.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 474.8
95% Approximate Gamma UCL	160.8	
95% Adjusted Gamma UCL	161.1	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 283

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
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Iron

General Statistics

Number of Valid Observations 182
Number of Distinct Observations 146

Raw Statistics

Minimum 1990
Maximum 183000
Mean 20490
Median 15100
SD 22970
Std. Error of Mean 1703
Coefficient of Variation 1.121
Skewness 4.429

Log-transformed Statistics

Minimum of Log Data 7.596
Maximum of Log Data 12.12
Mean of log Data 9.634
SD of log Data 0.7

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.236
Lilliefors Critical Value 0.0657
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.0606
Lilliefors Critical Value 0.0657
Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 23305

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 23888
95% Modified-t UCL (Johnson-1978) 23398

Assuming Lognormal Distribution

95% H-UCL 21592
95% Chebyshev (MVUE) UCL 24382
97.5% Chebyshev (MVUE) UCL 26500
99% Chebyshev (MVUE) UCL 30658

Gamma Distribution Test

k star (bias corrected) 1.826
Theta Star 11222
MLE of Mean 20490
MLE of Standard Deviation 15164
nu star 664.6
Approximate Chi Square Value (.05) 605.8
Adjusted Level of Significance 0.0487
Adjusted Chi Square Value 605.3

Anderson-Darling Test Statistic 4.886
Anderson-Darling 5% Critical Value 0.768
Kolmogorov-Smirnov Test Statistic 0.124
Kolmogorov-Smirnov 5% Critical Value 0.0693
Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 22479
95% Adjusted Gamma UCL 22496

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL 23291
95% Jackknife UCL 23305
95% Standard Bootstrap UCL 23312
95% Bootstrap-t UCL 24275
95% Hall's Bootstrap UCL 24199
95% Percentile Bootstrap UCL 23369
95% BCA Bootstrap UCL 24047
95% Chebyshev(Mean, Sd) UCL 27912
97.5% Chebyshev(Mean, Sd) UCL 31123
99% Chebyshev(Mean, Sd) UCL 37431

Potential UCL to Use

Use 95% H-UCL 21592

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
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Lead

General Statistics

Number of Valid Observations	182	Number of Distinct Observations	166

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.9	Minimum of Log Data	1.065
Maximum	198000	Maximum of Log Data	12.2
Mean	2651	Mean of log Data	4.041
Median	31.2	SD of log Data	1.983
SD	17089		
Std. Error of Mean	1267		
Coefficient of Variation	6.447		
Skewness	9.381		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.455	Lilliefors Test Statistic	0.22
Lilliefors Critical Value	0.0657	Lilliefors Critical Value	0.0657
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	4745	95% H-UCL	650.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	806.1
95% Adjusted-CLT UCL (Chen-1995)	5675	97.5% Chebyshev (MVUE) UCL	984.4
95% Modified-t UCL (Johnson-1978)	4892	99% Chebyshev (MVUE) UCL	1335

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.193	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	13723	
MLE of Mean	2651	
MLE of Standard Deviation	6031	
nu star	70.31	
Approximate Chi Square Value (.05)	52.01	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 4734
Adjusted Chi Square Value	51.88	95% Jackknife UCL 4745
		95% Standard Bootstrap UCL 4731
Anderson-Darling Test Statistic	38.09	95% Bootstrap-t UCL 7986
Anderson-Darling 5% Critical Value	0.927	95% Hall's Bootstrap UCL 10186
Kolmogorov-Smirnov Test Statistic	0.335	95% Percentile Bootstrap UCL 5002
Kolmogorov-Smirnov 5% Critical Value	0.076	95% BCA Bootstrap UCL 5962
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 8172
		97.5% Chebyshev(Mean, Sd) UCL 10561
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 15254
95% Approximate Gamma UCL	3584	
95% Adjusted Gamma UCL	3592	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 8172

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.

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ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
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Manganese

General Statistics

Number of Valid Observations 184
Number of Distinct Observations 165

Raw Statistics

Minimum 4.8
Maximum 1710
Mean 102.6
Median 45.9
SD 217.1
Std. Error of Mean 16
Coefficient of Variation 2.115
Skewness 5.073

Log-transformed Statistics

Minimum of Log Data 1.569
Maximum of Log Data 7.444
Mean of log Data 3.983
SD of log Data 0.912

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.344
Lilliefors Critical Value 0.0653
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.149
Lilliefors Critical Value 0.0653
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 129.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 135.3
95% Modified-t UCL (Johnson-1978) 130.1

Assuming Lognormal Distribution

95% H-UCL 93.79
95% Chebyshev (MVUE) UCL 109.2
97.5% Chebyshev (MVUE) UCL 121.4
99% Chebyshev (MVUE) UCL 145.2

Gamma Distribution Test

k star (bias corrected) 0.891
Theta Star 115.1
MLE of Mean 102.6
MLE of Standard Deviation 108.7
nu star 328
Approximate Chi Square Value (.05) 287
Adjusted Level of Significance 0.0487
Adjusted Chi Square Value 286.7

Anderson-Darling Test Statistic 18.72
Anderson-Darling 5% Critical Value 0.789
Kolmogorov-Smirnov Test Statistic 0.249
Kolmogorov-Smirnov 5% Critical Value 0.07
Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 117.3
95% Adjusted Gamma UCL 117.4

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL 128.9
95% Jackknife UCL 129.1
95% Standard Bootstrap UCL 128.3
95% Bootstrap-t UCL 139
95% Hall's Bootstrap UCL 137.5
95% Percentile Bootstrap UCL 129.7
95% BCA Bootstrap UCL 137.8
95% Chebyshev(Mean, Sd) UCL 172.4
97.5% Chebyshev(Mean, Sd) UCL 202.6
99% Chebyshev(Mean, Sd) UCL 261.9

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 172.4

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 C-8
ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Nickel

General Statistics

Number of Valid Observations	186	Number of Distinct Observations	107

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.48	Minimum of Log Data	-0.734
Maximum	1500	Maximum of Log Data	7.313
Mean	18.86	Mean of log Data	1.792
Median	5.3	SD of log Data	0.989
SD	112.2		
Std. Error of Mean	8.226		
Coefficient of Variation	5.948		
Skewness	12.65		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.435	Lilliefors Test Statistic	0.114
Lilliefors Critical Value	0.065	Lilliefors Critical Value	0.065
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	32.46	95% H-UCL	11.46
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.48
95% Adjusted-CLT UCL (Chen-1995)	40.54	97.5% Chebyshev (MVUE) UCL	15.09
95% Modified-t UCL (Johnson-1978)	33.73	99% Chebyshev (MVUE) UCL	18.26

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.542	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	34.79	
MLE of Mean	18.86	
MLE of Standard Deviation	25.62	
nu star	201.6	
Approximate Chi Square Value (.05)	169.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 32.39
Adjusted Chi Square Value	169.6	95% Jackknife UCL 32.46
		95% Standard Bootstrap UCL 32.41
Anderson-Darling Test Statistic	5.38E+28	95% Bootstrap-t UCL 94.04
Anderson-Darling 5% Critical Value	0.816	95% Hall's Bootstrap UCL 77.63
Kolmogorov-Smirnov Test Statistic	0.302	95% Percentile Bootstrap UCL 34.68
Kolmogorov-Smirnov 5% Critical Value	0.0709	95% BCA Bootstrap UCL 44.62
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 54.72
		97.5% Chebyshev(Mean, Sd) UCL 70.23
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 100.7
95% Approximate Gamma UCL	22.4	
95% Adjusted Gamma UCL	22.43	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 54.72

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.

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ProUCL Output - Areas 8 and 11 Surface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations 186
Number of Distinct Observations 150

Raw Statistics

Minimum	2.8
Maximum	75.1
Mean	24.39
Median	21.45
SD	14.09
Std. Error of Mean	1.033
Coefficient of Variation	0.578
Skewness	1.337

Log-transformed Statistics

Minimum of Log Data	1.03
Maximum of Log Data	4.319
Mean of log Data	3.023
SD of log Data	0.628

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.117
Lilliefors Critical Value	0.065

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0959
Lilliefors Critical Value	0.065

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	26.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	26.2
95% Modified-t UCL (Johnson-1978)	26.11

Assuming Lognormal Distribution

95% H-UCL	27.3
95% Chebyshev (MVUE) UCL	30.45
97.5% Chebyshev (MVUE) UCL	32.81
99% Chebyshev (MVUE) UCL	37.45

Gamma Distribution Test

k star (bias corrected)	3.027
Theta Star	8.056
MLE of Mean	24.39
MLE of Standard Deviation	14.02
nu star	1126
Approximate Chi Square Value (.05)	1049
Adjusted Level of Significance	0.0487
Adjusted Chi Square Value	1049
Anderson-Darling Test Statistic	0.882
Anderson-Darling 5% Critical Value	0.76
Kolmogorov-Smirnov Test Statistic	0.0633
Kolmogorov-Smirnov 5% Critical Value	0.0677

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	26.18
95% Adjusted Gamma UCL	26.19

Nonparametric Statistics

95% CLT UCL	26.09
95% Jackknife UCL	26.1
95% Standard Bootstrap UCL	26.12
95% Bootstrap-t UCL	26.2
95% Hall's Bootstrap UCL	26.17
95% Percentile Bootstrap UCL	26.09
95% BCA Bootstrap UCL	26.21
95% Chebyshev(Mean, Sd) UCL	28.89
97.5% Chebyshev(Mean, Sd) UCL	30.84
99% Chebyshev(Mean, Sd) UCL	34.67

Potential UCL to Use

Use 95% Approximate Gamma UCL 26.18

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.

Zinc

General Statistics

Number of Valid Observations	184	Number of Distinct Observations	169

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.3	Minimum of Log Data	1.194
Maximum	2700	Maximum of Log Data	7.901
Mean	140.4	Mean of log Data	4.275
Median	69	SD of log Data	0.96
SD	308.6		
Std. Error of Mean	22.75		
Coefficient of Variation	2.198		
Skewness	5.349		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.386	Lilliefors Test Statistic	0.171
Lilliefors Critical Value	0.0653	Lilliefors Critical Value	0.0653
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	178	95% H-UCL	132.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	155.5
95% Adjusted-CLT UCL (Chen-1995)	187.4	97.5% Chebyshev (MVUE) UCL	173.7
95% Modified-t UCL (Johnson-1978)	179.5	99% Chebyshev (MVUE) UCL	209.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.866	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	162.1	
MLE of Mean	140.4	
MLE of Standard Deviation	150.9	
nu star	318.6	
Approximate Chi Square Value (.05)	278.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.0487	95% CLT UCL 177.8
Adjusted Chi Square Value	278	95% Jackknife UCL 178
		95% Standard Bootstrap UCL 176.9
Anderson-Darling Test Statistic	19.6	95% Bootstrap-t UCL 193.3
Anderson-Darling 5% Critical Value	0.79	95% Hall's Bootstrap UCL 193.6
Kolmogorov-Smirnov Test Statistic	0.281	95% Percentile Bootstrap UCL 178.7
Kolmogorov-Smirnov 5% Critical Value	0.0701	95% BCA Bootstrap UCL 188.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 239.5
		97.5% Chebyshev(Mean, Sd) UCL 282.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 366.7
95% Approximate Gamma UCL	160.7	
95% Adjusted Gamma UCL	160.9	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 239.5

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	AllArea_SS_SB
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations	423	Number of Distinct Observations	155

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	3000	Maximum of Log Data	8.006
Mean	75.15	Mean of log Data	2.663
Median	13	SD of log Data	1.804
SD	230.3		
Std. Error of Mean	11.2		
Coefficient of Variation	3.064		
Skewness	8.199		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.375	Lilliefors Test Statistic	0.159
Lilliefors Critical Value	0.0431	Lilliefors Critical Value	0.0431
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	93.61	95% H-UCL	93.79
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	116.2
95% Adjusted-CLT UCL (Chen-1995)	98.34	97.5% Chebyshev (MVUE) UCL	135.3
95% Modified-t UCL (Johnson-1978)	94.35	99% Chebyshev (MVUE) UCL	172.6

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.396	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	189.6	
MLE of Mean	75.15	
MLE of Standard Deviation	119.4	
nu star	335.3	
Approximate Chi Square Value (.05)	293.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0494	95% CLT UCL 93.57
Adjusted Chi Square Value	293.7	95% Jackknife UCL 93.61
		95% Standard Bootstrap UCL 93.8
Anderson-Darling Test Statistic	22.25	95% Bootstrap-t UCL 101.4
Anderson-Darling 5% Critical Value	0.848	95% Hall's Bootstrap UCL 105.9
Kolmogorov-Smirnov Test Statistic	0.173	95% Percentile Bootstrap UCL 94.87
Kolmogorov-Smirnov 5% Critical Value	0.0473	95% BCA Bootstrap UCL 99.74
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 124
		97.5% Chebyshev(Mean, Sd) UCL 145.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 186.5
95% Approximate Gamma UCL	85.75	
95% Adjusted Gamma UCL	85.79	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 124

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations	420	Number of Distinct Observations	161

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	2300	Maximum of Log Data	7.741
Mean	66.95	Mean of log Data	2.57
Median	11	SD of log Data	1.797
SD	195		
Std. Error of Mean	9.513		
Coefficient of Variation	2.912		
Skewness	7.949		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.369	Lilliefors Test Statistic	0.177
Lilliefors Critical Value	0.0432	Lilliefors Critical Value	0.0432
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	82.64	95% H-UCL	84.35
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	104.5
95% Adjusted-CLT UCL (Chen-1995)	86.54	97.5% Chebyshev (MVUE) UCL	121.6
95% Modified-t UCL (Johnson-1978)	83.25	99% Chebyshev (MVUE) UCL	155.1

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.401	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	166.9	
MLE of Mean	66.95	
MLE of Standard Deviation	105.7	
nu star	336.9	
Approximate Chi Square Value (.05)	295.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.0494	95% CLT UCL 82.6
Adjusted Chi Square Value	295.2	95% Jackknife UCL 82.64
		95% Standard Bootstrap UCL 82.23
Anderson-Darling Test Statistic	23.6	95% Bootstrap-t UCL 89.21
Anderson-Darling 5% Critical Value	0.847	95% Hall's Bootstrap UCL 91.77
Kolmogorov-Smirnov Test Statistic	0.178	95% Percentile Bootstrap UCL 83.04
Kolmogorov-Smirnov 5% Critical Value	0.0474	95% BCA Bootstrap UCL 85.91
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 108.4
		97.5% Chebyshev(Mean, Sd) UCL 126.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 161.6
95% Approximate Gamma UCL	76.37	
95% Adjusted Gamma UCL	76.4	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 108.4

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations	423	Number of Distinct Observations	168

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	3100	Maximum of Log Data	8.039
Mean	82.13	Mean of log Data	2.833
Median	16	SD of log Data	1.813
SD	233		
Std. Error of Mean	11.33		
Coefficient of Variation	2.837		
Skewness	8.079		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.365	Lilliefors Test Statistic	0.137
Lilliefors Critical Value	0.0431	Lilliefors Critical Value	0.0431
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	100.8	95% H-UCL	113.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	140.5
95% Adjusted-CLT UCL (Chen-1995)	105.5	97.5% Chebyshev (MVUE) UCL	163.6
95% Modified-t UCL (Johnson-1978)	101.5	99% Chebyshev (MVUE) UCL	209

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.414	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	198.4	
MLE of Mean	82.13	
MLE of Standard Deviation	127.6	
nu star	350.2	
Approximate Chi Square Value (.05)	307.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0494	95% CLT UCL 100.8
Adjusted Chi Square Value	307.7	95% Jackknife UCL 100.8
		95% Standard Bootstrap UCL 100.5
Anderson-Darling Test Statistic	17.43	95% Bootstrap-t UCL 107.3
Anderson-Darling 5% Critical Value	0.843	95% Hall's Bootstrap UCL 115.9
Kolmogorov-Smirnov Test Statistic	0.156	95% Percentile Bootstrap UCL 101.1
Kolmogorov-Smirnov 5% Critical Value	0.0472	95% BCA Bootstrap UCL 106.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 131.5
		97.5% Chebyshev(Mean, Sd) UCL 152.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 194.8
95% Approximate Gamma UCL	93.43	
95% Adjusted Gamma UCL	93.47	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 131.5

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.

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	418	Number of Distinct Observations	110

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	520	Maximum of Log Data	6.254
Mean	39.42	Mean of log Data	1.985
Median	2.175	SD of log Data	1.744
SD	87.15		
Std. Error of Mean	4.263		
Coefficient of Variation	2.211		
Skewness	3.489		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.333	Lilliefors Test Statistic	0.278
Lilliefors Critical Value	0.0433	Lilliefors Critical Value	0.0433
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	46.45	95% H-UCL	42.22
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	52.09
95% Adjusted-CLT UCL (Chen-1995)	47.21	97.5% Chebyshev (MVUE) UCL	60.36
95% Modified-t UCL (Johnson-1978)	46.57	99% Chebyshev (MVUE) UCL	76.61

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.39	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	101.2	
MLE of Mean	39.42	
MLE of Standard Deviation	63.15	
nu star	325.8	
Approximate Chi Square Value (.05)	285	**Nonparametric Statistics**
Adjusted Level of Significance	0.0494	95% CLT UCL 46.44
Adjusted Chi Square Value	284.8	95% Jackknife UCL 46.45
		95% Standard Bootstrap UCL 46.32
Anderson-Darling Test Statistic	48.82	95% Bootstrap-t UCL 47.42
Anderson-Darling 5% Critical Value	0.849	95% Hall's Bootstrap UCL 47.78
Kolmogorov-Smirnov Test Statistic	0.288	95% Percentile Bootstrap UCL 46.65
Kolmogorov-Smirnov 5% Critical Value	0.0476	95% BCA Bootstrap UCL 47.54
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 58
		97.5% Chebyshev(Mean, Sd) UCL 66.04
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 81.84
95% Approximate Gamma UCL	45.07	
95% Adjusted Gamma UCL	45.09	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 58

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.

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations	422	Number of Distinct Observations	150

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	1200	Maximum of Log Data	7.09
Mean	51.49	Mean of log Data	2.342
Median	5.45	SD of log Data	1.78
SD	121.9		
Std. Error of Mean	5.936		
Coefficient of Variation	2.368		
Skewness	5.516		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.342	Lilliefors Test Statistic	0.202
Lilliefors Critical Value	0.0431	Lilliefors Critical Value	0.0431
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	61.27	95% H-UCL	64.76
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	80.12
95% Adjusted-CLT UCL (Chen-1995)	62.95	97.5% Chebyshev (MVUE) UCL	93.06
95% Modified-t UCL (Johnson-1978)	61.54	99% Chebyshev (MVUE) UCL	118.5

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.409	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	126	
MLE of Mean	51.49	
MLE of Standard Deviation	80.55	
nu star	344.8	
Approximate Chi Square Value (.05)	302.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0494	95% CLT UCL 61.25
Adjusted Chi Square Value	302.6	95% Jackknife UCL 61.27
		95% Standard Bootstrap UCL 61.09
Anderson-Darling Test Statistic	30.76	95% Bootstrap-t UCL 64.36
Anderson-Darling 5% Critical Value	0.845	95% Hall's Bootstrap UCL 64.62
Kolmogorov-Smirnov Test Statistic	0.202	95% Percentile Bootstrap UCL 61.4
Kolmogorov-Smirnov 5% Critical Value	0.0473	95% BCA Bootstrap UCL 63.01
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 77.36
		97.5% Chebyshev(Mean, Sd) UCL 88.56
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 110.5
95% Approximate Gamma UCL	58.63	
95% Adjusted Gamma UCL	58.66	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 77.36

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aroclor 1254

General Statistics

Number of Valid Observations	422	Number of Distinct Observations	71

Raw Statistics		**Log-transformed Statistics**	
Minimum	4.1	Minimum of Log Data	1.411
Maximum	62000	Maximum of Log Data	11.03
Mean	262	Mean of log Data	3.287
Median	19	SD of log Data	0.99
SD	3205		
Std. Error of Mean	156		
Coefficient of Variation	12.23		
Skewness	17.81		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.468	Lilliefors Test Statistic	0.362
Lilliefors Critical Value	0.0431	Lilliefors Critical Value	0.0431
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	519.2	95% H-UCL	48.34
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	54.74
95% Adjusted-CLT UCL (Chen-1995)	663.1	97.5% Chebyshev (MVUE) UCL	59.56
95% Modified-t UCL (Johnson-1978)	541.7	99% Chebyshev (MVUE) UCL	69.02

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.301	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	869.3	
MLE of Mean	262	
MLE of Standard Deviation	477.2	
nu star	254.4	
Approximate Chi Square Value (.05)	218.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.0494	95% CLT UCL 518.6
Adjusted Chi Square Value	218.3	95% Jackknife UCL 519.2
		95% Standard Bootstrap UCL 519.6
Anderson-Darling Test Statistic	2.37E+28	95% Bootstrap-t UCL 3540
Anderson-Darling 5% Critical Value	0.871	95% Hall's Bootstrap UCL 2067
Kolmogorov-Smirnov Test Statistic	0.448	95% Percentile Bootstrap UCL 565.9
Kolmogorov-Smirnov 5% Critical Value	0.0479	95% BCA Bootstrap UCL 798.3
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 942
		97.5% Chebyshev(Mean, Sd) UCL 1236
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1814
95% Approximate Gamma UCL	305.1	
95% Adjusted Gamma UCL	305.2	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 942

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations 771
Number of Distinct Observations 515

Raw Statistics

Minimum	149
Maximum	30400
Mean	2647
Median	1750
SD	2730
Std. Error of Mean	98.33
Coefficient of Variation	1.031
Skewness	3.548

Log-transformed Statistics

Minimum of Log Data	5.004
Maximum of Log Data	10.32
Mean of log Data	7.497
SD of log Data	0.883

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.18
Lilliefors Critical Value	0.0319

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0317
Lilliefors Critical Value	0.0319

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	2809

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	2822
95% Modified-t UCL (Johnson-1978)	2811

Assuming Lognormal Distribution

95% H-UCL	2839
95% Chebyshev (MVUE) UCL	3095
97.5% Chebyshev (MVUE) UCL	3283
99% Chebyshev (MVUE) UCL	3652

Gamma Distribution Test

k star (bias corrected)	1.441
Theta Star	1837
MLE of Mean	2647
MLE of Standard Deviation	2205
nu star	2222
Approximate Chi Square Value (.05)	2114
Adjusted Level of Significance	0.0497
Adjusted Chi Square Value	2113
Anderson-Darling Test Statistic	8.744
Anderson-Darling 5% Critical Value	0.773
Kolmogorov-Smirnov Test Statistic	0.0858
Kolmogorov-Smirnov 5% Critical Value	0.0347

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	2783
95% Adjusted Gamma UCL	2783

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	2809
95% Jackknife UCL	2809
95% Standard Bootstrap UCL	2812
95% Bootstrap-t UCL	2821
95% Hall's Bootstrap UCL	2821
95% Percentile Bootstrap UCL	2814
95% BCA Bootstrap UCL	2818
95% Chebyshev(Mean, Sd) UCL	3076
97.5% Chebyshev(Mean, Sd) UCL	3261
99% Chebyshev(Mean, Sd) UCL	3626

Potential UCL to Use

Use 95% H-UCL 2839

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	770	Number of Distinct Observations	239
Number of Missing Values	10		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.065	Minimum of Log Data	-2.733
Maximum	3270	Maximum of Log Data	8.093
Mean	18.25	Mean of log Data	-0.0785
Median	0.9	SD of log Data	2.163
SD	152.4		
Std. Error of Mean	5.492		
Coefficient of Variation	8.351		
Skewness	17.2		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.453	Lilliefors Test Statistic	0.122
Lilliefors Critical Value	0.0319	Lilliefors Critical Value	0.0319
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	27.29	95% H-UCL	12.31
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	15.29
95% Adjusted-CLT UCL (Chen-1995)	30.92	97.5% Chebyshev (MVUE) UCL	17.8
95% Modified-t UCL (Johnson-1978)	27.86	99% Chebyshev (MVUE) UCL	22.73

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.24	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	76.13	
MLE of Mean	18.25	
MLE of Standard Deviation	37.27	
nu star	369.1	
Approximate Chi Square Value (.05)	325.6	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 27.28
Adjusted Chi Square Value	325.5	95% Jackknife UCL 27.29
		95% Standard Bootstrap UCL 27.36
Anderson-Darling Test Statistic	1.299E+28	95% Bootstrap-t UCL 41.7
Anderson-Darling 5% Critical Value	0.9	95% Hall's Bootstrap UCL 69.33
Kolmogorov-Smirnov Test Statistic	0.281	95% Percentile Bootstrap UCL 28.37
Kolmogorov-Smirnov 5% Critical Value	0.0375	95% BCA Bootstrap UCL 31.97
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 42.19
		97.5% Chebyshev(Mean, Sd) UCL 52.55
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 72.89
95% Approximate Gamma UCL	20.69	
95% Adjusted Gamma UCL	20.69	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 42.19

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	771	Number of Distinct Observations	272
Number of Missing Values	9		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.09	Minimum of Log Data	-2.408
Maximum	2100	Maximum of Log Data	7.65
Mean	16.74	Mean of log Data	1.075
Median	3	SD of log Data	1.546
SD	107.6		
Std. Error of Mean	3.876		
Coefficient of Variation	6.43		
Skewness	14.72		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.439	Lilliefors Test Statistic	0.0605
Lilliefors Critical Value	0.0319	Lilliefors Critical Value	0.0319
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.12	95% H-UCL	11.16
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.08
95% Adjusted-CLT UCL (Chen-1995)	25.31	97.5% Chebyshev (MVUE) UCL	14.57
95% Modified-t UCL (Johnson-1978)	23.46	99% Chebyshev (MVUE) UCL	17.5

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.38	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	44.04	
MLE of Mean	16.74	
MLE of Standard Deviation	27.15	
nu star	586	
Approximate Chi Square Value (.05)	530.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 23.11
Adjusted Chi Square Value	530.7	95% Jackknife UCL 23.12
		95% Standard Bootstrap UCL 23.14
Anderson-Darling Test Statistic	1.297E+28	95% Bootstrap-t UCL 29.32
Anderson-Darling 5% Critical Value	0.852	95% Hall's Bootstrap UCL 48.82
Kolmogorov-Smirnov Test Statistic	0.244	95% Percentile Bootstrap UCL 23.32
Kolmogorov-Smirnov 5% Critical Value	0.0366	95% BCA Bootstrap UCL 26.15
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 33.63
		97.5% Chebyshev(Mean, Sd) UCL 40.94
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 55.3
95% Approximate Gamma UCL	18.48	
95% Adjusted Gamma UCL	18.48	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 33.63

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cadmium

General Statistics

Number of Valid Observations	776	Number of Distinct Observations	201
Number of Missing Values	4		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.0083	Minimum of Log Data	-4.791
Maximum	12.5	Maximum of Log Data	2.526
Mean	0.313	Mean of log Data	-2.154
Median	0.13	SD of log Data	1.345
SD	0.874		
Std. Error of Mean	0.0314		
Coefficient of Variation	2.788		
Skewness	9.128		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.363	Lilliefors Test Statistic	0.0948
Lilliefors Critical Value	0.0318	Lilliefors Critical Value	0.0318
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.365	95% H-UCL	0.322
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.369
95% Adjusted-CLT UCL (Chen-1995)	0.376	97.5% Chebyshev (MVUE) UCL	0.404
95% Modified-t UCL (Johnson-1978)	0.367	99% Chebyshev (MVUE) UCL	0.475

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.617	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.508	
MLE of Mean	0.313	
MLE of Standard Deviation	0.399	
nu star	957.9	
Approximate Chi Square Value (.05)	887	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 0.365
Adjusted Chi Square Value	886.9	95% Jackknife UCL 0.365
		95% Standard Bootstrap UCL 0.364
Anderson-Darling Test Statistic	26.94	95% Bootstrap-t UCL 0.381
Anderson-Darling 5% Critical Value	0.811	95% Hall's Bootstrap UCL 0.382
Kolmogorov-Smirnov Test Statistic	0.185	95% Percentile Bootstrap UCL 0.366
Kolmogorov-Smirnov 5% Critical Value	0.0356	95% BCA Bootstrap UCL 0.377
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.45
		97.5% Chebyshev(Mean, Sd) UCL 0.509
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.626
95% Approximate Gamma UCL	0.338	
95% Adjusted Gamma UCL	0.339	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 0.45

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	478	Number of Distinct Observations	106
Number of Missing Values	16		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.05	Minimum of Log Data	-2.996
Maximum	46	Maximum of Log Data	3.829
Mean	0.841	Mean of log Data	-0.645
Median	0.55	SD of log Data	0.864
SD	2.306		
Std. Error of Mean	0.105		
Coefficient of Variation	2.743		
Skewness	16.28		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.366	Lilliefors Test Statistic	0.174
Lilliefors Critical Value	0.0405	Lilliefors Critical Value	0.0405
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.015	95% H-UCL	0.824
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.914
95% Adjusted-CLT UCL (Chen-1995)	1.098	97.5% Chebyshev (MVUE) UCL	0.98
95% Modified-t UCL (Johnson-1978)	1.028	99% Chebyshev (MVUE) UCL	1.11

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.192	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.706	
MLE of Mean	0.841	
MLE of Standard Deviation	0.77	
nu star	1139	
Approximate Chi Square Value (.05)	1062	**Nonparametric Statistics**
Adjusted Level of Significance	0.0495	95% CLT UCL 1.014
Adjusted Chi Square Value	1062	95% Jackknife UCL 1.015
		95% Standard Bootstrap UCL 1.017
Anderson-Darling Test Statistic	2.092E+28	95% Bootstrap-t UCL 1.229
Anderson-Darling 5% Critical Value	0.78	95% Hall's Bootstrap UCL 1.69
Kolmogorov-Smirnov Test Statistic	0.255	95% Percentile Bootstrap UCL 1.034
Kolmogorov-Smirnov 5% Critical Value	0.0426	95% BCA Bootstrap UCL 1.197
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1.301
		97.5% Chebyshev(Mean, Sd) UCL 1.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.891
95% Approximate Gamma UCL	0.902	
95% Adjusted Gamma UCL	0.902	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1.301

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.

Cobalt

General Statistics

Number of Valid Observations	771	Number of Distinct Observations	173
Number of Missing Values	9		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.115	Minimum of Log Data	-2.163
Maximum	24.8	Maximum of Log Data	3.211
Mean	1.796	Mean of log Data	0.0137
Median	1	SD of log Data	1.128
SD	2.229		
Std. Error of Mean	0.0803		
Coefficient of Variation	1.241		
Skewness	4.09		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.225	Lilliefors Test Statistic	0.114
Lilliefors Critical Value	0.0319	Lilliefors Critical Value	0.0319
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.928	95% H-UCL	2.095
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.345
95% Adjusted-CLT UCL (Chen-1995)	1.94	97.5% Chebyshev (MVUE) UCL	2.532
95% Modified-t UCL (Johnson-1978)	1.93	99% Chebyshev (MVUE) UCL	2.899

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.006	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1.785	
MLE of Mean	1.796	
MLE of Standard Deviation	1.79	
nu star	1551	
Approximate Chi Square Value (.05)	1460	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 1.928
Adjusted Chi Square Value	1460	95% Jackknife UCL 1.928
		95% Standard Bootstrap UCL 1.927
Anderson-Darling Test Statistic	7.574	95% Bootstrap-t UCL 1.945
Anderson-Darling 5% Critical Value	0.785	95% Hall's Bootstrap UCL 1.949
Kolmogorov-Smirnov Test Statistic	0.0881	95% Percentile Bootstrap UCL 1.924
Kolmogorov-Smirnov 5% Critical Value	0.0351	95% BCA Bootstrap UCL 1.93
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.145
		97.5% Chebyshev(Mean, Sd) UCL 2.297
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2.594
95% Approximate Gamma UCL	1.907	
95% Adjusted Gamma UCL	1.907	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2.145

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	763	Number of Distinct Observations	352
Number of Missing Values	17		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.46	Minimum of Log Data	-0.777
Maximum	4950	Maximum of Log Data	8.507
Mean	44.11	Mean of log Data	2.373
Median	9.4	SD of log Data	1.344
SD	226.2		
Std. Error of Mean	8.19		
Coefficient of Variation	5.129		
Skewness	15.67		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.424	Lilliefors Test Statistic	0.0708
Lilliefors Critical Value	0.0321	Lilliefors Critical Value	0.0321
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	57.59	95% H-UCL	29.75
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	34.13
95% Adjusted-CLT UCL (Chen-1995)	62.54	97.5% Chebyshev (MVUE) UCL	37.46
95% Modified-t UCL (Johnson-1978)	58.37	99% Chebyshev (MVUE) UCL	44

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.455	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	96.94	
MLE of Mean	44.11	
MLE of Standard Deviation	65.39	
nu star	694.3	
Approximate Chi Square Value (.05)	634.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 57.58
Adjusted Chi Square Value	634.1	95% Jackknife UCL 57.59
		95% Standard Bootstrap UCL 57.79
Anderson-Darling Test Statistic	1.311E+28	95% Bootstrap-t UCL 68.15
Anderson-Darling 5% Critical Value	0.834	95% Hall's Bootstrap UCL 110.3
Kolmogorov-Smirnov Test Statistic	0.235	95% Percentile Bootstrap UCL 58.11
Kolmogorov-Smirnov 5% Critical Value	0.0365	95% BCA Bootstrap UCL 65.15
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 79.81
		97.5% Chebyshev(Mean, Sd) UCL 95.25
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 125.6
95% Approximate Gamma UCL	48.29	
95% Adjusted Gamma UCL	48.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 79.81

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations	771	Number of Distinct Observations	448

Raw Statistics		**Log-transformed Statistics**	
Minimum	912	Minimum of Log Data	6.816
Maximum	154000	Maximum of Log Data	11.94
Mean	16545	Mean of log Data	9.467
Median	13900	SD of log Data	0.736
SD	12735		
Std. Error of Mean	458.6		
Coefficient of Variation	0.77		
Skewness	3.226		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.129	Lilliefors Test Statistic	0.058
Lilliefors Critical Value	0.0319	Lilliefors Critical Value	0.0319
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17300	95% H-UCL	17819
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	19134
95% Adjusted-CLT UCL (Chen-1995)	17356	97.5% Chebyshev (MVUE) UCL	20086
95% Modified-t UCL (Johnson-1978)	17309	99% Chebyshev (MVUE) UCL	21958

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.167	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	7636	
MLE of Mean	16545	
MLE of Standard Deviation	11240	
nu star	3341	
Approximate Chi Square Value (.05)	3208	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 17300
Adjusted Chi Square Value	3208	95% Jackknife UCL 17300
		95% Standard Bootstrap UCL 17299
Anderson-Darling Test Statistic	1.581	95% Bootstrap-t UCL 17390
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL 17368
Kolmogorov-Smirnov Test Statistic	0.0373	95% Percentile Bootstrap UCL 17336
Kolmogorov-Smirnov 5% Critical Value	0.0345	95% BCA Bootstrap UCL 17358
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 18544
		97.5% Chebyshev(Mean, Sd) UCL 19409
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 21108
95% Approximate Gamma UCL	17233	
95% Adjusted Gamma UCL	17234	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 18544

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	757	Number of Distinct Observations	518
Number of Missing Values	25		

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	40000	Maximum of Log Data	10.6
Mean	408.1	Mean of log Data	3.695
Median	29.7	SD of log Data	1.764
SD	2517		
Std. Error of Mean	91.48		
Coefficient of Variation	6.167		
Skewness	12.7		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.436	Lilliefors Test Statistic	0.0816
Lilliefors Critical Value	0.0322	Lilliefors Critical Value	0.0322
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	558.7	95% H-UCL	227.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	273.4
95% Adjusted-CLT UCL (Chen-1995)	603.7	97.5% Chebyshev (MVUE) UCL	309.6
95% Modified-t UCL (Johnson-1978)	565.8	99% Chebyshev (MVUE) UCL	380.9

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.298	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	1371	
MLE of Mean	408.1	
MLE of Standard Deviation	748	
nu star	450.7	
Approximate Chi Square Value (.05)	402.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 558.6
Adjusted Chi Square Value	402.4	95% Jackknife UCL 558.7
		95% Standard Bootstrap UCL 557
Anderson-Darling Test Statistic	84.17	95% Bootstrap-t UCL 653.4
Anderson-Darling 5% Critical Value	0.872	95% Hall's Bootstrap UCL 654
Kolmogorov-Smirnov Test Statistic	0.243	95% Percentile Bootstrap UCL 566.9
Kolmogorov-Smirnov 5% Critical Value	0.0373	95% BCA Bootstrap UCL 607
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 806.8
		97.5% Chebyshev(Mean, Sd) UCL 979.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1318
95% Approximate Gamma UCL	457	
95% Adjusted Gamma UCL	457.1	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 806.8

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations 780 | Number of Distinct Observations 500

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.66	Minimum of Log Data	-0.416
Maximum	1250	Maximum of Log Data	7.131
Mean	58.76	Mean of log Data	3.375
Median	30.4	SD of log Data	1.207
SD	96.52		
Std. Error of Mean	3.456		
Coefficient of Variation	1.643		
Skewness	5.994		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.274	Lilliefors Test Statistic	0.0277
Lilliefors Critical Value	0.0317	Lilliefors Critical Value	0.0317
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	64.45	95% H-UCL	66.73
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	75.31
95% Adjusted-CLT UCL (Chen-1995)	65.24	97.5% Chebyshev (MVUE) UCL	81.76
95% Modified-t UCL (Johnson-1978)	64.57	99% Chebyshev (MVUE) UCL	94.42

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.841	**Data appear Lognormal at 5% Significance Level**
Theta Star	69.84	
MLE of Mean	58.76	
MLE of Standard Deviation	64.06	
nu star	1313	
Approximate Chi Square Value (.05)	1229	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 64.44
Adjusted Chi Square Value	1229	95% Jackknife UCL 64.45
		95% Standard Bootstrap UCL 64.45
Anderson-Darling Test Statistic	11.08	95% Bootstrap-t UCL 66.14
Anderson-Darling 5% Critical Value	0.792	95% Hall's Bootstrap UCL 65.51
Kolmogorov-Smirnov Test Statistic	0.0925	95% Percentile Bootstrap UCL 64.88
Kolmogorov-Smirnov 5% Critical Value	0.0351	95% BCA Bootstrap UCL 65.42
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 73.82
		97.5% Chebyshev(Mean, Sd) UCL 80.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 93.14
95% Approximate Gamma UCL	62.73	
95% Adjusted Gamma UCL	62.74	
Potential UCL to Use		Use 95% H-UCL 66.73

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 C-9
ProUCL Output - All Upland Areas Surface/Subsurface Soil
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	778	Number of Distinct Observations	345
Number of Missing Values	2		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.65	Minimum of Log Data	-0.431
Maximum	202	Maximum of Log Data	5.308
Mean	17.75	Mean of log Data	2.594
Median	13.35	SD of log Data	0.753
SD	16.35		
Std. Error of Mean	0.586		
Coefficient of Variation	0.921		
Skewness	4.323		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.165	Lilliefors Test Statistic	0.0227
Lilliefors Critical Value	0.0318	Lilliefors Critical Value	0.0318
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	18.71	95% H-UCL	18.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	20.11
95% Adjusted-CLT UCL (Chen-1995)	18.81	97.5% Chebyshev (MVUE) UCL	21.14
95% Modified-t UCL (Johnson-1978)	18.73	99% Chebyshev (MVUE) UCL	23.14

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.914	**Data appear Lognormal at 5% Significance Level**
Theta Star	9.274	
MLE of Mean	17.75	
MLE of Standard Deviation	12.83	
nu star	2978	
Approximate Chi Square Value (.05)	2852	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 18.71
Adjusted Chi Square Value	2852	95% Jackknife UCL 18.71
		95% Standard Bootstrap UCL 18.71
Anderson-Darling Test Statistic	3.993	95% Bootstrap-t UCL 18.89
Anderson-Darling 5% Critical Value	0.768	95% Hall's Bootstrap UCL 18.79
Kolmogorov-Smirnov Test Statistic	0.0554	95% Percentile Bootstrap UCL 18.65
Kolmogorov-Smirnov 5% Critical Value	0.0344	95% BCA Bootstrap UCL 18.83
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 20.3
		97.5% Chebyshev(Mean, Sd) UCL 21.41
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 23.58
95% Approximate Gamma UCL	18.53	
95% Adjusted Gamma UCL	18.53	

Potential UCL to Use		Use 95% H-UCL	18.7

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.

Zinc

General Statistics

Number of Valid Observations	753	Number of Distinct Observations	420
Number of Missing Values	27		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.26	Minimum of Log Data	-1.347
Maximum	5160	Maximum of Log Data	8.549
Mean	41.63	Mean of log Data	2.74
Median	15.4	SD of log Data	1.248
SD	204.3		
Std. Error of Mean	7.446		
Coefficient of Variation	4.908		
Skewness	21.57		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.42	Lilliefors Test Statistic	0.0269
Lilliefors Critical Value	0.0323	Lilliefors Critical Value	0.0323
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	53.89	95% H-UCL	37.47
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	42.56
95% Adjusted-CLT UCL (Chen-1995)	60.13	97.5% Chebyshev (MVUE) UCL	46.39
95% Modified-t UCL (Johnson-1978)	54.87	99% Chebyshev (MVUE) UCL	53.93

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.62	**Data appear Lognormal at 5% Significance Level**
Theta Star	67.14	
MLE of Mean	41.63	
MLE of Standard Deviation	52.87	
nu star	933.8	
Approximate Chi Square Value (.05)	863.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0497	95% CLT UCL 53.88
Adjusted Chi Square Value	863.7	95% Jackknife UCL 53.89
		95% Standard Bootstrap UCL 53.95
Anderson-Darling Test Statistic	1.328E+28	95% Bootstrap-t UCL 74.19
Anderson-Darling 5% Critical Value	0.81	95% Hall's Bootstrap UCL 100.7
Kolmogorov-Smirnov Test Statistic	0.145	95% Percentile Bootstrap UCL 54.95
Kolmogorov-Smirnov 5% Critical Value	0.0362	95% BCA Bootstrap UCL 64.83
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 74.09
		97.5% Chebyshev(Mean, Sd) UCL 88.13
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 115.7
95% Approximate Gamma UCL	45	
95% Adjusted Gamma UCL	45.01	

Potential UCL to Use		Use 95% H-UCL	37.47

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Groundwater
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene

General Statistics

Number of Valid Observations 20
Number of Distinct Observations 6

Raw Statistics

Minimum	0.2
Maximum	5
Mean	0.709
Median	0.2
SD	1.28
Std. Error of Mean	0.286
Coefficient of Variation	1.805
Skewness	2.827

Log-transformed Statistics

Minimum of Log Data	-1.609
Maximum of Log Data	1.609
Mean of log Data	-1.102
SD of log Data	1.019

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.469
Shapiro Wilk Critical Value	0.905

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.571
Shapiro Wilk Critical Value	0.905

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1.204

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	1.373
95% Modified-t UCL (Johnson-1978)	1.234

Assuming Lognormal Distribution

95% H-UCL	1.041
95% Chebyshev (MVUE) UCL	1.139
97.5% Chebyshev (MVUE) UCL	1.398
99% Chebyshev (MVUE) UCL	1.908

Gamma Distribution Test

k star (bias corrected)	0.701
Theta Star	1.012
MLE of Mean	0.709
MLE of Standard Deviation	0.847
nu star	28.03
Approximate Chi Square Value (.05)	16.95
Adjusted Level of Significance	0.038
Adjusted Chi Square Value	16.27
Anderson-Darling Test Statistic	4.445
Anderson-Darling 5% Critical Value	0.778
Kolmogorov-Smirnov Test Statistic	0.45
Kolmogorov-Smirnov 5% Critical Value	0.201

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1.172
95% Adjusted Gamma UCL	1.221

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	1.18
95% Jackknife UCL	1.204
95% Standard Bootstrap UCL	1.166
95% Bootstrap-t UCL	2.882
95% Hall's Bootstrap UCL	3.107
95% Percentile Bootstrap UCL	1.21
95% BCA Bootstrap UCL	1.43
95% Chebyshev(Mean, Sd) UCL	1.957
97.5% Chebyshev(Mean, Sd) UCL	2.496
99% Chebyshev(Mean, Sd) UCL	3.557

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 1.957

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	16.3	Minimum of Log Data	2.791
Maximum	34800	Maximum of Log Data	10.46
Mean	4541	Mean of log Data	7.372
Median	1345	SD of log Data	1.704
SD	7814		
Std. Error of Mean	1747		
Coefficient of Variation	1.721		
Skewness	3.366		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.562	Shapiro Wilk Test Statistic	0.942
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	7562	95% H-UCL	29746
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	17643
95% Adjusted-CLT UCL (Chen-1995)	8820	97.5% Chebyshev (MVUE) UCL	22750
95% Modified-t UCL (Johnson-1978)	7781	99% Chebyshev (MVUE) UCL	32781

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.535	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	8485	
MLE of Mean	4541	
MLE of Standard Deviation	6207	
nu star	21.41	
Approximate Chi Square Value (.05)	11.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 7415
Adjusted Chi Square Value	11.34	95% Jackknife UCL 7562
		95% Standard Bootstrap UCL 7409
Anderson-Darling Test Statistic	0.548	95% Bootstrap-t UCL 12045
Anderson-Darling 5% Critical Value	0.794	95% Hall's Bootstrap UCL 17540
Kolmogorov-Smirnov Test Statistic	0.151	95% Percentile Bootstrap UCL 7549
Kolmogorov-Smirnov 5% Critical Value	0.204	95% BCA Bootstrap UCL 8953
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 12157
		97.5% Chebyshev(Mean, Sd) UCL 15453
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 21926
95% Approximate Gamma UCL	8172	
95% Adjusted Gamma UCL	8575	

Potential UCL to Use	Use 95% Approximate Gamma UCL 8172

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	13

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.036	Minimum of Log Data	-3.324
Maximum	5.4	Maximum of Log Data	1.686
Mean	0.896	Mean of log Data	-0.953
Median	0.77	SD of log Data	1.483
SD	1.219		
Std. Error of Mean	0.273		
Coefficient of Variation	1.361		
Skewness	2.885		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.652	Shapiro Wilk Test Statistic	0.914
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.367	95% H-UCL	3.683
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.853
95% Adjusted-CLT UCL (Chen-1995)	1.532	97.5% Chebyshev (MVUE) UCL	3.635
95% Modified-t UCL (Johnson-1978)	1.397	99% Chebyshev (MVUE) UCL	5.17

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.641	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	1.398	
MLE of Mean	0.896	
MLE of Standard Deviation	1.119	
nu star	25.64	
Approximate Chi Square Value (.05)	15.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 1.344
Adjusted Chi Square Value	14.46	95% Jackknife UCL 1.367
		95% Standard Bootstrap UCL 1.327
Anderson-Darling Test Statistic	0.71	95% Bootstrap-t UCL 1.804
Anderson-Darling 5% Critical Value	0.783	95% Hall's Bootstrap UCL 3.299
Kolmogorov-Smirnov Test Statistic	0.188	95% Percentile Bootstrap UCL 1.378
Kolmogorov-Smirnov 5% Critical Value	0.202	95% BCA Bootstrap UCL 1.515
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.084
		97.5% Chebyshev(Mean, Sd) UCL 2.599
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3.609
95% Approximate Gamma UCL	1.521	
95% Adjusted Gamma UCL	1.588	

Potential UCL to Use	Use 95% Approximate Gamma UCL 1.521

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	17

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.45	Minimum of Log Data	-0.799
Maximum	6.8	Maximum of Log Data	1.917
Mean	2.003	Mean of log Data	0.395
Median	1.35	SD of log Data	0.767
SD	1.803		
Std. Error of Mean	0.403		
Coefficient of Variation	0.9		
Skewness	1.862		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.75	Shapiro Wilk Test Statistic	0.96
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2.7	95% H-UCL	2.994
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.532
95% Adjusted-CLT UCL (Chen-1995)	2.845	97.5% Chebyshev (MVUE) UCL	4.214
95% Modified-t UCL (Johnson-1978)	2.728	99% Chebyshev (MVUE) UCL	5.554

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.578	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	1.269	
MLE of Mean	2.003	
MLE of Standard Deviation	1.594	
nu star	63.11	
Approximate Chi Square Value (.05)	45.84	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 2.666
Adjusted Chi Square Value	44.68	95% Jackknife UCL 2.7
		95% Standard Bootstrap UCL 2.656
Anderson-Darling Test Statistic	0.655	95% Bootstrap-t UCL 3.207
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL 3.428
Kolmogorov-Smirnov Test Statistic	0.165	95% Percentile Bootstrap UCL 2.706
Kolmogorov-Smirnov 5% Critical Value	0.197	95% BCA Bootstrap UCL 2.851
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 3.76
		97.5% Chebyshev(Mean, Sd) UCL 4.52
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 6.014
95% Approximate Gamma UCL	2.757	
95% Adjusted Gamma UCL	2.829	

Potential UCL to Use	Use 95% Approximate Gamma UCL 2.757

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cadmium

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	17

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.0215	Minimum of Log Data	-3.84
Maximum	4.7	Maximum of Log Data	1.548
Mean	0.761	Mean of log Data	-1.245
Median	0.225	SD of log Data	1.465
SD	1.167		
Std. Error of Mean	0.261		
Coefficient of Variation	1.534		
Skewness	2.428		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.659	Shapiro Wilk Test Statistic	0.961
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.212	95% H-UCL	2.614
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.063
95% Adjusted-CLT UCL (Chen-1995)	1.341	97.5% Chebyshev (MVUE) UCL	2.626
95% Modified-t UCL (Johnson-1978)	1.236	99% Chebyshev (MVUE) UCL	3.73

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.57	**Data appear Lognormal at 5% Significance Level**
Theta Star	1.335	
MLE of Mean	0.761	
MLE of Standard Deviation	1.008	
nu star	22.79	
Approximate Chi Square Value (.05)	12.94	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 1.19
Adjusted Chi Square Value	12.35	95% Jackknife UCL 1.212
		95% Standard Bootstrap UCL 1.191
Anderson-Darling Test Statistic	0.84	95% Bootstrap-t UCL 1.534
Anderson-Darling 5% Critical Value	0.79	95% Hall's Bootstrap UCL 1.589
Kolmogorov-Smirnov Test Statistic	0.226	95% Percentile Bootstrap UCL 1.207
Kolmogorov-Smirnov 5% Critical Value	0.203	95% BCA Bootstrap UCL 1.324
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1.898
		97.5% Chebyshev(Mean, Sd) UCL 2.39
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3.357
95% Approximate Gamma UCL	1.341	
95% Adjusted Gamma UCL	1.404	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 1.898

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations 20 | Number of Distinct Observations 20

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.38	Minimum of Log Data	-0.968
Maximum	40.1	Maximum of Log Data	3.691
Mean	14.3	Mean of log Data	2.022
Median	11.1	SD of log Data	1.411
SD	12.73		
Std. Error of Mean	2.846		
Coefficient of Variation	0.89		
Skewness	0.79		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.893	Shapiro Wilk Test Statistic	0.898
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	19.22	95% H-UCL	58.94
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	49.14
95% Adjusted-CLT UCL (Chen-1995)	19.52	97.5% Chebyshev (MVUE) UCL	62.31
95% Modified-t UCL (Johnson-1978)	19.31	99% Chebyshev (MVUE) UCL	88.18

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.81	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	17.66	
MLE of Mean	14.3	
MLE of Standard Deviation	15.89	
nu star	32.39	
Approximate Chi Square Value (.05)	20.38	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 18.98
Adjusted Chi Square Value	19.63	95% Jackknife UCL 19.22
		95% Standard Bootstrap UCL 18.92
Anderson-Darling Test Statistic	0.432	95% Bootstrap-t UCL 20.06
Anderson-Darling 5% Critical Value	0.772	95% Hall's Bootstrap UCL 19.35
Kolmogorov-Smirnov Test Statistic	0.138	95% Percentile Bootstrap UCL 19
Kolmogorov-Smirnov 5% Critical Value	0.2	95% BCA Bootstrap UCL 19.51
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 26.71
		97.5% Chebyshev(Mean, Sd) UCL 32.08
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 42.62
95% Approximate Gamma UCL	22.73	
95% Adjusted Gamma UCL	23.6	

Potential UCL to Use		Use 95% Approximate Gamma UCL	22.73

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.63	Minimum of Log Data	-0.462
Maximum	271	Maximum of Log Data	5.602
Mean	23.33	Mean of log Data	2.112
Median	8.55	SD of log Data	1.274
SD	59.05		
Std. Error of Mean	13.2		
Coefficient of Variation	2.531		
Skewness	4.292		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.357	Shapiro Wilk Test Statistic	0.95
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	46.16	95% H-UCL	45.45
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	42.6
95% Adjusted-CLT UCL (Chen-1995)	58.59	97.5% Chebyshev (MVUE) UCL	53.5
95% Modified-t UCL (Johnson-1978)	48.28	99% Chebyshev (MVUE) UCL	74.91

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.54	**Data appear Lognormal at 5% Significance Level**
Theta Star	43.21	
MLE of Mean	23.33	
MLE of Standard Deviation	31.75	
nu star	21.6	
Approximate Chi Square Value (.05)	12.04	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 45.05
Adjusted Chi Square Value	11.48	95% Jackknife UCL 46.16
		95% Standard Bootstrap UCL 44
Anderson-Darling Test Statistic	1.781	95% Bootstrap-t UCL 167.1
Anderson-Darling 5% Critical Value	0.794	95% Hall's Bootstrap UCL 130.2
Kolmogorov-Smirnov Test Statistic	0.243	95% Percentile Bootstrap UCL 48.41
Kolmogorov-Smirnov 5% Critical Value	0.204	95% BCA Bootstrap UCL 64.13
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 80.89
		97.5% Chebyshev(Mean, Sd) UCL 105.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 154.7
95% Approximate Gamma UCL	41.86	
95% Adjusted Gamma UCL	43.91	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 80.89

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.

Iron

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	64.2	Minimum of Log Data	4.162
Maximum	372000	Maximum of Log Data	12.83
Mean	32287	Mean of log Data	8.171
Median	4365	SD of log Data	2.454
SD	82873		
Std. Error of Mean	18531		
Coefficient of Variation	2.567		
Skewness	4.005		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.419	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	64330	95% H-UCL	1295861
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	180663
95% Adjusted-CLT UCL (Chen-1995)	80501	97.5% Chebyshev (MVUE) UCL	238993
95% Modified-t UCL (Johnson-1978)	67096	99% Chebyshev (MVUE) UCL	353570

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.297	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	108718	
MLE of Mean	32287	
MLE of Standard Deviation	59247	
nu star	11.88	
Approximate Chi Square Value (.05)	5.148	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 62768
Adjusted Chi Square Value	4.801	95% Jackknife UCL 64330
		95% Standard Bootstrap UCL 62447
Anderson-Darling Test Statistic	0.715	95% Bootstrap-t UCL 161243
Anderson-Darling 5% Critical Value	0.843	95% Hall's Bootstrap UCL 172969
Kolmogorov-Smirnov Test Statistic	0.169	95% Percentile Bootstrap UCL 65890
Kolmogorov-Smirnov 5% Critical Value	0.21	95% BCA Bootstrap UCL 88136
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 113062
		97.5% Chebyshev(Mean, Sd) UCL 148013
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 216668
95% Approximate Gamma UCL	74510	
95% Adjusted Gamma UCL	79894	

Potential UCL to Use		Use 95% Adjusted Gamma UCL	79894

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 C-10
ProUCL Output - Groundwater (All Wells)
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	19

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.4	Minimum of Log Data	-0.916
Maximum	107	Maximum of Log Data	4.673
Mean	10.57	Mean of log Data	1.41
Median	4.05	SD of log Data	1.289
SD	23.32		
Std. Error of Mean	5.214		
Coefficient of Variation	2.207		
Skewness	4.11		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.412	Shapiro Wilk Test Statistic	0.967
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	19.58	95% H-UCL	23.36
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	21.64
95% Adjusted-CLT UCL (Chen-1995)	24.26	97.5% Chebyshev (MVUE) UCL	27.21
95% Modified-t UCL (Johnson-1978)	20.38	99% Chebyshev (MVUE) UCL	38.15

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.582	**Data appear Lognormal at 5% Significance Level**
Theta Star	18.17	
MLE of Mean	10.57	
MLE of Standard Deviation	13.85	
nu star	23.26	
Approximate Chi Square Value (.05)	13.29	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 19.14
Adjusted Chi Square Value	12.7	95% Jackknife UCL 19.58
		95% Standard Bootstrap UCL 19.19
Anderson-Darling Test Statistic	1.235	95% Bootstrap-t UCL 45.55
Anderson-Darling 5% Critical Value	0.789	95% Hall's Bootstrap UCL 46.96
Kolmogorov-Smirnov Test Statistic	0.233	95% Percentile Bootstrap UCL 20.53
Kolmogorov-Smirnov 5% Critical Value	0.203	95% BCA Bootstrap UCL 24.95
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 33.29
		97.5% Chebyshev(Mean, Sd) UCL 43.13
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 62.44
95% Approximate Gamma UCL	18.49	
95% Adjusted Gamma UCL	19.36	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 33.29

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.

Manganese

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	2060	Maximum of Log Data	7.63
Mean	783.9	Mean of log Data	5.877
Median	496	SD of log Data	1.767
SD	705.5		
Std. Error of Mean	157.8		
Coefficient of Variation	0.9		
Skewness	0.562		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.856	Shapiro Wilk Test Statistic	0.843
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1057	95% H-UCL	8222
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4461
95% Adjusted-CLT UCL (Chen-1995)	1065	97.5% Chebyshev (MVUE) UCL	5769
95% Modified-t UCL (Johnson-1978)	1060	99% Chebyshev (MVUE) UCL	8340

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.679	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	1154	
MLE of Mean	783.9	
MLE of Standard Deviation	951.3	
nu star	27.16	
Approximate Chi Square Value (.05)	16.27	**Nonparametric Statistics**
Adjusted Level of Significance	0.038	95% CLT UCL 1043
Adjusted Chi Square Value	15.61	95% Jackknife UCL 1057
		95% Standard Bootstrap UCL 1042
Anderson-Darling Test Statistic	0.54	95% Bootstrap-t UCL 1086
Anderson-Darling 5% Critical Value	0.779	95% Hall's Bootstrap UCL 1044
Kolmogorov-Smirnov Test Statistic	0.188	95% Percentile Bootstrap UCL 1044
Kolmogorov-Smirnov 5% Critical Value	0.201	95% BCA Bootstrap UCL 1050
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1471
		97.5% Chebyshev(Mean, Sd) UCL 1769
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 2353
95% Approximate Gamma UCL	1308	
95% Adjusted Gamma UCL	1364	

Potential UCL to Use	Use 95% Approximate Gamma UCL 1308

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 C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	SurfaceWater
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations	115	Number of Distinct Observations	38

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	12600	Maximum of Log Data	9.441
Mean	1470	Mean of log Data	6.935
Median	1000	SD of log Data	0.92
SD	1703		
Std. Error of Mean	158.8		
Coefficient of Variation	1.159		
Skewness	3.793		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.432	Lilliefors Test Statistic	0.349
Lilliefors Critical Value	0.0826	Lilliefors Critical Value	0.0826
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1733	95% H-UCL	1887
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2246
95% Adjusted-CLT UCL (Chen-1995)	1791	97.5% Chebyshev (MVUE) UCL	2542
95% Modified-t UCL (Johnson-1978)	1742	99% Chebyshev (MVUE) UCL	3125

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.507	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	975.2	
MLE of Mean	1470	
MLE of Standard Deviation	1197	
nu star	346.6	
Approximate Chi Square Value (.05)	304.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.0479	95% CLT UCL 1731
Adjusted Chi Square Value	304	95% Jackknife UCL 1733
		95% Standard Bootstrap UCL 1727
Anderson-Darling Test Statistic	18.06	95% Bootstrap-t UCL 1800
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL 1834
Kolmogorov-Smirnov Test Statistic	0.39	95% Percentile Bootstrap UCL 1764
Kolmogorov-Smirnov 5% Critical Value	0.0871	95% BCA Bootstrap UCL 1793
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2162
		97.5% Chebyshev(Mean, Sd) UCL 2462
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3050
95% Approximate Gamma UCL	1673	
95% Adjusted Gamma UCL	1676	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 2162

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 C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Antimony

General Statistics

Number of Valid Observations	61	Number of Distinct Observations	23

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.34	Minimum of Log Data	-1.079
Maximum	53.2	Maximum of Log Data	3.974
Mean	13.17	Mean of log Data	2.215
Median	10	SD of log Data	0.935
SD	11		
Std. Error of Mean	1.408		
Coefficient of Variation	0.835		
Skewness	1.348		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.315	Lilliefors Test Statistic	0.209
Lilliefors Critical Value	0.113	Lilliefors Critical Value	0.113
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	15.52	95% H-UCL	18.51
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22.57
95% Adjusted-CLT UCL (Chen-1995)	15.75	97.5% Chebyshev (MVUE) UCL	26.26
95% Modified-t UCL (Johnson-1978)	15.56	99% Chebyshev (MVUE) UCL	33.51

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.459	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	9.028	
MLE of Mean	13.17	
MLE of Standard Deviation	10.9	
nu star	178	
Approximate Chi Square Value (.05)	148.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0461	95% CLT UCL 15.49
Adjusted Chi Square Value	147.5	95% Jackknife UCL 15.52
		95% Standard Bootstrap UCL 15.48
Anderson-Darling Test Statistic	2.788	95% Bootstrap-t UCL 15.73
Anderson-Darling 5% Critical Value	0.769	95% Hall's Bootstrap UCL 15.84
Kolmogorov-Smirnov Test Statistic	0.219	95% Percentile Bootstrap UCL 15.54
Kolmogorov-Smirnov 5% Critical Value	0.116	95% BCA Bootstrap UCL 15.63
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 19.31
		97.5% Chebyshev(Mean, Sd) UCL 21.96
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 27.18
95% Approximate Gamma UCL	15.82	
95% Adjusted Gamma UCL	15.89	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 19.31

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 C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	139	Number of Distinct Observations	33

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.026	Minimum of Log Data	-3.65
Maximum	70.9	Maximum of Log Data	4.261
Mean	32.35	Mean of log Data	3.005
Median	50	SD of log Data	1.24
SD	21.35		
Std. Error of Mean	1.811		
Coefficient of Variation	0.66		
Skewness	-0.39		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.364	Lilliefors Test Statistic	0.336
Lilliefors Critical Value	0.0751	Lilliefors Critical Value	0.0751
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	35.35	95% H-UCL	56.22
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	68.75
95% Adjusted-CLT UCL (Chen-1995)	35.26	97.5% Chebyshev (MVUE) UCL	79.84
95% Modified-t UCL (Johnson-1978)	35.34	99% Chebyshev (MVUE) UCL	101.6

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.178	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	27.46	
MLE of Mean	32.35	
MLE of Standard Deviation	29.8	
nu star	327.5	
Approximate Chi Square Value (.05)	286.6	**Nonparametric Statistics**
Adjusted Level of Significance	0.0483	95% CLT UCL 35.33
Adjusted Chi Square Value	286.2	95% Jackknife UCL 35.35
		95% Standard Bootstrap UCL 35.27
Anderson-Darling Test Statistic	17.36	95% Bootstrap-t UCL 35.31
Anderson-Darling 5% Critical Value	0.778	95% Hall's Bootstrap UCL 35.24
Kolmogorov-Smirnov Test Statistic	0.36	95% Percentile Bootstrap UCL 35.27
Kolmogorov-Smirnov 5% Critical Value	0.0814	95% BCA Bootstrap UCL 35.08
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 40.24
		97.5% Chebyshev(Mean, Sd) UCL 43.66
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 50.37
95% Approximate Gamma UCL	36.97	
95% Adjusted Gamma UCL	37.02	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 40.24

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 positvely skewed data sets.

Appendix C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations 116
Number of Distinct Observations 16

Raw Statistics

Minimum 0.175
Maximum 250
Mean 172.5
Median 250
SD 111.6
Std. Error of Mean 10.36
Coefficient of Variation 0.647
Skewness -0.754

Log-transformed Statistics

Minimum of Log Data -1.743
Maximum of Log Data 5.521
Mean of log Data 4.37
SD of log Data 1.821

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.429
Lilliefors Critical Value 0.0823
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.409
Lilliefors Critical Value 0.0823
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 189.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 188.8
95% Modified-t UCL (Johnson-1978) 189.6

Assuming Lognormal Distribution

95% H-UCL 704.1
95% Chebyshev (MVUE) UCL 849.9
97.5% Chebyshev (MVUE) UCL 1045
99% Chebyshev (MVUE) UCL 1427

Gamma Distribution Test

k star (bias corrected) 0.751
Theta Star 229.9
MLE of Mean 172.5
MLE of Standard Deviation 199.1
nu star 174.2
Approximate Chi Square Value (.05) 144.6
Adjusted Level of Significance 0.0479
Adjusted Chi Square Value 144.3

Anderson-Darling Test Statistic 20.16
Anderson-Darling 5% Critical Value 0.795
Kolmogorov-Smirnov Test Statistic 0.437
Kolmogorov-Smirnov 5% Critical Value 0.0886
Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 207.8
95% Adjusted Gamma UCL 208.2

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL 189.6
95% Jackknife UCL 189.7
95% Standard Bootstrap UCL 189.5
95% Bootstrap-t UCL 189.6
95% Hall's Bootstrap UCL 189.4
95% Percentile Bootstrap UCL 188.2
95% BCA Bootstrap UCL 187.4
95% Chebyshev(Mean, Sd) UCL 217.7
97.5% Chebyshev(Mean, Sd) UCL 237.3
99% Chebyshev(Mean, Sd) UCL 275.7

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 217.7

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 positvely skewed data sets.

Appendix C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Copper

General Statistics

Number of Valid Observations	139	Number of Distinct Observations	34

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.35	Minimum of Log Data	-1.05
Maximum	154	Maximum of Log Data	5.037
Mean	76.78	Mean of log Data	3.714
Median	125	SD of log Data	1.392
SD	56.52		
Std. Error of Mean	4.794		
Coefficient of Variation	0.736		
Skewness	-0.317		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.372	Lilliefors Test Statistic	0.357
Lilliefors Critical Value	0.0751	Lilliefors Critical Value	0.0751
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	84.72	95% H-UCL	146.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	181.3
95% Adjusted-CLT UCL (Chen-1995)	84.53	97.5% Chebyshev (MVUE) UCL	213.7
95% Modified-t UCL (Johnson-1978)	84.7	99% Chebyshev (MVUE) UCL	277.1

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.914	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	84	
MLE of Mean	76.78	
MLE of Standard Deviation	80.31	
nu star	254.1	
Approximate Chi Square Value (.05)	218.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0483	95% CLT UCL 84.66
Adjusted Chi Square Value	217.8	95% Jackknife UCL 84.72
		95% Standard Bootstrap UCL 84.65
Anderson-Darling Test Statistic	17.75	95% Bootstrap-t UCL 85.17
Anderson-Darling 5% Critical Value	0.787	95% Hall's Bootstrap UCL 84.7
Kolmogorov-Smirnov Test Statistic	0.37	95% Percentile Bootstrap UCL 84.36
Kolmogorov-Smirnov 5% Critical Value	0.082	95% BCA Bootstrap UCL 83.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 97.67
		97.5% Chebyshev(Mean, Sd) UCL 106.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 124.5
95% Approximate Gamma UCL	89.41	
95% Adjusted Gamma UCL	89.56	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 97.67

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.

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 positvely skewed data sets.

Iron

General Statistics

Number of Valid Observations 113
Number of Distinct Observations 46

Raw Statistics

Minimum 27
Maximum 74400
Mean 3156
Median 500
SD 8399
Std. Error of Mean 790.1
Coefficient of Variation 2.662
Skewness 6.058

Log-transformed Statistics

Minimum of Log Data 3.296
Maximum of Log Data 11.22
Mean of log Data 6.842
SD of log Data 1.274

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic 0.372
Lilliefors Critical Value 0.0833
Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic 0.379
Lilliefors Critical Value 0.0833
Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL 4466

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995) 4936
95% Modified-t UCL (Johnson-1978) 4541

Assuming Lognormal Distribution

95% H-UCL 2842
95% Chebyshev (MVUE) UCL 3497
97.5% Chebyshev (MVUE) UCL 4110
99% Chebyshev (MVUE) UCL 5314

Gamma Distribution Test

k star (bias corrected) 0.512
Theta Star 6166
MLE of Mean 3156
MLE of Standard Deviation 4411
nu star 115.7
Approximate Chi Square Value (.05) 91.83
Adjusted Level of Significance 0.0479
Adjusted Chi Square Value 91.55

Anderson-Darling Test Statistic 20.67
Anderson-Darling 5% Critical Value 0.817
Kolmogorov-Smirnov Test Statistic 0.391
Kolmogorov-Smirnov 5% Critical Value 0.0909
Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL 3975
95% Adjusted Gamma UCL 3986

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL 4455
95% Jackknife UCL 4466
95% Standard Bootstrap UCL 4438
95% Bootstrap-t UCL 5354
95% Hall's Bootstrap UCL 9903
95% Percentile Bootstrap UCL 4558
95% BCA Bootstrap UCL 5245
95% Chebyshev(Mean, Sd) UCL 6600
97.5% Chebyshev(Mean, Sd) UCL 8090
99% Chebyshev(Mean, Sd) UCL 11017

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 6600

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 C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	67	Number of Distinct Observations	42

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.145	Minimum of Log Data	-1.931
Maximum	1580	Maximum of Log Data	7.365
Mean	106.2	Mean of log Data	3.034
Median	15	SD of log Data	1.764
SD	276		
Std. Error of Mean	33.72		
Coefficient of Variation	2.598		
Skewness	4.334		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.362	Lilliefors Test Statistic	0.16
Lilliefors Critical Value	0.108	Lilliefors Critical Value	0.108
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	162.5	95% H-UCL	176.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	219.2
95% Adjusted-CLT UCL (Chen-1995)	180.8	97.5% Chebyshev (MVUE) UCL	273.7
95% Modified-t UCL (Johnson-1978)	165.5	99% Chebyshev (MVUE) UCL	380.9

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.395	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	269.1	
MLE of Mean	106.2	
MLE of Standard Deviation	169.1	
nu star	52.9	
Approximate Chi Square Value (.05)	37.19	**Nonparametric Statistics**
Adjusted Level of Significance	0.0464	95% CLT UCL 161.7
Adjusted Chi Square Value	36.9	95% Jackknife UCL 162.5
		95% Standard Bootstrap UCL 161.5
Anderson-Darling Test Statistic	4.805	95% Bootstrap-t UCL 224.5
Anderson-Darling 5% Critical Value	0.84	95% Hall's Bootstrap UCL 381.6
Kolmogorov-Smirnov Test Statistic	0.212	95% Percentile Bootstrap UCL 167.5
Kolmogorov-Smirnov 5% Critical Value	0.117	95% BCA Bootstrap UCL 184.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 253.2
		97.5% Chebyshev(Mean, Sd) UCL 316.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 441.8
95% Approximate Gamma UCL	151.1	
95% Adjusted Gamma UCL	152.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 253.2

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 C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	114	Number of Distinct Observations	43

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.155	Minimum of Log Data	-1.864
Maximum	2620	Maximum of Log Data	7.871
Mean	169.6	Mean of log Data	4.611
Median	75	SD of log Data	0.942
SD	331.3		
Std. Error of Mean	31.03		
Coefficient of Variation	1.954		
Skewness	5.454		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.362	Lilliefors Test Statistic	0.308
Lilliefors Critical Value	0.083	Lilliefors Critical Value	0.083
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	221	95% H-UCL	190
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	226.9
95% Adjusted-CLT UCL (Chen-1995)	237.5	97.5% Chebyshev (MVUE) UCL	257.5
95% Modified-t UCL (Johnson-1978)	223.7	99% Chebyshev (MVUE) UCL	317.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.071	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	158.3	
MLE of Mean	169.6	
MLE of Standard Deviation	163.8	
nu star	244.2	
Approximate Chi Square Value (.05)	209.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0479	95% CLT UCL 220.6
Adjusted Chi Square Value	208.7	95% Jackknife UCL 221
		95% Standard Bootstrap UCL 220.4
Anderson-Darling Test Statistic	20.05	95% Bootstrap-t UCL 269.9
Anderson-Darling 5% Critical Value	0.781	95% Hall's Bootstrap UCL 256.5
Kolmogorov-Smirnov Test Statistic	0.346	95% Percentile Bootstrap UCL 225.4
Kolmogorov-Smirnov 5% Critical Value	0.0882	95% BCA Bootstrap UCL 245.7
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 304.8
		97.5% Chebyshev(Mean, Sd) UCL 363.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 478.3
95% Approximate Gamma UCL	198.1	
95% Adjusted Gamma UCL	198.5	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 304.8

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 C-11
ProUCL Output - All Areas (except Wetland Area of Area 9) Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	116	Number of Distinct Observations	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.95	Minimum of Log Data	-0.0513
Maximum	250	Maximum of Log Data	5.521
Mean	177.2	Mean of log Data	4.646
Median	250	SD of log Data	1.423
SD	105.6		
Std. Error of Mean	9.804		
Coefficient of Variation	0.596		
Skewness	-0.787		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.427	Lilliefors Test Statistic	0.403
Lilliefors Critical Value	0.0823	Lilliefors Critical Value	0.0823
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	193.4	95% H-UCL	407.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	503
95% Adjusted-CLT UCL (Chen-1995)	192.5	97.5% Chebyshev (MVUE) UCL	598.8
95% Modified-t UCL (Johnson-1978)	193.3	99% Chebyshev (MVUE) UCL	786.9

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.056	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	167.8	
MLE of Mean	177.2	
MLE of Standard Deviation	172.4	
nu star	245	
Approximate Chi Square Value (.05)	209.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.0479	95% CLT UCL 193.3
Adjusted Chi Square Value	209.3	95% Jackknife UCL 193.4
		95% Standard Bootstrap UCL 193.4
Anderson-Darling Test Statistic	19.23	95% Bootstrap-t UCL 192.7
Anderson-Darling 5% Critical Value	0.781	95% Hall's Bootstrap UCL 192.1
Kolmogorov-Smirnov Test Statistic	0.429	95% Percentile Bootstrap UCL 191.7
Kolmogorov-Smirnov 5% Critical Value	0.0877	95% BCA Bootstrap UCL 193.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 219.9
		97.5% Chebyshev(Mean, Sd) UCL 238.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 274.7
95% Approximate Gamma UCL	206.9	
95% Adjusted Gamma UCL	207.3	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 219.9

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 positvely skewed data sets.

Appendix C-12
ProUCL Output - Wetland Area of Area 9 Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Wetland_SW
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Number of Valid Observations	15	Number of Distinct Observations	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	27	Minimum of Log Data	3.296
Maximum	21100	Maximum of Log Data	9.957
Mean	3922	Mean of log Data	7.087
Median	1360	SD of log Data	1.957
SD	5679		
Std. Error of Mean	1466		
Coefficient of Variation	1.448		
Skewness	2.27		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.704	Shapiro Wilk Test Statistic	0.92
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	6505	95% H-UCL	84536
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	21521
95% Adjusted-CLT UCL (Chen-1995)	7252	97.5% Chebyshev (MVUE) UCL	28199
95% Modified-t UCL (Johnson-1978)	6648	99% Chebyshev (MVUE) UCL	41316

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.468	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	8373	
MLE of Mean	3922	
MLE of Standard Deviation	5731	
nu star	14.05	
Approximate Chi Square Value (.05)	6.608	**Nonparametric Statistics**
Adjusted Level of Significance	0.0324	95% CLT UCL 6334
Adjusted Chi Square Value	5.989	95% Jackknife UCL 6505
		95% Standard Bootstrap UCL 6255
Anderson-Darling Test Statistic	0.315	95% Bootstrap-t UCL 8329
Anderson-Darling 5% Critical Value	0.791	95% Hall's Bootstrap UCL 15818
Kolmogorov-Smirnov Test Statistic	0.136	95% Percentile Bootstrap UCL 6469
Kolmogorov-Smirnov 5% Critical Value	0.233	95% BCA Bootstrap UCL 7043
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 10314
		97.5% Chebyshev(Mean, Sd) UCL 13079
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 18511
95% Approximate Gamma UCL	8342	
95% Adjusted Gamma UCL	9204	

Potential UCL to Use	Use 95% Approximate Gamma UCL 8342

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 C-12
ProUCL Output - Wetland Area of Area 9 Surface Water
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	15	Number of Distinct Observations	14

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.155	Minimum of Log Data	-1.864
Maximum	637	Maximum of Log Data	6.457
Mean	187.8	Mean of log Data	4.027
Median	111	SD of log Data	2.602
SD	188.7		
Std. Error of Mean	48.72		
Coefficient of Variation	1.005		
Skewness	1.114		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.879	Shapiro Wilk Test Statistic	0.758
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	273.6	95% H-UCL	91094
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3621
95% Adjusted-CLT UCL (Chen-1995)	282.9	97.5% Chebyshev (MVUE) UCL	4818
95% Modified-t UCL (Johnson-1978)	275.9	99% Chebyshev (MVUE) UCL	7171

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.462	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	406.2	
MLE of Mean	187.8	
MLE of Standard Deviation	276.2	
nu star	13.87	
Approximate Chi Square Value (.05)	6.482	**Nonparametric Statistics**
Adjusted Level of Significance	0.0324	95% CLT UCL 267.9
Adjusted Chi Square Value	5.87	95% Jackknife UCL 273.6
		95% Standard Bootstrap UCL 265.5
Anderson-Darling Test Statistic	0.551	95% Bootstrap-t UCL 291.2
Anderson-Darling 5% Critical Value	0.791	95% Hall's Bootstrap UCL 297.2
Kolmogorov-Smirnov Test Statistic	0.145	95% Percentile Bootstrap UCL 266.2
Kolmogorov-Smirnov 5% Critical Value	0.233	95% BCA Bootstrap UCL 281
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 400.1
		97.5% Chebyshev(Mean, Sd) UCL 492
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 672.5
95% Approximate Gamma UCL	401.8	
95% Adjusted Gamma UCL	443.6	

Potential UCL to Use	Use 95% Approximate Gamma UCL 401.8

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 C-13
ProUCL Output - Area 1 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area1_Sed
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations	73	Number of Distinct Observations	67

Raw Statistics		**Log-transformed Statistics**	
Minimum	276	Minimum of Log Data	5.62
Maximum	9950	Maximum of Log Data	9.205
Mean	1648	Mean of log Data	7.1
Median	1320	SD of log Data	0.783
SD	1523		
Std. Error of Mean	178.2		
Coefficient of Variation	0.924		
Skewness	2.961		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.184	Lilliefors Test Statistic	0.0758
Lilliefors Critical Value	0.104	Lilliefors Critical Value	0.104
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1945	95% H-UCL	1991
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2373
95% Adjusted-CLT UCL (Chen-1995)	2008	97.5% Chebyshev (MVUE) UCL	2691
95% Modified-t UCL (Johnson-1978)	1956	99% Chebyshev (MVUE) UCL	3316

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.711	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	963.6	
MLE of Mean	1648	
MLE of Standard Deviation	1260	
nu star	249.8	
Approximate Chi Square Value (.05)	214.2	
Adjusted Level of Significance	0.0467	
Adjusted Chi Square Value	213.5	
Anderson-Darling Test Statistic	0.645	
Anderson-Darling 5% Critical Value	0.766	
Kolmogorov-Smirnov Test Statistic	0.0786	
Kolmogorov-Smirnov 5% Critical Value	0.106	
Data appear Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
95% CLT UCL	1942
95% Jackknife UCL	1945
95% Standard Bootstrap UCL	1937
95% Bootstrap-t UCL	2042
95% Hall's Bootstrap UCL	2151
95% Percentile Bootstrap UCL	1943
95% BCA Bootstrap UCL	1994
95% Chebyshev(Mean, Sd) UCL	2425
97.5% Chebyshev(Mean, Sd) UCL	2761
99% Chebyshev(Mean, Sd) UCL	3422

Assuming Gamma Distribution	
95% Approximate Gamma UCL	1922
95% Adjusted Gamma UCL	1928

Potential UCL to Use	Use 95% Approximate Gamma UCL 1922

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 C-13
ProUCL Output - Area 1 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations 73
Number of Distinct Observations 61

Raw Statistics

Minimum	0.92
Maximum	40.2
Mean	7.515
Median	7.1
SD	6.214
Std. Error of Mean	0.727
Coefficient of Variation	0.827
Skewness	2.24

Log-transformed Statistics

Minimum of Log Data	-0.0834
Maximum of Log Data	3.694
Mean of log Data	1.674
SD of log Data	0.894

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.144
Lilliefors Critical Value	0.104

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.132
Lilliefors Critical Value	0.104

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	8.727

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	8.915
95% Modified-t UCL (Johnson-1978)	8.758

Assuming Lognormal Distribution

95% H-UCL	9.984
95% Chebyshev (MVUE) UCL	12.06
97.5% Chebyshev (MVUE) UCL	13.87
99% Chebyshev (MVUE) UCL	17.41

Gamma Distribution Test

k star (bias corrected)	1.547
Theta Star	4.856
MLE of Mean	7.515
MLE of Standard Deviation	6.041
nu star	225.9
Approximate Chi Square Value (.05)	192.1
Adjusted Level of Significance	0.0467
Adjusted Chi Square Value	191.5
Anderson-Darling Test Statistic	0.802
Anderson-Darling 5% Critical Value	0.768
Kolmogorov-Smirnov Test Statistic	0.0952
Kolmogorov-Smirnov 5% Critical Value	0.106

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	8.836
95% Adjusted Gamma UCL	8.865

Data Distribution

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	8.711
95% Jackknife UCL	8.727
95% Standard Bootstrap UCL	8.707
95% Bootstrap-t UCL	8.917
95% Hall's Bootstrap UCL	9.221
95% Percentile Bootstrap UCL	8.688
95% BCA Bootstrap UCL	8.956
95% Chebyshev(Mean, Sd) UCL	10.69
97.5% Chebyshev(Mean, Sd) UCL	12.06
99% Chebyshev(Mean, Sd) UCL	14.75

Potential UCL to Use

Use 95% Approximate Gamma UCL 8.836

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 C-13
ProUCL Output - Area 1 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations 25
Number of Distinct Observations 9

Raw Statistics

Minimum	0.39
Maximum	1
Mean	0.662
Median	0.65
SD	0.134
Std. Error of Mean	0.0267
Coefficient of Variation	0.202
Skewness	0.433

Log-transformed Statistics

Minimum of Log Data	-0.942
Maximum of Log Data	0
Mean of log Data	-0.433
SD of log Data	0.209

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.761
Shapiro Wilk Critical Value	0.918

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.751
Shapiro Wilk Critical Value	0.918

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.707

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.708
95% Modified-t UCL (Johnson-1978)	0.708

Assuming Lognormal Distribution

95% H-UCL	0.714
95% Chebyshev (MVUE) UCL	0.784
97.5% Chebyshev (MVUE) UCL	0.836
99% Chebyshev (MVUE) UCL	0.939

Gamma Distribution Test

k star (bias corrected)	21.92
Theta Star	0.0302
MLE of Mean	0.662
MLE of Standard Deviation	0.141
nu star	1096
Approximate Chi Square Value (.05)	1020
Adjusted Level of Significance	0.0395
Adjusted Chi Square Value	1015
Anderson-Darling Test Statistic	3.312
Anderson-Darling 5% Critical Value	0.743
Kolmogorov-Smirnov Test Statistic	0.372
Kolmogorov-Smirnov 5% Critical Value	0.174

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.711
95% Adjusted Gamma UCL	0.714

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	0.706
95% Jackknife UCL	0.707
95% Standard Bootstrap UCL	0.704
95% Bootstrap-t UCL	0.712
95% Hall's Bootstrap UCL	0.723
95% Percentile Bootstrap UCL	0.706
95% BCA Bootstrap UCL	0.709
95% Chebyshev(Mean, Sd) UCL	0.778
97.5% Chebyshev(Mean, Sd) UCL	0.829
99% Chebyshev(Mean, Sd) UCL	0.928

Potential UCL to Use

Use 95% Student's-t UCL 0.707
or 95% Modified-t UCL 0.708

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.

Cobalt

General Statistics

Number of Valid Observations 73
Number of Distinct Observations 33

Raw Statistics

Minimum	0.41
Maximum	5.9
Mean	2.118
Median	2
SD	1.034
Std. Error of Mean	0.121
Coefficient of Variation	0.488
Skewness	0.585

Log-transformed Statistics

Minimum of Log Data	-0.892
Maximum of Log Data	1.775
Mean of log Data	0.608
SD of log Data	0.584

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.104
Lilliefors Critical Value	0.104

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.117
Lilliefors Critical Value	0.104

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	2.32

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	2.326
95% Modified-t UCL (Johnson-1978)	2.321

Assuming Lognormal Distribution

95% H-UCL	2.483
95% Chebyshev (MVUE) UCL	2.866
97.5% Chebyshev (MVUE) UCL	3.166
99% Chebyshev (MVUE) UCL	3.755

Gamma Distribution Test

k star (bias corrected)	3.515
Theta Star	0.603
MLE of Mean	2.118
MLE of Standard Deviation	1.13
nu star	513.2
Approximate Chi Square Value (.05)	461.7
Adjusted Level of Significance	0.0467
Adjusted Chi Square Value	460.7
Anderson-Darling Test Statistic	1.118
Anderson-Darling 5% Critical Value	0.757
Kolmogorov-Smirnov Test Statistic	0.107
Kolmogorov-Smirnov 5% Critical Value	0.105

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	2.355
95% Adjusted Gamma UCL	2.36

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	2.317
95% Jackknife UCL	2.32
95% Standard Bootstrap UCL	2.317
95% Bootstrap-t UCL	2.329
95% Hall's Bootstrap UCL	2.331
95% Percentile Bootstrap UCL	2.329
95% BCA Bootstrap UCL	2.329
95% Chebyshev(Mean, Sd) UCL	2.646
97.5% Chebyshev(Mean, Sd) UCL	2.874
99% Chebyshev(Mean, Sd) UCL	3.322

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 2.646

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.

Iron

General Statistics

Number of Valid Observations 73 | Number of Distinct Observations 70

Raw Statistics		**Log-transformed Statistics**	
Minimum	2000	Minimum of Log Data	7.601
Maximum	36800	Maximum of Log Data	10.51
Mean	10363	Mean of log Data	9.025
Median	8390	SD of log Data	0.679
SD	7204		
Std. Error of Mean	843.2		
Coefficient of Variation	0.695		
Skewness	1.44		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.139	Lilliefors Test Statistic	0.0519
Lilliefors Critical Value	0.104	Lilliefors Critical Value	0.104
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	11768	95% H-UCL	12246
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	14370
95% Adjusted-CLT UCL (Chen-1995)	11902	97.5% Chebyshev (MVUE) UCL	16080
95% Modified-t UCL (Johnson-1978)	11792	99% Chebyshev (MVUE) UCL	19439

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.322	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	4463	
MLE of Mean	10363	
MLE of Standard Deviation	6801	
nu star	339	
Approximate Chi Square Value (.05)	297.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.0467	95% CLT UCL 11750
Adjusted Chi Square Value	296.6	95% Jackknife UCL 11768
		95% Standard Bootstrap UCL 11725
Anderson-Darling Test Statistic	0.456	95% Bootstrap-t UCL 11957
Anderson-Darling 5% Critical Value	0.761	95% Hall's Bootstrap UCL 12002
Kolmogorov-Smirnov Test Statistic	0.0607	95% Percentile Bootstrap UCL 11726
Kolmogorov-Smirnov 5% Critical Value	0.106	95% BCA Bootstrap UCL 11901
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 14038
		97.5% Chebyshev(Mean, Sd) UCL 15629
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 18753
95% Approximate Gamma UCL	11815	
95% Adjusted Gamma UCL	11846	

Potential UCL to Use	Use 95% Approximate Gamma UCL 11815

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 C-13
ProUCL Output - Area 1 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations 73
Number of Distinct Observations 69

Raw Statistics

Minimum	12.6
Maximum	219
Mean	49.46
Median	38
SD	36.68
Std. Error of Mean	4.293
Coefficient of Variation	0.742
Skewness	2.385

Log-transformed Statistics

Minimum of Log Data	2.534
Maximum of Log Data	5.389
Mean of log Data	3.703
SD of log Data	0.61

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.181
Lilliefors Critical Value	0.104

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.0625
Lilliefors Critical Value	0.104

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	56.62

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	57.8
95% Modified-t UCL (Johnson-1978)	56.82

Assuming Lognormal Distribution

95% H-UCL	56.13
95% Chebyshev (MVUE) UCL	65.08
97.5% Chebyshev (MVUE) UCL	72.15
99% Chebyshev (MVUE) UCL	86.04

Gamma Distribution Test

k star (bias corrected)	2.582
Theta Star	19.15
MLE of Mean	49.46
MLE of Standard Deviation	30.78
nu star	377
Approximate Chi Square Value (.05)	333
Adjusted Level of Significance	0.0467
Adjusted Chi Square Value	332.2
Anderson-Darling Test Statistic	1.107
Anderson-Darling 5% Critical Value	0.76
Kolmogorov-Smirnov Test Statistic	0.109
Kolmogorov-Smirnov 5% Critical Value	0.105

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	56
95% Adjusted Gamma UCL	56.14

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	56.52
95% Jackknife UCL	56.62
95% Standard Bootstrap UCL	56.42
95% Bootstrap-t UCL	58.56
95% Hall's Bootstrap UCL	58.72
95% Percentile Bootstrap UCL	56.59
95% BCA Bootstrap UCL	58.13
95% Chebyshev(Mean, Sd) UCL	68.17
97.5% Chebyshev(Mean, Sd) UCL	76.27
99% Chebyshev(Mean, Sd) UCL	92.18

Potential UCL to Use

Use 95% H-UCL 56.13

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.

Vanadium

General Statistics

Number of Valid Observations 73
Number of Distinct Observations 60

Raw Statistics

Minimum	4.2
Maximum	66.3
Mean	18.95
Median	18.6
SD	12.15
Std. Error of Mean	1.422
Coefficient of Variation	0.641
Skewness	1.826

Log-transformed Statistics

Minimum of Log Data	1.435
Maximum of Log Data	4.194
Mean of log Data	2.76
SD of log Data	0.618

Relevant UCL Statistics

Normal Distribution Test

Lilliefors Test Statistic	0.154
Lilliefors Critical Value	0.104

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Lilliefors Test Statistic	0.114
Lilliefors Critical Value	0.104

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	21.32

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	21.62
95% Modified-t UCL (Johnson-1978)	21.37

Assuming Lognormal Distribution

95% H-UCL	22.02
95% Chebyshev (MVUE) UCL	25.57
97.5% Chebyshev (MVUE) UCL	28.38
99% Chebyshev (MVUE) UCL	33.9

Gamma Distribution Test

k star (bias corrected)	2.794
Theta Star	6.783
MLE of Mean	18.95
MLE of Standard Deviation	11.34
nu star	408
Approximate Chi Square Value (.05)	362.2
Adjusted Level of Significance	0.0467
Adjusted Chi Square Value	361.3
Anderson-Darling Test Statistic	0.645
Anderson-Darling 5% Critical Value	0.758
Kolmogorov-Smirnov Test Statistic	0.0774
Kolmogorov-Smirnov 5% Critical Value	0.105

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	21.35
95% Adjusted Gamma UCL	21.4

Nonparametric Statistics

95% CLT UCL	21.29
95% Jackknife UCL	21.32
95% Standard Bootstrap UCL	21.29
95% Bootstrap-t UCL	21.68
95% Hall's Bootstrap UCL	22
95% Percentile Bootstrap UCL	21.41
95% BCA Bootstrap UCL	21.62
95% Chebyshev(Mean, Sd) UCL	25.15
97.5% Chebyshev(Mean, Sd) UCL	27.83
99% Chebyshev(Mean, Sd) UCL	33.1

Potential UCL to Use

Use 95% Approximate Gamma UCL 21.35

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 C-14
ProUCL Output - Areas 5, 6, and Beach Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Area5_6_9_Sed
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Number of Valid Observations 27
Number of Distinct Observations 15

Raw Statistics

Minimum	0.5
Maximum	10.9
Mean	1.864
Median	0.65
SD	2.251
Std. Error of Mean	0.433
Coefficient of Variation	1.208
Skewness	2.708

Log-transformed Statistics

Minimum of Log Data	-0.693
Maximum of Log Data	2.389
Mean of log Data	0.148
SD of log Data	0.915

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.61
Shapiro Wilk Critical Value	0.923

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.731
Shapiro Wilk Critical Value	0.923

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	2.603

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	2.818
95% Modified-t UCL (Johnson-1978)	2.641

Assuming Lognormal Distribution

95% H-UCL	2.719
95% Chebyshev (MVUE) UCL	3.216
97.5% Chebyshev (MVUE) UCL	3.86
99% Chebyshev (MVUE) UCL	5.126

Gamma Distribution Test

k star (bias corrected)	1.085
Theta Star	1.719
MLE of Mean	1.864
MLE of Standard Deviation	1.79
nu star	58.57
Approximate Chi Square Value (.05)	41.98
Adjusted Level of Significance	0.0401
Adjusted Chi Square Value	41.08
Anderson-Darling Test Statistic	3.635
Anderson-Darling 5% Critical Value	0.769
Kolmogorov-Smirnov Test Statistic	0.372
Kolmogorov-Smirnov 5% Critical Value	0.172

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	2.601
95% Adjusted Gamma UCL	2.658

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	2.577
95% Jackknife UCL	2.603
95% Standard Bootstrap UCL	2.549
95% Bootstrap-t UCL	3.082
95% Hall's Bootstrap UCL	5.304
95% Percentile Bootstrap UCL	2.63
95% BCA Bootstrap UCL	2.884
95% Chebyshev(Mean, Sd) UCL	3.753
97.5% Chebyshev(Mean, Sd) UCL	4.57
99% Chebyshev(Mean, Sd) UCL	6.175

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 3.753

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 C-14
ProUCL Output - Areas 5, 6, and Beach Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations 27 | Number of Distinct Observations 22

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.66	Minimum of Log Data	-0.416
Maximum	12.3	Maximum of Log Data	2.51
Mean	4.209	Mean of log Data	1.082
Median	2.8	SD of log Data	0.898
SD	3.371		
Std. Error of Mean	0.649		
Coefficient of Variation	0.801		
Skewness	0.816		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.873	Shapiro Wilk Test Statistic	0.925
Shapiro Wilk Critical Value	0.923	Shapiro Wilk Critical Value	0.923
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5.315	95% H-UCL	6.725
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	7.974
95% Adjusted-CLT UCL (Chen-1995)	5.385	97.5% Chebyshev (MVUE) UCL	9.552
95% Modified-t UCL (Johnson-1978)	5.332	99% Chebyshev (MVUE) UCL	12.65

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.404	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	2.997	
MLE of Mean	4.209	
MLE of Standard Deviation	3.551	
nu star	75.84	
Approximate Chi Square Value (.05)	56.78	**Nonparametric Statistics**
Adjusted Level of Significance	0.0401	95% CLT UCL 5.276
Adjusted Chi Square Value	55.73	95% Jackknife UCL 5.315
		95% Standard Bootstrap UCL 5.274
Anderson-Darling Test Statistic	0.815	95% Bootstrap-t UCL 5.474
Anderson-Darling 5% Critical Value	0.762	95% Hall's Bootstrap UCL 5.306
Kolmogorov-Smirnov Test Statistic	0.167	95% Percentile Bootstrap UCL 5.292
Kolmogorov-Smirnov 5% Critical Value	0.171	95% BCA Bootstrap UCL 5.348
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 7.037
		97.5% Chebyshev(Mean, Sd) UCL 8.26
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 10.66
95% Approximate Gamma UCL	5.621	
95% Adjusted Gamma UCL	5.727	

Potential UCL to Use	Use 95% Approximate Gamma UCL 5.621

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 C-14
ProUCL Output - Areas 5, 6, and Beach Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations	27	Number of Distinct Observations	23

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.029	Minimum of Log Data	-3.54
Maximum	3.4	Maximum of Log Data	1.224
Mean	1.206	Mean of log Data	-0.212
Median	0.71	SD of log Data	1.039
SD	1.008		
Std. Error of Mean	0.194		
Coefficient of Variation	0.836		
Skewness	1.009		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.832	Shapiro Wilk Test Statistic	0.903
Shapiro Wilk Critical Value	0.923	Shapiro Wilk Critical Value	0.923
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.536	95% H-UCL	2.345
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.701
95% Adjusted-CLT UCL (Chen-1995)	1.565	97.5% Chebyshev (MVUE) UCL	3.286
95% Modified-t UCL (Johnson-1978)	1.543	99% Chebyshev (MVUE) UCL	4.435

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.267	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	0.951	
MLE of Mean	1.206	
MLE of Standard Deviation	1.071	
nu star	68.43	
Approximate Chi Square Value (.05)	50.39	**Nonparametric Statistics**
Adjusted Level of Significance	0.0401	95% CLT UCL 1.525
Adjusted Chi Square Value	49.4	95% Jackknife UCL 1.536
		95% Standard Bootstrap UCL 1.509
Anderson-Darling Test Statistic	0.685	95% Bootstrap-t UCL 1.58
Anderson-Darling 5% Critical Value	0.765	95% Hall's Bootstrap UCL 1.561
Kolmogorov-Smirnov Test Statistic	0.132	95% Percentile Bootstrap UCL 1.525
Kolmogorov-Smirnov 5% Critical Value	0.172	95% BCA Bootstrap UCL 1.574
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2.051
		97.5% Chebyshev(Mean, Sd) UCL 2.417
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3.135
95% Approximate Gamma UCL	1.637	
95% Adjusted Gamma UCL	1.67	

Potential UCL to Use	Use 95% Approximate Gamma UCL 1.637

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 C-14
ProUCL Output - Areas 5, 6, and Beach Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations 21
Number of Distinct Observations 21

Raw Statistics

Minimum	1940
Maximum	27900
Mean	9710
Median	5100
SD	8471
Std. Error of Mean	1849
Coefficient of Variation	0.872
Skewness	1.125

Log-transformed Statistics

Minimum of Log Data	7.57
Maximum of Log Data	10.24
Mean of log Data	8.827
SD of log Data	0.861

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.807
Shapiro Wilk Critical Value	0.908

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.92
Shapiro Wilk Critical Value	0.908

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	12898

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	13235
95% Modified-t UCL (Johnson-1978)	12974

Assuming Lognormal Distribution

95% H-UCL	15628
95% Chebyshev (MVUE) UCL	18330
97.5% Chebyshev (MVUE) UCL	22085
99% Chebyshev (MVUE) UCL	29462

Gamma Distribution Test

k star (bias corrected)	1.368
Theta Star	7096
MLE of Mean	9710
MLE of Standard Deviation	8301
nu star	57.47
Approximate Chi Square Value (.05)	41.04
Adjusted Level of Significance	0.0383
Adjusted Chi Square Value	39.98
Anderson-Darling Test Statistic	0.863
Anderson-Darling 5% Critical Value	0.758
Kolmogorov-Smirnov Test Statistic	0.196
Kolmogorov-Smirnov 5% Critical Value	0.193

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	13596
95% Adjusted Gamma UCL	13959

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	12751
95% Jackknife UCL	12898
95% Standard Bootstrap UCL	12553
95% Bootstrap-t UCL	13507
95% Hall's Bootstrap UCL	13037
95% Percentile Bootstrap UCL	12831
95% BCA Bootstrap UCL	13006
95% Chebyshev(Mean, Sd) UCL	17768
97.5% Chebyshev(Mean, Sd) UCL	21254
99% Chebyshev(Mean, Sd) UCL	28103

Potential UCL to Use

Use 95% H-UCL 15628

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 C-14
ProUCL Output - Areas 5, 6, and Beach Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	27	Number of Distinct Observations	24

Raw Statistics		**Log-transformed Statistics**	
Minimum	4	Minimum of Log Data	1.386
Maximum	45	Maximum of Log Data	3.807
Mean	13.76	Mean of log Data	2.397
Median	10	SD of log Data	0.667
SD	10.21		
Std. Error of Mean	1.966		
Coefficient of Variation	0.742		
Skewness	1.569		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.825	Shapiro Wilk Test Statistic	0.953
Shapiro Wilk Critical Value	0.923	Shapiro Wilk Critical Value	0.923
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	17.12	95% H-UCL	18.14
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	21.76
95% Adjusted-CLT UCL (Chen-1995)	17.63	97.5% Chebyshev (MVUE) UCL	25.29
95% Modified-t UCL (Johnson-1978)	17.21	99% Chebyshev (MVUE) UCL	32.23

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.138	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	6.436	
MLE of Mean	13.76	
MLE of Standard Deviation	9.412	
nu star	115.5	
Approximate Chi Square Value (.05)	91.66	**Nonparametric Statistics**
Adjusted Level of Significance	0.0401	95% CLT UCL 17
Adjusted Chi Square Value	90.3	95% Jackknife UCL 17.12
		95% Standard Bootstrap UCL 16.87
Anderson-Darling Test Statistic	0.691	95% Bootstrap-t UCL 18.32
Anderson-Darling 5% Critical Value	0.755	95% Hall's Bootstrap UCL 17.86
Kolmogorov-Smirnov Test Statistic	0.167	95% Percentile Bootstrap UCL 17.17
Kolmogorov-Smirnov 5% Critical Value	0.17	95% BCA Bootstrap UCL 17.36
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 22.33
		97.5% Chebyshev(Mean, Sd) UCL 26.04
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 33.32
95% Approximate Gamma UCL	17.34	
95% Adjusted Gamma UCL	17.6	

Potential UCL to Use	Use 95% Approximate Gamma UCL 17.34

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Wetland_Sed
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	32

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.35	Minimum of Log Data	1.209
Maximum	550	Maximum of Log Data	6.31
Mean	82.05	Mean of log Data	3.589
Median	32	SD of log Data	1.293
SD	126.7		
Std. Error of Mean	20.55		
Coefficient of Variation	1.544		
Skewness	2.649		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.61	Shapiro Wilk Test Statistic	0.973
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	116.7	95% H-UCL	149.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	171.4
95% Adjusted-CLT UCL (Chen-1995)	125.3	97.5% Chebyshev (MVUE) UCL	210.8
95% Modified-t UCL (Johnson-1978)	118.2	99% Chebyshev (MVUE) UCL	288.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.693	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	118.4	
MLE of Mean	82.05	
MLE of Standard Deviation	98.55	
nu star	52.67	
Approximate Chi Square Value (.05)	37	**Nonparametric Statistics**
Adjusted Level of Significance	0.0434	95% CLT UCL 115.8
Adjusted Chi Square Value	36.46	95% Jackknife UCL 116.7
		95% Standard Bootstrap UCL 115.4
Anderson-Darling Test Statistic	1.232	95% Bootstrap-t UCL 137.7
Anderson-Darling 5% Critical Value	0.79	95% Hall's Bootstrap UCL 131.6
Kolmogorov-Smirnov Test Statistic	0.143	95% Percentile Bootstrap UCL 118.7
Kolmogorov-Smirnov 5% Critical Value	0.149	95% BCA Bootstrap UCL 127.1
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 171.6
		97.5% Chebyshev(Mean, Sd) UCL 210.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 286.5
95% Approximate Gamma UCL	116.8	
95% Adjusted Gamma UCL	118.5	

Potential UCL to Use	Use 95% Approximate Gamma UCL 116.8

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(a)pyrene

General Statistics

Number of Valid Observations 38
Number of Distinct Observations 32

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.35	Minimum of Log Data	1.209
Maximum	570	Maximum of Log Data	6.346
Mean	73.96	Mean of log Data	3.479
Median	34	SD of log Data	1.329
SD	111.6		
Std. Error of Mean	18.1		
Coefficient of Variation	1.508		
Skewness	3.052		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.634	Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	104.5	95% H-UCL	144.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	163.8
95% Adjusted-CLT UCL (Chen-1995)	113.3	97.5% Chebyshev (MVUE) UCL	202.1
95% Modified-t UCL (Johnson-1978)	106	99% Chebyshev (MVUE) UCL	277.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.689	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	107.3	
MLE of Mean	73.96	
MLE of Standard Deviation	89.1	
nu star	52.37	
Approximate Chi Square Value (.05)	36.74	**Nonparametric Statistics**
Adjusted Level of Significance	0.0434	95% CLT UCL 103.7
Adjusted Chi Square Value	36.2	95% Jackknife UCL 104.5
		95% Standard Bootstrap UCL 104.6
Anderson-Darling Test Statistic	0.845	95% Bootstrap-t UCL 125.1
Anderson-Darling 5% Critical Value	0.791	95% Hall's Bootstrap UCL 243.6
Kolmogorov-Smirnov Test Statistic	0.139	95% Percentile Bootstrap UCL 106.1
Kolmogorov-Smirnov 5% Critical Value	0.149	95% BCA Bootstrap UCL 114.4
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 152.8
		97.5% Chebyshev(Mean, Sd) UCL 187
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 254
95% Approximate Gamma UCL	105.4	
95% Adjusted Gamma UCL	107	

Potential UCL to Use	Use 95% Approximate Gamma UCL 105.4

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Benzo(b)fluoranthene

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	31

Raw Statistics		**Log-transformed Statistics**	
Minimum	95	Minimum of Log Data	4.554
Maximum	1000	Maximum of Log Data	6.908
Mean	242.5	Mean of log Data	5.329
Median	182.5	SD of log Data	0.539
SD	169.7		
Std. Error of Mean	27.52		
Coefficient of Variation	0.7		
Skewness	2.7		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.736	Shapiro Wilk Test Statistic	0.941
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	288.9	95% H-UCL	283.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	333.2
95% Adjusted-CLT UCL (Chen-1995)	300.7	97.5% Chebyshev (MVUE) UCL	374.5
95% Modified-t UCL (Johnson-1978)	290.9	99% Chebyshev (MVUE) UCL	455.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	3.012	**Data appear Lognormal at 5% Significance Level**
Theta Star	80.52	
MLE of Mean	242.5	
MLE of Standard Deviation	139.7	
nu star	228.9	
Approximate Chi Square Value (.05)	194.9	**Nonparametric Statistics**
Adjusted Level of Significance	0.0434	95% CLT UCL 287.8
Adjusted Chi Square Value	193.6	95% Jackknife UCL 288.9
		95% Standard Bootstrap UCL 286.7
Anderson-Darling Test Statistic	1.127	95% Bootstrap-t UCL 309.1
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL 341.2
Kolmogorov-Smirnov Test Statistic	0.159	95% Percentile Bootstrap UCL 291.7
Kolmogorov-Smirnov 5% Critical Value	0.144	95% BCA Bootstrap UCL 306.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 362.5
		97.5% Chebyshev(Mean, Sd) UCL 414.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 516.4
95% Approximate Gamma UCL	284.8	
95% Adjusted Gamma UCL	286.7	

Potential UCL to Use	Use 95% H-UCL 283.6

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	37

Raw Statistics		**Log-transformed Statistics**	
Minimum	1.9	Minimum of Log Data	0.642
Maximum	76	Maximum of Log Data	4.331
Mean	13.44	Mean of log Data	2.016
Median	6.45	SD of log Data	1.035
SD	17.59		
Std. Error of Mean	2.854		
Coefficient of Variation	1.309		
Skewness	2.432		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.659	Shapiro Wilk Test Statistic	0.924
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	18.26	95% H-UCL	19.41
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.33
95% Adjusted-CLT UCL (Chen-1995)	19.34	97.5% Chebyshev (MVUE) UCL	27.99
95% Modified-t UCL (Johnson-1978)	18.44	99% Chebyshev (MVUE) UCL	37.15

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.932	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	14.43	
MLE of Mean	13.44	
MLE of Standard Deviation	13.92	
nu star	70.81	
Approximate Chi Square Value (.05)	52.44	**Nonparametric Statistics**
Adjusted Level of Significance	0.0434	95% CLT UCL 18.13
Adjusted Chi Square Value	51.78	95% Jackknife UCL 18.26
		95% Standard Bootstrap UCL 18.11
Anderson-Darling Test Statistic	1.719	95% Bootstrap-t UCL 20.59
Anderson-Darling 5% Critical Value	0.778	95% Hall's Bootstrap UCL 21.53
Kolmogorov-Smirnov Test Statistic	0.185	95% Percentile Bootstrap UCL 18.5
Kolmogorov-Smirnov 5% Critical Value	0.147	95% BCA Bootstrap UCL 19.21
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 25.88
		97.5% Chebyshev(Mean, Sd) UCL 31.26
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 41.83
95% Approximate Gamma UCL	18.15	
95% Adjusted Gamma UCL	18.38	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 25.88

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.

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	31

Raw Statistics		**Log-transformed Statistics**	
Minimum	68	Minimum of Log Data	4.22
Maximum	500	Maximum of Log Data	6.215
Mean	211.4	Mean of log Data	5.237
Median	182.5	SD of log Data	0.49
SD	106.8		
Std. Error of Mean	17.32		
Coefficient of Variation	0.505		
Skewness	1.051		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.906	Shapiro Wilk Test Statistic	0.982
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	240.6	95% H-UCL	247.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	287.9
95% Adjusted-CLT UCL (Chen-1995)	243.1	97.5% Chebyshev (MVUE) UCL	321
95% Modified-t UCL (Johnson-1978)	241.1	99% Chebyshev (MVUE) UCL	386.1

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	4.106	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	51.49	
MLE of Mean	211.4	
MLE of Standard Deviation	104.3	
nu star	312.1	
Approximate Chi Square Value (.05)	272.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.0434	95% CLT UCL 239.9
Adjusted Chi Square Value	270.6	95% Jackknife UCL 240.6
		95% Standard Bootstrap UCL 239.6
Anderson-Darling Test Statistic	0.335	95% Bootstrap-t UCL 245.4
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL 244.7
Kolmogorov-Smirnov Test Statistic	0.0872	95% Percentile Bootstrap UCL 240
Kolmogorov-Smirnov 5% Critical Value	0.144	95% BCA Bootstrap UCL 242.4
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 286.9
		97.5% Chebyshev(Mean, Sd) UCL 319.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 383.7
95% Approximate Gamma UCL	242.4	
95% Adjusted Gamma UCL	243.8	

Potential UCL to Use	Use 95% Approximate Gamma UCL 242.4

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.

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ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Aluminum

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	936	Minimum of Log Data	6.842
Maximum	20900	Maximum of Log Data	9.948
Mean	7320	Mean of log Data	8.737
Median	7305	SD of log Data	0.645
SD	3759		
Std. Error of Mean	594.4		
Coefficient of Variation	0.514		
Skewness	0.976		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.94	Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data appear Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	8322	95% H-UCL	9470
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	11273
95% Adjusted-CLT UCL (Chen-1995)	8396	97.5% Chebyshev (MVUE) UCL	12852
95% Modified-t UCL (Johnson-1978)	8337	99% Chebyshev (MVUE) UCL	15954

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	3.03	**Data appear Normal at 5% Significance Level**
Theta Star	2416	
MLE of Mean	7320	
MLE of Standard Deviation	4205	
nu star	242.4	
Approximate Chi Square Value (.05)	207.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 8298
Adjusted Chi Square Value	206.2	95% Jackknife UCL 8322
		95% Standard Bootstrap UCL 8278
Anderson-Darling Test Statistic	0.684	95% Bootstrap-t UCL 8445
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL 8566
Kolmogorov-Smirnov Test Statistic	0.112	95% Percentile Bootstrap UCL 8297
Kolmogorov-Smirnov 5% Critical Value	0.14	95% BCA Bootstrap UCL 8361
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 9911
		97.5% Chebyshev(Mean, Sd) UCL 11032
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 13234
95% Approximate Gamma UCL	8557	
95% Adjusted Gamma UCL	8607	

Potential UCL to Use	Use 95% Student's-t UCL 8322

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.

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ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Arsenic

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.7	Minimum of Log Data	1.308
Maximum	88.9	Maximum of Log Data	4.488
Mean	16.58	Mean of log Data	2.579
Median	13.05	SD of log Data	0.65
SD	14.51		
Std. Error of Mean	2.294		
Coefficient of Variation	0.875		
Skewness	3.463		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.674	Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	20.44	95% H-UCL	20.15
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24
95% Adjusted-CLT UCL (Chen-1995)	21.69	97.5% Chebyshev (MVUE) UCL	27.38
95% Modified-t UCL (Johnson-1978)	20.65	99% Chebyshev (MVUE) UCL	34.02

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.178	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	7.612	
MLE of Mean	16.58	
MLE of Standard Deviation	11.23	
nu star	174.2	
Approximate Chi Square Value (.05)	144.7	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 20.35
Adjusted Chi Square Value	143.7	95% Jackknife UCL 20.44
		95% Standard Bootstrap UCL 20.28
Anderson-Darling Test Statistic	0.684	95% Bootstrap-t UCL 23.23
Anderson-Darling 5% Critical Value	0.758	95% Hall's Bootstrap UCL 37.24
Kolmogorov-Smirnov Test Statistic	0.116	95% Percentile Bootstrap UCL 20.8
Kolmogorov-Smirnov 5% Critical Value	0.141	95% BCA Bootstrap UCL 21.55
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 26.57
		97.5% Chebyshev(Mean, Sd) UCL 30.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 39.4
95% Approximate Gamma UCL	19.96	
95% Adjusted Gamma UCL	20.1	

Potential UCL to Use	Use 95% Approximate Gamma UCL 19.96

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Chromium VI

General Statistics

Number of Valid Observations	35	Number of Distinct Observations	23

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	2.1	Maximum of Log Data	0.742
Mean	1.038	Mean of log Data	-0.0457
Median	0.95	SD of log Data	0.416
SD	0.431		
Std. Error of Mean	0.0728		
Coefficient of Variation	0.415		
Skewness	0.714		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.927	Shapiro Wilk Test Statistic	0.949
Shapiro Wilk Critical Value	0.934	Shapiro Wilk Critical Value	0.934
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.161	95% H-UCL	1.191
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.368
95% Adjusted-CLT UCL (Chen-1995)	1.167	97.5% Chebyshev (MVUE) UCL	1.51
95% Modified-t UCL (Johnson-1978)	1.163	99% Chebyshev (MVUE) UCL	1.79

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	5.677	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	0.183	
MLE of Mean	1.038	
MLE of Standard Deviation	0.436	
nu star	397.4	
Approximate Chi Square Value (.05)	352.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.0425	95% CLT UCL 1.158
Adjusted Chi Square Value	350.1	95% Jackknife UCL 1.161
		95% Standard Bootstrap UCL 1.156
Anderson-Darling Test Statistic	0.393	95% Bootstrap-t UCL 1.178
Anderson-Darling 5% Critical Value	0.749	95% Hall's Bootstrap UCL 1.171
Kolmogorov-Smirnov Test Statistic	0.0999	95% Percentile Bootstrap UCL 1.159
Kolmogorov-Smirnov 5% Critical Value	0.149	95% BCA Bootstrap UCL 1.161
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 1.355
		97.5% Chebyshev(Mean, Sd) UCL 1.493
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.762
95% Approximate Gamma UCL	1.171	
95% Adjusted Gamma UCL	1.178	

Potential UCL to Use	Use 95% Approximate Gamma UCL 1.171

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.

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ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Cobalt

General Statistics

Number of Valid Observations 40
Number of Distinct Observations 34

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.15	Minimum of Log Data	-1.897
Maximum	12.7	Maximum of Log Data	2.542
Mean	4.876	Mean of log Data	1.328
Median	4.525	SD of log Data	0.886
SD	2.895		
Std. Error of Mean	0.458		
Coefficient of Variation	0.594		
Skewness	0.723		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.957	Shapiro Wilk Test Statistic	0.846
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data appear Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5.647	95% H-UCL	7.728
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.344
95% Adjusted-CLT UCL (Chen-1995)	5.684	97.5% Chebyshev (MVUE) UCL	11
95% Modified-t UCL (Johnson-1978)	5.655	99% Chebyshev (MVUE) UCL	14.25

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.965	**Data appear Normal at 5% Significance Level**
Theta Star	2.482	
MLE of Mean	4.876	
MLE of Standard Deviation	3.478	
nu star	157.2	
Approximate Chi Square Value (.05)	129.2	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 5.628
Adjusted Chi Square Value	128.2	95% Jackknife UCL 5.647
		95% Standard Bootstrap UCL 5.632
Anderson-Darling Test Statistic	0.593	95% Bootstrap-t UCL 5.727
Anderson-Darling 5% Critical Value	0.759	95% Hall's Bootstrap UCL 5.698
Kolmogorov-Smirnov Test Statistic	0.107	95% Percentile Bootstrap UCL 5.599
Kolmogorov-Smirnov 5% Critical Value	0.141	95% BCA Bootstrap UCL 5.644
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 6.871
		97.5% Chebyshev(Mean, Sd) UCL 7.734
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 9.43
95% Approximate Gamma UCL	5.932	
95% Adjusted Gamma UCL	5.975	

Potential UCL to Use	Use 95% Student's-t UCL 5.647

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.

Copper

General Statistics

Number of Valid Observations 40
Number of Distinct Observations 40

Raw Statistics		**Log-transformed Statistics**	
Minimum	3	Minimum of Log Data	1.099
Maximum	1790	Maximum of Log Data	7.49
Mean	115.4	Mean of log Data	3.799
Median	52.25	SD of log Data	1.182
SD	297.4		
Std. Error of Mean	47.02		
Coefficient of Variation	2.578		
Skewness	5.082		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.349	Shapiro Wilk Test Statistic	0.954
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	194.6	95% H-UCL	147.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	173.8
95% Adjusted-CLT UCL (Chen-1995)	233.1	97.5% Chebyshev (MVUE) UCL	211.3
95% Modified-t UCL (Johnson-1978)	200.9	99% Chebyshev (MVUE) UCL	284.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.613	**Data appear Lognormal at 5% Significance Level**
Theta Star	188.3	
MLE of Mean	115.4	
MLE of Standard Deviation	147.4	
nu star	49.02	
Approximate Chi Square Value (.05)	33.95	
Adjusted Level of Significance	0.044	
Adjusted Chi Square Value	33.48	
Anderson-Darling Test Statistic	3.179	
Anderson-Darling 5% Critical Value	0.799	
Kolmogorov-Smirnov Test Statistic	0.23	
Kolmogorov-Smirnov 5% Critical Value	0.146	
Data not Gamma Distributed at 5% Significance Level		

Nonparametric Statistics	
95% CLT UCL	192.7
95% Jackknife UCL	194.6
95% Standard Bootstrap UCL	190.1
95% Bootstrap-t UCL	539.5
95% Hall's Bootstrap UCL	518.4
95% Percentile Bootstrap UCL	201.5
95% BCA Bootstrap UCL	259.9
95% Chebyshev(Mean, Sd) UCL	320.3
97.5% Chebyshev(Mean, Sd) UCL	409
99% Chebyshev(Mean, Sd) UCL	583.2

Assuming Gamma Distribution	
95% Approximate Gamma UCL	166.6
95% Adjusted Gamma UCL	168.9

Potential UCL to Use Use 95% H-UCL 147.8

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Iron

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	9940	Minimum of Log Data	9.204
Maximum	89700	Maximum of Log Data	11.4
Mean	29226	Mean of log Data	10.15
Median	26350	SD of log Data	0.512
SD	16661		
Std. Error of Mean	2634		
Coefficient of Variation	0.57		
Skewness	1.728		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.853	Shapiro Wilk Test Statistic	0.982
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	33664	95% H-UCL	34175
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	39833
95% Adjusted-CLT UCL (Chen-1995)	34328	97.5% Chebyshev (MVUE) UCL	44491
95% Modified-t UCL (Johnson-1978)	33784	99% Chebyshev (MVUE) UCL	53640

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	3.651	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	8005	
MLE of Mean	29226	
MLE of Standard Deviation	15296	
nu star	292.1	
Approximate Chi Square Value (.05)	253.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 33559
Adjusted Chi Square Value	252.1	95% Jackknife UCL 33664
		95% Standard Bootstrap UCL 33519
Anderson-Darling Test Statistic	0.401	95% Bootstrap-t UCL 34864
Anderson-Darling 5% Critical Value	0.753	95% Hall's Bootstrap UCL 35488
Kolmogorov-Smirnov Test Statistic	0.0898	95% Percentile Bootstrap UCL 33563
Kolmogorov-Smirnov 5% Critical Value	0.14	95% BCA Bootstrap UCL 34603
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 40709
		97.5% Chebyshev(Mean, Sd) UCL 45677
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 55437
95% Approximate Gamma UCL	33675	
95% Adjusted Gamma UCL	33854	

Potential UCL to Use	Use 95% Approximate Gamma UCL 33675

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.9	Minimum of Log Data	1.065
Maximum	564	Maximum of Log Data	6.335
Mean	117.3	Mean of log Data	4.271
Median	81.85	SD of log Data	1.097
SD	117.7		
Std. Error of Mean	18.61		
Coefficient of Variation	1.004		
Skewness	1.897		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.81	Shapiro Wilk Test Statistic	0.973
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	148.6	95% H-UCL	203.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	242.8
95% Adjusted-CLT UCL (Chen-1995)	153.8	97.5% Chebyshev (MVUE) UCL	292.6
95% Modified-t UCL (Johnson-1978)	149.6	99% Chebyshev (MVUE) UCL	390.4

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.081	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	108.5	
MLE of Mean	117.3	
MLE of Standard Deviation	112.8	
nu star	86.46	
Approximate Chi Square Value (.05)	66.03	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 147.9
Adjusted Chi Square Value	65.36	95% Jackknife UCL 148.6
		95% Standard Bootstrap UCL 147.8
Anderson-Darling Test Statistic	0.299	95% Bootstrap-t UCL 157.7
Anderson-Darling 5% Critical Value	0.775	95% Hall's Bootstrap UCL 157.4
Kolmogorov-Smirnov Test Statistic	0.0831	95% Percentile Bootstrap UCL 149.8
Kolmogorov-Smirnov 5% Critical Value	0.143	95% BCA Bootstrap UCL 151.7
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 198.4
		97.5% Chebyshev(Mean, Sd) UCL 233.5
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 302.5
95% Approximate Gamma UCL	153.6	
95% Adjusted Gamma UCL	155.1	

Potential UCL to Use	Use 95% Approximate Gamma UCL 153.6

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Manganese

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	16.9	Minimum of Log Data	2.827
Maximum	218	Maximum of Log Data	5.384
Mean	80.45	Mean of log Data	4.191
Median	72.5	SD of log Data	0.66
SD	49.91		
Std. Error of Mean	7.891		
Coefficient of Variation	0.62		
Skewness	1.041		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.911	Shapiro Wilk Test Statistic	0.968
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	93.74	95% H-UCL	102.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	121.8
95% Adjusted-CLT UCL (Chen-1995)	94.81	97.5% Chebyshev (MVUE) UCL	139.2
95% Modified-t UCL (Johnson-1978)	93.96	99% Chebyshev (MVUE) UCL	173.3

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.516	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	31.97	
MLE of Mean	80.45	
MLE of Standard Deviation	50.71	
nu star	201.3	
Approximate Chi Square Value (.05)	169.5	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 93.42
Adjusted Chi Square Value	168.4	95% Jackknife UCL 93.74
		95% Standard Bootstrap UCL 93.82
Anderson-Darling Test Statistic	0.193	95% Bootstrap-t UCL 95.78
Anderson-Darling 5% Critical Value	0.756	95% Hall's Bootstrap UCL 95.54
Kolmogorov-Smirnov Test Statistic	0.0629	95% Percentile Bootstrap UCL 93.4
Kolmogorov-Smirnov 5% Critical Value	0.141	95% BCA Bootstrap UCL 94.87
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 114.8
		97.5% Chebyshev(Mean, Sd) UCL 129.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 159
95% Approximate Gamma UCL	95.55	
95% Adjusted Gamma UCL	96.17	

Potential UCL to Use	Use 95% Approximate Gamma UCL 95.55

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Mercury

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	33

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.018	Minimum of Log Data	-4.017
Maximum	2.6	Maximum of Log Data	0.956
Mean	0.26	Mean of log Data	-1.867
Median	0.15	SD of log Data	0.975
SD	0.418		
Std. Error of Mean	0.0679		
Coefficient of Variation	1.608		
Skewness	4.988		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.464	Shapiro Wilk Test Statistic	0.984
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.375	95% H-UCL	0.363
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.439
95% Adjusted-CLT UCL (Chen-1995)	0.431	97.5% Chebyshev (MVUE) UCL	0.523
95% Modified-t UCL (Johnson-1978)	0.384	99% Chebyshev (MVUE) UCL	0.688

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.028	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	0.253	
MLE of Mean	0.26	
MLE of Standard Deviation	0.257	
nu star	78.16	
Approximate Chi Square Value (.05)	58.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0434	95% CLT UCL 0.372
Adjusted Chi Square Value	58.1	95% Jackknife UCL 0.375
		95% Standard Bootstrap UCL 0.374
Anderson-Darling Test Statistic	0.945	95% Bootstrap-t UCL 0.571
Anderson-Darling 5% Critical Value	0.775	95% Hall's Bootstrap UCL 0.819
Kolmogorov-Smirnov Test Statistic	0.119	95% Percentile Bootstrap UCL 0.381
Kolmogorov-Smirnov 5% Critical Value	0.147	95% BCA Bootstrap UCL 0.459
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.556
		97.5% Chebyshev(Mean, Sd) UCL 0.684
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 0.936
95% Approximate Gamma UCL	0.346	
95% Adjusted Gamma UCL	0.35	

Potential UCL to Use	Use 95% Approximate Gamma UCL 0.346

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 C-15
ProUCL Output - Wetland Area of Area 9 Sediment
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Vanadium

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	10.5	Minimum of Log Data	2.351
Maximum	106	Maximum of Log Data	4.663
Mean	44.09	Mean of log Data	3.687
Median	39.6	SD of log Data	0.463
SD	20.32		
Std. Error of Mean	3.212		
Coefficient of Variation	0.461		
Skewness	1.315		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.901	Shapiro Wilk Test Statistic	0.97
Shapiro Wilk Critical Value	0.94	Shapiro Wilk Critical Value	0.94
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	49.5	95% H-UCL	51.13
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	59.03
95% Adjusted-CLT UCL (Chen-1995)	50.09	97.5% Chebyshev (MVUE) UCL	65.41
95% Modified-t UCL (Johnson-1978)	49.61	99% Chebyshev (MVUE) UCL	77.93

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	4.807	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	9.172	
MLE of Mean	44.09	
MLE of Standard Deviation	20.11	
nu star	384.6	
Approximate Chi Square Value (.05)	340.1	**Nonparametric Statistics**
Adjusted Level of Significance	0.044	95% CLT UCL 49.37
Adjusted Chi Square Value	338.5	95% Jackknife UCL 49.5
		95% Standard Bootstrap UCL 49.26
Anderson-Darling Test Statistic	0.419	95% Bootstrap-t UCL 50.49
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL 50.95
Kolmogorov-Smirnov Test Statistic	0.0994	95% Percentile Bootstrap UCL 49.51
Kolmogorov-Smirnov 5% Critical Value	0.14	95% BCA Bootstrap UCL 50.36
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 58.09
		97.5% Chebyshev(Mean, Sd) UCL 64.15
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 76.05
95% Approximate Gamma UCL	49.85	
95% Adjusted Gamma UCL	50.08	

Potential UCL to Use	Use 95% Approximate Gamma UCL 49.85

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 C-16
ProUCL Output - Ribbed Mussel
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

General UCL Statistics for Full Data Sets

User Selected Options

From File	Tissue.wst
Full Precision	OFF
Confidence Coefficient	95%
umber of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	7

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.049	Minimum of Log Data	-3.016
Maximum	0.89	Maximum of Log Data	-0.117
Mean	0.466	Mean of log Data	-1.388
Median	0.665	SD of log Data	1.404
SD	0.365		
Std. Error of Mean	0.115		
Coefficient of Variation	0.784		
Skewness	-0.357		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.767	Shapiro Wilk Test Statistic	0.687
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.677	95% H-UCL	4.317
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.737
95% Adjusted-CLT UCL (Chen-1995)	0.641	97.5% Chebyshev (MVUE) UCL	2.242
95% Modified-t UCL (Johnson-1978)	0.675	99% Chebyshev (MVUE) UCL	3.233

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	0.72	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	0.647	
MLE of Mean	0.466	
MLE of Standard Deviation	0.549	
nu star	14.4	
Approximate Chi Square Value (.05)	6.847	**Nonparametric Statistics**
Adjusted Level of Significance	0.0267	95% CLT UCL 0.655
Adjusted Chi Square Value	5.965	95% Jackknife UCL 0.677
		95% Standard Bootstrap UCL 0.646
Anderson-Darling Test Statistic	1.524	95% Bootstrap-t UCL 0.669
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL 0.616
Kolmogorov-Smirnov Test Statistic	0.357	95% Percentile Bootstrap UCL 0.643
Kolmogorov-Smirnov 5% Critical Value	0.274	95% BCA Bootstrap UCL 0.637
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.968
		97.5% Chebyshev(Mean, Sd) UCL 1.186
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.613
95% Approximate Gamma UCL	0.979	
95% Adjusted Gamma UCL	1.124	

Potential UCL to Use	Use 95% Chebyshev (Mean, Sd) UCL 0.968

Recommended UCL exceeds the maximum observation

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 positvely skewed data sets.

Appendix C-16
ProUCL Output - Ribbed Mussel
Raritan Bay Slag Site
Old Bridge/Sayreville, New Jersey

Lead

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.14	Minimum of Log Data	-1.966
Maximum	0.81	Maximum of Log Data	-0.211
Mean	0.361	Mean of log Data	-1.176
Median	0.3	SD of log Data	0.591
SD	0.217		
Std. Error of Mean	0.0686		
Coefficient of Variation	0.601		
Skewness	1.047		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Test Statistic	0.962
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
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	0.487	95% H-UCL	0.584
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.661
95% Adjusted-CLT UCL (Chen-1995)	0.498	97.5% Chebyshev (MVUE) UCL	0.791
95% Modified-t UCL (Johnson-1978)	0.491	99% Chebyshev (MVUE) UCL	1.047

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.402	**Data appear Normal at 5% Significance Level**
Theta Star	0.15	
MLE of Mean	0.361	
MLE of Standard Deviation	0.233	
nu star	48.04	
Approximate Chi Square Value (.05)	33.13	**Nonparametric Statistics**
Adjusted Level of Significance	0.0267	95% CLT UCL 0.474
Adjusted Chi Square Value	31	95% Jackknife UCL 0.487
		95% Standard Bootstrap UCL 0.467
Anderson-Darling Test Statistic	0.233	95% Bootstrap-t UCL 0.546
Anderson-Darling 5% Critical Value	0.731	95% Hall's Bootstrap UCL 0.55
Kolmogorov-Smirnov Test Statistic	0.148	95% Percentile Bootstrap UCL 0.475
Kolmogorov-Smirnov 5% Critical Value	0.268	95% BCA Bootstrap UCL 0.499
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 0.66
		97.5% Chebyshev(Mean, Sd) UCL 0.789
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 1.044
95% Approximate Gamma UCL	0.523	
95% Adjusted Gamma UCL	0.56	

Potential UCL to Use		Use 95% Student's-t UCL	0.487

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 D
Lead and Arsenic Bioavailability and Speciation Study

US Army Corps of Engineers
Kansas City District

Lead and Arsenic Bioavailability and Speciation Study

Remedial Investigation/ Feasibility Study
Raritan Bay Slag Superfund Site
Old Bridge/ Sayreville, New Jersey

USACE Contract No. W912DQ-08-D-0018
Task Order No. 018

June 2011

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Attachment B Electron Microprobe Analysis Results for Lead and Arsenic in Soils

Acronyms and Abbreviations

ABA	absolute bioavailability
BEI	backscatter electron image
CDM	CDM Federal Programs Corporation
CR	cancer risk
CSF	cancer slope factor
DI	daily intake
EDS	energy dispersive spectrophotometer
EMPA	electron microprobe analysis
HQ	hazard quotient
IVBA	*in vitro* bioavailability
Q-Q	quantile-quantile
RBA	relative bioavailability
RI/FS	Remedial Investigation/Feasibility Study
RfD	reference dose
USACE	United States Army Corps of Engineers
WDS	wavelength dispersive spectrophotometer

Section 1
Introduction

Under the United States Army Corps of Engineers (USACE), Kansas City District Contract No. W912DQ-08-D-0018, Task Order No. 018, CDM Federal Programs Corporation (CDM) has been tasked to provide technical services to complete a Remedial Investigation/Feasibility Study (RI/FS) for the Raritan Bay Slag Superfund Site (the site) located in Old Bridge and Sayreville, New Jersey.

Lead and arsenic have been identified as chemicals of potential concern at the site. When human receptors are exposed to soil or sediment contaminated with lead and arsenic, they may be absorbed into the blood stream by ingestion and inhalation. Ingestion exposure pathway accounts for most of the lead and arsenic taken up into the blood. It is well known that the physical and chemical characteristics of lead and arsenic affect their uptake into the human body and their ability to cause adverse health effects. The purposes of this study were to evaluate the site-specific physical and chemical characteristics of lead and arsenic detected at the site and to determine the degree to which lead and arsenic at the site are available for uptake into the human body when exposed to lead- or arsenic-contaminated soils at the site.

In vitro bioavailability and speciation studies were performed for both arsenic and lead for soil samples collected from the site. This report summarizes findings of the bioavailability study.

This report is composed of six sections, with tables and figures presented at the end of the text. The organization of the report and the contents of each section are described below.

Section 1 Introduction – provides an overview of the objectives and organization of the report.

Section 2 Background and Methodology – provides a brief background on bioavailability, describes sample collections and methodologies for *in vitro* bioavailability testing and electron microprobe analysis (EMPA) evaluation

Section 3 Results and Conclusions – presents results and conclusions from the *in vitro* bioavailability testing and EMPA evaluation

Section 4 References – provides a list of references cited in this report

Section 2
Background and Methodology

This section provides a brief background on bioavailability and describes sample collections and preparation, and methods for *in vitro* bioavailability and geochemical speciation.

2.1 Background

In most cases, the toxicity of an ingested chemical depends, in part, on the degree to which it is absorbed from the gastrointestinal tract into the body. Because oral reference doses (RfDs) and cancer slope factors (CSFs) are generally expressed in terms of ingested dose (rather than absorbed dose), accounting for potential differences in absorption between different exposure media can be important to site risk assessments (EPA 1989). This is true for all chemicals, but is of special importance for metals. This is because metals can exist in a variety of chemical and physical forms, and not all forms of a given metal are absorbed to the same extent.

Lead and arsenic occur in soil as a complex mixture of solid phase chemical compounds (forms or species) of varying particle size and morphology. The occurrence and relative distribution of an element among these various phases, and the physical relation between the phases and the soil, will control an element's dissolution properties and, hence, its bioavailability. The spatial heterogeneity of these complex mixtures in soil will be reflected by variable metal bioavailability from soil at a site. The process of how much a metal crosses the stomach lining and enters into the bloodstream and the body is known as bioavailability. In other words, bioavailability is the fraction of an ingested dose that crosses the gastrointestinal epithelium and becomes available for distribution to internal target tissues and organs (EPA 2007a).

Bioavailability expressed as a fraction (or percentage) of a dose is commonly referred to as absolute bioavailability (ABA). The term relative bioavailability (RBA) refers to the ratio of the bioavailability of a metal in one exposure context (i.e., physical chemical matrix or physical chemical form of the metal) to that in another exposure context (EPA 2007a).

When a site-specific RBA value is available, the exposure estimate (i.e., intake) is adjusted when calculating the hazard quotient (HQ):

$$HQ = \frac{DI \times RBA}{RfD}$$

where:

DI	=	daily oral intake (mg/kg-day)
RfD	=	reference dose (mg/kg-day)
HQ	=	hazard quotient
RBA	=	relative bioavailability

Similarly, the exposure estimate is adjusted when estimating cancer risk (CR):

$$CR = (DI \times RBA) \times CSF$$

where:

CSF	=	cancer slope factor (per mg/kg-day)
DI	=	daily oral intake (mg/kg-day)
RBA	=	relative bioavailability

Two different types of tests, *in vivo* and *in vitro,* are used to measure the bioavailability of metal in soil. In the *in vivo* test, a particular metal form or species to be tested is fed to the animal and the amount of the metal in the blood and tissues is measured. The ratio of the measured metal in the blood and tissues, to the measured metal uptake from another very water soluble form or species of the same metal (e.g., lead acetate for lead) is termed RBA.

The *in vivo* studies require live animals (such as mini swine or rats) and are costly, time consuming, and complex. As a result, *in vitro* testing of metal has been used as a surrogate for examining the amount of metal that is available for uptake by the digestive tract. The *in vitro* bioavailability test involves a laboratory procedure that is designed to mimic some of the conditions of the human digestive tract. The fraction of the metal which solubilizes in an *in vitro* system is referred to as *in vitro* bioaccessibility (IVBA), which may then be used as an indicator of *in vivo* RBA (EPA 2007b).

EPA has developed *in vitro* bioavailability correlation factor for lead based on swine studies to evaluate the relative *in vivo* bioavailability (EPA 2007b). However, the correlation for arsenic is not strong enough to warrant using the *in vitro* method as a standalone means for determining a site-specific arsenic bioavailability coefficient. Thus, for arsenic bioavailability testing, EPA supports a weight-of-evidence approach which combines *in vitro* results and geochemical speciation data (EPA Region 8 2005).

The geochemical properties most commonly considered in relation to metals bioavailability are the forms or species of the solid phase, matrix association, and particle size. A discussion of these geochemical properties is presented below.

- ***Forms or Species of the Solid Phase:*** Refers to the chemical form, or species, in which the metal occurs in solids composing site soil or sediment. Examples for arsenic include iron oxyhydroxides; iron and zinc sulfates; iron sulfides; and arsenic-bearing phosphates. These various compounds can be either crystalline or amorphous. In general, less soluble mineral phases are associated with low RBA values.

- ***Matrix Association:*** Refers to the physical association of the metal-bearing grains with other mineral phases or matrices that may limit contact of the metal-bearing grain with gastrointestinal fluids. Metal-bearing grains that are entirely free in the soil are referred to as "liberated," whereas grains that are bound together are referred to as "cemented". Particles that exist in a secondary phase coating are referred to as "rimming". Metal-bearing grains that are fully encased or cemented are essentially isolated from gastrointestinal fluid, are not believed to be available for dissolution and adsorption, and thus are typically associated with a lower RBA.

- ***Particle Size:*** Metals-bearing particles occur in a large variety of sizes. Because dissolution of the particles in gastrointestinal fluid only occurs on a particle's surface, large particles are likely associated with lower RBA values than smaller ones, since the ratio of particle surface area to volume tends to decrease as size increases.

2.2 Sample Collection and Preparation

For the site, relative bioavailability for arsenic and lead in the soil sample was estimated by determining lead and arsenic solubility in an *in vitro* test. In addition, lead and arsenic speciation and particle size analyses were performed as weight-of-evidence to support the observed *in vitro* test results.

In vitro bioavailability analyses for arsenic and lead were performed on 39 representative soil samples collected from Areas 2, 3, 5, 6, and 9. Areas 2, 5, 6, and 9 are comprised beach areas between Cheesequake Creek and Margaret's Creek. Area 3 is a playground adjacent to the western end of the seawall. Soil samples were collected at depths ranging from the ground surface to 2 feet below ground surface (bgs) in the intertidal zone from Areas 2, 5, and 6. Upland soil samples were collected in Area 3 and Area 9 (Margaret's Creek) at depths ranging from the ground surface to 2 feet bgs. The soil sampling locations are provided in Figures 2-1 to 2-4.

Soils were prepared by drying at 40 ^{0}C and sieved to <250 micrometer (µm), a particle size fraction that sticks to hands and is most likely be ingested (EPA 2000). This portion of the total sample that passes through a 250 µm is termed the fine fraction (EPA 2000). Each soil sample was separated into three aliquots. An aliquot was analyzed for lead and arsenic concentrations. The second aliquot was used in the *in vitro* analysis. The third aliquot was used in the electron microprobe analysis.

2.3 Methods

The bioavailability study consists of *in vitro* bioavailability study and geochemical speciation study using EMPA. These tests were performed by the Laboratory for Geological Studies (LEGS) of University of Colorado in Boulder, Colorado.

2.3.1 In Vitro Bioavailability Testing

For bioavailability studies, *in vitro* tests involve testing solubility of a metal in a simulated human stomach environment (e.g., a solution with a pH of about 1.5). The bioavailability leaching procedure followed the simplified *in vitro* protocol developed and verified against animal models (EPA 2008). The method is briefly described below.

Synthetic gastric solution was prepared by adding glycine to deionized water and adjusting the pH to a value of 1.50 ± 0.05. One gram of the sample was combined with 100 milliliter (mL) of gastric solution and combined in a tightly sealed 125 mL high-density polyethylene bottle and then inverted to homogenize any media attached to the bottom. The bottle was placed into a toxicity characteristic leaching procedure extractor and rotated for 1 hour in a water bath maintained at 37°C.

The extracts were then drawn from the bottle and filtered through a 0.45 µm cellulose disk filter into a clean vial for analysis. Samples were analyzed for lead and arsenic as specified in EPA Method 6020 (EPA 2008).

2.3.2 Electron Microprobe Analysis

To determine the lead and arsenic mineralogy and forms/species, 13 selected samples were analyzed by EMPA on a JEOL 8600 electron microprobe following the protocol specified by the LEGS (2003). The samples were characterized using EMPA analysis to determine the chemical speciation, particle size distribution, association of the metal-bearing forms, frequency of occurrence, and relative mass.

2.3.2.1 Methodology

Polished sample pucks were prepared for EMPA by embedding 4 grams of sample in epoxy within a sample mold, setting the molds to cure at room temperature, and grinding flat surface on the sample side to expose as much sample as possible. All polishing steps used kerosene to avoid dissolution of water-soluble metal phases, and were performed at low speeds to avoid plucking of the sample grains. Finally, the sample pucks were cleaned in an ultrasonic cleaner with isopropyl alcohol, air dried, and placed in a carbon coater, where a thin layer of carbon is applied onto the surface of each puck.

Quantitative elemental composition and the associated forms/species were determined using wavelength dispersive spectrophotometers (WDS) and mineral standards, and corrected using Phi Rho Z parameters. The lead and arsenic-bearing particles were identified using energy dispersive spectrophotometers (EDS) detection, WDS detection, and backscatter electron image (BEI) detection.

Point counts were made by traversing each sample from left to right and top to bottom in a grid pattern, with each vertical displacement moving only to the adjacent field of view. Subsequently, metal mass distribution was determined by correcting the percent composition data for each phase by the metal concentration and specific gravity of that phase, and normalizing the resulting data to 100 percent (%). The portion of the sample examined in the second pass, under the higher magnification, depended on the time available, the number of lead- or arsenic-bearing particles, and the complexity of metal mineralogy. A maximum of 8 hours were spent per sample.

The largest dimension of any one metal-bearing form was measured and the frequency of occurrence weighted by that dimension.

The relations between lead- and arsenic-bearing phases were established from BEI images and WDS/EDS analyses as necessary. Representative BEI photomicrographs of identified phases and their associations were produced, with scale bar, magnification, sample identification, and phase identification recorded on each photomicrograph.

2.3.2.2 Calculations

Data from EMPA are summarized in terms of frequency of occurrence and relative mass.

Frequency of Occurrence

The frequency of occurrence was calculated by summing the longest dimension of all the lead bearing phases observed and then dividing each phase by the total.

The following equation serves as an example to the calculation for a lead-bearing compound.

$$F_M \; in \; phase-1 = \frac{\sum (PLD)_{phase1}}{\sum (PLD)_{phase1} + \sum (PLD)_{phase2} + ... + \sum (PLD)_{phase\,n}}$$

where:

F_M	=	Frequency of occurrence of lead in a single phase
PLD	=	An individual particles longest dimension, µm

These data thus illustrate which metal-bearing phase(s) is the most commonly observed in the sample or relative volume percent.

Relative Mass

The second calculation used in this report is the determination of relative mass of a lead or arsenic bearing phase. These data were calculated by substituting the PLD term in the equation above with the value of mass of lead or arsenic in a phase. This term was calculated as defined below.

$$M_M = F_m \times SG \times ppm_M$$

where:

M_M	=	Mass of a metal in a phase
F_M	=	Frequency of occurrence of metal in a single phase
SG	=	Specific gravity of a phase
ppm_M	=	Concentration in ppm of a metal in phase

2.4 Background Concentrations

Background samples were collected to develop site-specific background concentrations. Background intertidal soil and upland soil samples were collected at depths ranging from ground surface to 2 feet bgs in Area 10. Site-specific background soil concentrations for lead and arsenic are 18 mg/kg and 13 mg/kg, respectively. The New Jersey natural soil background arsenic concentration is 19 mg/kg (New Jersey Administration Code 7:26D).

It should be noted that fine soil fractions generally are "enriched" in metals compared to total soil samples (EPA 2000). Therefore, the fine soil fractions used in the bioavailability study may contain higher concentrations of lead and arsenic than that in the total soil samples. Concentrations of lead and arsenic in the total soil samples were not measured

for the bioavailability study. Schenabel Engineering (Schenabel 2011) analyzed metal concentrations in different sized soil particles in a slag treatability study. Results of the study indicate that the highest metal concentrations in site soils are associated with fine fractions such as silt and clay (< 75 µm particles). Thus metal concentrations in the fine fraction are not totally comparable to the background concentrations measured in total soil samples.

Section 3
Results and Conclusions

This section discusses the results of the *in vitro* bioavailability testing and EMPA evaluation.

3.1 *In Vitro* Bioavailability Testing

Results of the fine fraction lead and arsenic concentrations and *in vitro* bioavailability are discussed below.

3.1.1 Metal Concentrations

Results of arsenic and lead concentrations in the fine fraction (< 250 µm particles) are summarized in Table 3-1. A statistical summary of fine fraction metal concentrations is presented in Table 3-2 by study area.

Lead

The fine fraction lead concentrations are extremely variable, ranging from 6 mg/kg to 34,697 mg/kg. Distributions of lead concentrations are characterized by the following:

- Area 6 has lead concentrations below or at the site-specific background soil concentration of 18 mg/kg. It is noted that the fine fraction metal concentrations are not totally comparable to the background concentrations measured in total soil samples.

- Concentrations of lead in Areas 3 and 5 range from 8 mg/kg to 403 mg/kg. All samples except one (A5-B1) exceed the background lead level.

- Concentrations of lead in Area 2 range from 32 mg/kg to 1,602 mg/kg, with an average concentration of 555 mg/kg. All samples exceed the background lead level. The highest lead concentration was found in a sample (A2-B2) collected in an area with notable battery casing (Figure 2-1).

- Concentrations of lead in Area 9 are extremely variable, ranging from 41 mg/kg to 34,697 mg/kg and exceeding the background lead concentration. The highest concentrations of lead were found in samples (i.e. A9-B4 at 5,704 mg/kg, A9-B7 at 22,287 mg/kg, and A9-B10 at 34,697 mg/kg) collected from areas where battery casings were observed (Figure 2-2).

Arsenic

The fine fraction arsenic concentrations range from 1 mg/kg to 39 mg/kg. The distributions of arsenic concentrations are characterized by the following:

- The highest concentration of arsenic (39 mg/kg) was found in Area 2 (A2-B2).

- Concentrations of arsenic in Areas 3 and 6 range from 1 mg/kg to 9 mg/kg, below the site-specific background concentration of 13 mg/kg (Figure 2-3).

- Concentrations of arsenic in Area 5 range from 3 to 22 mg/kg. Only one sample (A5-B9) contains arsenic concentration (22 mg/kg) above the site-specific background level.

- Concentrations of arsenic in Area 9 range from 3 to 23 mg/kg. Three samples have arsenic concentrations exceeding the site-specific background arsenic concentration (Figure 2-4).

- Concentrations of arsenic are positively correlated with lead concentrations. The samples having arsenic concentrations above the site-specific background concentration generally contain highly elevated concentrations of lead.

Data Distribution

Environmental data sets are typically log-normally distributed. A significant deviation from this distribution may indicate that the data sets contain more than one "population" of data. Statistical tests for distributions can be used to help establish confidence in the data sets. Further, when data sets contain more than one data population, a background data set can often be identified as a data subset that occurs nearest the origin of a probability plot. This analysis, sometimes called an "inflection" point analysis can allow site data to be used to help define background. Not all areas of a site will ordinarily be contaminated and therefore site data sets often contain a subset of data points that reflect of background.

Lognormal probability plots (also called quantile-quantile [Q-Q] plots) represent a simple graphical method to evaluate the lognormality of a data distribution. A linear pattern displayed by the bulk of the data suggests approximate lognormality (performed on log-transformed data) of the data distribution. Apparent jumps (changes in slope) and breaks in the Q-Q plot suggest the presence of multiple populations.

A lognormal Q-Q plot for the fine fraction lead data set is presented in Figure 3-1. The plot of data shows a data set with three regions. Region 1 consists of the first four points shown on Figure 3-1, starting in the lower left hand corner (with y values relatively constant ranging from 2.0 to 2.5). Region 2 consists of the bulk of the data transition from lower to higher variability. As can be observed, the slope of the data in Region 1 is relatively flat followed by an inflection in the slope where the y values increased from 2.5 to almost 4.0. Region 3 consists of the last five points in the upper right hand corner with high variability.

Data in Region 1 could reasonably represent background, which is consistent with the site-specific background lead concentration of 18 mg/kg. These data make up a small percentage of the data set. The apparent slope increases in Region 2 is probably attributable to site releases. The data furthest to the right on the graph (Region 3) are highly variable and are likely representing waste material.

The arsenic data follow a lognormal distribution (Figure 3-2), although there is an apparent inflection in the slope where the y values increased from 2.3 to 3.0, indicating possible impacts from site releases.

3.1.2 *In Vitro* Bioaccesibility Values

The *in vitro* tests measure the extent of lead and arsenic solubilization in an extraction fluid that resembles gastric fluid. The fraction of lead and arsenic which solubilizes in an *in vitro* system is referred to as *in vitro* bioaccessibility (IVBA), which may then be used as an indicator of *in vivo* RBA (EPA 2007b). The IVBA results for the 39 samples are summarized in Table 3-2 and described below.

Lead

- IVBA is highly variable, ranging from 13% to 94%, with an average IVBA of 63%.
- For samples containing less than 18 mg/kg of lead in the fine fractions, IVBA is relatively low, with an average value of 41%.
- The IVBA values for samples containing greater than background lead concentration (18 mg/kg) to less than 1000 mg/kg are highly variable, ranging from 26% to 83%, with an average IVBA of 63%.
- The IVBA values for samples containing greater than 1,000 mg/kg of lead are more uniform, ranging from 74% to 94%, with an average IVBA of 84% (Figure 3-3).

Arsenic

- IVBA is highly variable, ranging from 0.3% to 63%, with an average of 14%.
- IVBA is not directly related to the soil arsenic concentration (Figure 3-4).

3.1.3 Relative Bioavailability

The IVBA results for lead are adjusted using a correlation factor based on EPA swine studies to calculate RBA (EPA 2007b):

$$RBA = 0.878 \times IVBA - 0.028$$

The EPA default RBA for lead in soil is 60%, based on the assumption that the ABA of lead in diet and water is 50%, and for soil is 30% for children (i.e., RBA=ABA/0.5) (EPA 2007b).

For all of the samples evaluated in the study, the average lead RBA is 56%. The RBA for samples containing less than 1,000 mg/kg of lead in the fine fractions is 60%, exactly at the EPA default value.

However soils containing greater than 1,000 mg/kg of lead had a RBA of 84%, significantly higher than the site-specific average RBA of 56% and the EPA default value 60% (Figure 3-3). This suggests that lead associated with the battery casing wastes or other wastes may be much more readily absorbed into the human body than is typically assumed for lead in soil.

The correlation for arsenic is not strong enough to warrant using the *in vitro* method as a standalone means for the determination of an arsenic RBA. As mentioned earlier, EPA

supports a weight-of-evidence approach which combines *in vitro* results and geochemical speciation data (EPA Region 8 2005).

3.2 Electron Microscope Analysis

Thirteen samples were analyzed by electron microprobe in order to identify the different forms of arsenic and lead that are present in the sample and to estimate approximately how much of the total arsenic or lead is present in each form. The EMPA results are summarized in Table 3-3 and complete results are presented in Attachment A. Evaluation of the EMPA data reveals the following main observations:

- The size of the particles in all the identified particles ranges from 1 to 200 µm. The largest of the particles found in the soils consist of a slag particle in sample A3-B10 and silicate phases in sample A9-B7.
- Based on frequency of occurrence, a majority of particles are associated with iron oxyhydroxides (FeOOH), which is expected to be moderately bioavailable. However, the five samples containing greater than 1,000 mg/kg of lead are associated mainly with cerussite ($PbCO_3$), anglesite ($PbSO_4$), and clay. The clays appear to come from clay molds used in lead smelting and natural clays in the soils.
- Based on relative lead mass, the four main lead-bearing phases found in the soils are cerussite, anglesite, lead metal oxides (PbMO and PbAsO), and iron oxyhydroxide.
- Arsenic was present as various alteration phases. Based on relative arsenic mass, the four main arsenic-bearing phases are iron oxyhydroxides, lead oxides, clay, and arsenic iron oxide (AsFeOOH).
- Most lead and arsenic-bearing particles are liberated.
- The high concentrations of lead and arsenic in the fine fraction soils are most likely associated with battery casing or other wastes such as clay molds. Slag is rarely present in the fine particles. Only four slag particles were observed out of 2,135 particles examined, or 0.2%.

3.2.1 Area 2

Area 2 soils were characterized by the following:

- Most particles are smaller than 10 µm in diameter.
- Lead-bearing grains are either “liberated” or “cemented”. Lead-bearing grains in the sample with the highest lead concentration (A2-B2) are either “inclusion” or “liberated”.
- The prevailing phases are iron oxyhydroxides, except A2B2, which consists of cerussite and anglesite.

- Lead was present as minerals consistent with cerussite and anglesite.
- Arsenic was present in lead oxides, arsenic oxides and iron oxyhydroxides.

3.2.2 Area 3 and Area 5

Area 3 and Area 5 soils were characterized by the following:

- Most particles are either smaller than 10 µm or between 10 to 50 µm in diameter.
- Lead-bearing grains are mostly "liberated".
- The prevailing phases are iron oxyhydroxides.
- Lead and arsenic masses were present predominantly associated with iron oxyhydroxides.

3.2.3 Area 9

Area 9 soils were characterized by the following:

- Most particles are smaller than 10 µm in diameter.
- Lead-bearing grains are either "liberated" or "cemented".
- The prevalent phases are cerussite, anglesite, and clay.
- Lead is predominately associated with cerussite and anglesite, accounting for 90% to 94% of the relative lead mass of the soil sample.
- Arsenic was present in iron oxyhydroxides, clay, and lead oxides.

It is important to note that these quantitative estimated of particle frequency and relative arsenic or lead mass are based on examination of a relative small number of arsenic or lead-bearing particles in each sample (sample number = 22 to 317). The particle counting error can be significant depending on the total number of particles counted and the individual component (species) percent. Based on studies in El-Hinnawi, 1966, the relative error of a point count based on 100 total particles versus one of 300 total particles is only 10% and 6% , respectively (for a species representing 30% of the count).

3.3 Correlation of *In Vitro* Bioavailability with Geochemical Speciation Data

Bioavailability for lead and arsenic varies widely among different samples, both within and across each area. RBA is not directly related to the soil lead and arsenic concentration; although a positive correlation is observed in soils with elevated lead concentrations. Thus, evaluating just the total metal concentrations in soils does not accurately reflect the fraction biologically available to human receptors.

The wide variability among RBA is further explained by EMPA which show that the form/species of the soild phase and particle size, and to a less extent matrix association, affect the bioavailability. A summary of correlations of RBA with the form/species of the phases, particle size, and matrix association is provided below.

- Based on site data, lead present in cerussite and anglesite tends to be more soluble in acidic conditions thus more bioavailable. Lead in iron oxyhydroxides tends to be less soluble in acidic conditions and thus less bioavailable.

- Based on site data, arsenic present in iron oxyhydroxides tends to have relatively low solubility in acidic conditions and thus much less bioavailable. Arsenic present in PbAsO tends to be less stable in the acidic conditions thus more bioavailable.

- Particle size is inversely related to bioavailability; i.e., particles less than 10 µm in diameter are much more readily absorbed than particles greater than 10 µm in diameter.

- The EMPA study reveals that lead is mainly associated with iron oxyhydroxide, which is expected to be moderately bioavailable. The site-specific average RBA for lead is 56%, similar to the EPA default value of 60% (EPA 2007b).

- The average RBA for the five samples (A2-B2, A9-B3, A9-B4, A9-B7 and A9-B10) with highly elevated lead concentrations (i.e., 1046 mg/kg to 34,697 mg/kg) is 84%, significantly higher than the EPA default value of 60%. The microprobe analyses indicate that most lead in these samples is present in relative soluble forms associated with cerussite and anglesite. The particles are either cemented (18% to 56%) or liberated (18% to 46%), with over 60% of the particles being less than 10 µm in diameter. The combination of these characteristics has resulted in the much higher lead bioavailability than the EPA default value of 60%. This suggests that lead associated with battery casing and other wastes may be much more readily absorbed into the human body than is typically assumed for lead in soil.

- IVBA results for arsenic range from 0.3% to 63%, with an average of 14%. These estimates are much less than the EPA Region 8 recommended default RBA value of 50% (EPA Region 8 2011). The arsenic IVBA results are consistent with microprobe analyses which indicate that most arsenic is present in relatively insoluble forms associated with arsenic bearing iron oxyhydroxides or natural soil matrix. These data form a reasonable basis for estimating site-specific arsenic bioavailability. For this assessment, it is assumed that IVBA and RBA of arsenic are about the same. Thus, RBA for arsenic in site soil is estimated to be 14%.

3.4 Conclusions

Bioavailability for lead and arsenic varies widely among different samples, both within and across each area. The RBA results for lead in site soils range from 12% to 84% and average about 56%. It is believed that the phases which are associated with the greatest metal mass influences the bioaccessability of the metal in a physiological system. The EMPA study

reveals that lead is mainly associated with iron oxyhydroxide, which is expected to be moderately bioavailable. The site-specific average RBA for lead is 56%, similar to the EPA default value of 60% (EPA 2007b). However, soils containing greater than 1,000 mg/kg of lead had a RBA of 84%, significantly higher than the EPA default value of 60%. The microprobe analyses indicate that most lead in these samples is present in relative soluble forms associated with cerussite and anglesite. The particles are either cemented (18% to 56%) or liberated (18% to 46%), with over 60% of the particles being less than 10 µm in diameter. The combination of these characteristics has resulted in the much higher lead bioavailability than the EPA default value of 60%. This suggests that lead associated with battery casing or other wastes may be much more readily absorbed into the human body than is typically assumed for lead in soil.

For practicality and conservatism, a RBA of 84% is recommended when the lead concentration for the fine fraction (i.e., <250 µm in TRW composite samples) is available. For lead in total soil samples, the EPA default RBA value of 60% is used.

In vitro bioaccessibility for arsenic is highly variable, ranging from 0.3% to 63%, with an average of 14%. The majority of the arsenic mass was consistently found in iron oxyhydroxide. Based on site data, the iron oxyhydroxides have relatively low solubility in acidic conditions and thus are much less bioavailable. Thus, a RBA of 14% for arsenic in soils at the site is recommended.

Results of site-specific bioavailability for lead and arsenic are summarized in Table 3-4.

The EMPA study indicates that slag is rarely present as fine particles. Only four slag particles were observed out of 2,135 particles examined, or 0.2%. Even though slag was the predominant source of lead and arsenic at the site, it does not appear to disintegrate into fine particles (<250 µm) to the extent to influence bioaccessability of lead and arsenic. Thus, high concentrations of lead and arsenic in the fine fraction soils are most likely associated with battery casings or other wastes.

Section 4
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Tables

TABLE 3-1
SUMMARY OF *IN VITRO* BIOAVAILABILITY RESULTS FOR LEAD AND ARSENIC IN SOILS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Area	Sample ID	Lead		Arsenic	
		Concentration[1] (mg/kg)	%IVBA	Concentration[1] (mg/kg)	%IVBA
Area 2	A2-B1	32	26	2	1.2
	A2-B2	1,602	74	39	13.6
	A2-B3	584	80	26	14.3
	A2-B4	461	61	9	38.0
	A2-B5	97	83	6	36.4
Area 3	**A3-B1**	116	70	6	0.5
	A3-B10	44	59	5	0.6
	A3-B2	48	72	7	33.9
	A3-B3	36	75	3	56.4
	A3-B4	48	61	4	0.8
	A3-B5	78	74	9	18.2
	A3-B6	38	80	6	34.2
	A3-B7	47	76	8	26.0
	A3-B8	17	53	2	1.2
	A3-B9	48	83	5	46.2
Area 5	**A5-B1**	8	13	4	0.7
	A5-B10	169	84	5	63.2
	A5-B2	69	62	5	0.6
	A5-B3	56	83	6	0.5
	A5-B4	70	80	3	46.0
	A5-B5	270	74	9	0.3
	A5-B6	63	60	4	0.8
	A5-B7	403	68	10	0.3
	A5-B8	248	48	8	0.3
	A5-B9	109	76	22	28.3
Area 6	A6-B1	11	29	1	2.0
	A6-B2	11	46	3	1.0
	A6-B3	6	15	2	1.5
	A6-B4	18	62	1	2.2
Area 9	A9-B1	73	22	3	0.9
	A9-B10	34,697	76	22	15.0
	A9-B2	46	44	8	0.4
	A9-B3	1,046	90	10	0.3
	A9-B4	5,704	94	20	57.0
	A9-B5	45	53	6	0.5
	A9-B6	41	54	5	0.6
	A9-B7	22,287	87	23	16.3
	A9-B8	51	55	8	0.4
	A9-B9	65	69	10	0.3

Bold indicates samples with electron microprobe analysis data
IVBA = *in vitro* bioaccessibility
[1] Total concentration in less than 250 micron sized particles

TABLE 3-2
STATISTICAL SUMMARY OF *IN-VITRO* BIOAVAILABILITY RESULTS FOR LEAD AND ARSENIC IN SOILS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Metal	Area	No. of Samples	Concentration[1] (mg/kg)			% *In Vitro* Bioaccessibility			% Relative Bioavailability		
			Minimum	Maximum	Average[2]	Minimum	Maximum	Average[2]	Minimum	Maximum	Average[2]
Lead	Area 2	5	32	1,602	555	26	83	65	23	73	57
	Area 3	10	17	116	52	53	83	70	47	73	62
	Area 5	10	8	403	146	13	84	65	12	74	57
	Area 6	4	6	18	12	15	62	38	13	54	33
	Area 9	10	41	34,697	6,406	22	94	64	19	82	56
	All Areas	39	6	34,697	1,766	13	94	63	12	82	56
Arsenic	Area 2	5	2	39	16	1.2	38	21	NA	NA	NA
	Area 3	10	2	9	5	0.5	56	24	NA	NA	NA
	Area 5	10	3	22	8	0.3	63	14	NA	NA	NA
	Area 6	4	1	3	2	1.0	2	2	NA	NA	NA
	Area 9	10	3	23	11	0.3	57	9	NA	NA	NA
	All Areas	39	1	39	9	0.3	63	14	NA	NA	NA

NA - not available
[1] Total concentration in less than 250 micron sized particles
[2] Averaged over all samples within the category

TABLE 3-3
SUMMARY OF ELECTRON MICROPROBE ANALYSIS RESULTS FOR LEAD AND ARSENIC IN SOILS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Sample ID	No. of Grains Counted	Mineral Association				Particle Size				Frequency of Occurrence						Relative Lead Mass						Relative Arsenic Mass				
		Liberated	Rimming	Cemented	Inclusion	<10 µm	10-50 µm	50-100 µm	>100 µm	Cerussite	Anglesite	PbMO or PbAsO	Clay	FeOOH	All Other	Cerussite	Anglesite	PbMO or PbAsO	Clay	FeOOH	All Other	AsFeOOH	PbO, PbMO, or PbAsO	Clay	FeOOH	All Other
A2-B2	175	29%	7%	18%	46%	81%	13%	5%	1%	27%	13%	3%	-	-	57%	54%	22%	6%	-	-	18%	20%	61%	-	16%	3%
A2-B3	150	35%	37%	18%	9%	58%	26%	8%	8%	4%	-	7%	25%	57%	6%	39%	2%	37%	5%	10%	7%	-	92%	-	6%	1%
A2-B4	130	30%	39%	18%	12%	68%	27%	5%	1%	3%	3%	1%	7%	69%	16%	29%	24%	5%	2%	10%	29%	-	12%	1%	59%	27%
A3-B1	45	78%	4%	11%	7%	64%	33%	2%	0%	-	-	-	-	92%	8%	-	-	-	-	77%	23%	-	-	-	89%	11%
A3-B10	104	86%	5%	6%	4%	37%	45%	14%	4%	-	-	-	-	92%	8%	-	-	-	-	97%	3%	-	-	-	92%	8%
A5-B1	106	57%	27%	16%	0%	17%	58%	16%	8%	-	-	-	-	100%	0%	-	-	-	-	100%	0%	-	-	-	100%	0%
A5-B2	108	61%	25%	13%	0%	25%	38%	21%	16%	-	-	-	-	99%	1%	-	-	-	-	92%	8%	-	-	-	78%	22%
A5-B3	101	63%	16%	9%	12%	30%	34%	19%	18%	-	-	-	4%	93%	3%	-	-	-	11%	87%	2%	-	-	-	99%	1%
A5-B4	22	91%	9%	0%	0%	14%	45%	27%	14%	-	9%	-	-	91%	1%	-	75%	-		18%	7%	-	-	-	90%	10%
A5-B5	111	46%	7%	26%	21%	66%	21%	9%	5%	9%	-	-	-	88%	3%	71%	-	-	-	14%	14%	-	42%	-	57%	1%
A5-B7	54	89%	6%	4%	2%	72%	20%	6%	2%	-	19%	-	-	70%	11%	-	88%	-	-	7%	5%	-	6%	-	63%	31%
A5-B8	110	37%	37%	2%	1%	49%	36%	9%	5%	1%	-	3%	-	86%	10%	18%	-	30%	-	36%	17%	-	34%	-	13%	53%
A9-B3	171	40%	8%	52%	0%	70%	16%	9%	5%	2%	20%	-	66%	11%	0%	10%	80%	-	9%	1%	0%	-	5%	40%	55%	-
A9-B4	172	46%	15%	39%	0%	62%	29%	8%	1%	46%	26%	6%	5%	-	18%	63%	30%	6%	-	-	1%	-	82%	-	7%	11%
A9-B7	317	23%	5%	41%	31%	79%	11%	6%	5%	9%	28%	-	51%	11%	2%	27%	67%	-	4%	1%	1%	-	-	46%	52%	2%
A9-B10	259	18%	7%	56%	18%	72%	17%	7%	3%	18%	40%	1%	30%	11%	0%	32%	61%	-	2%	0%	5%	-	-	25%	75%	-

TABLE 3-4

SITE-SPECIFIC BIOAVAILABILITY FOR LEAD AND ARSENIC

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Metal	Soil Type	% Relative Bioavailability	% Absolute Bioavailability
Lead	Fine fraction (<250 µm)	84%	42%
	Total soil	60%	30%
Arsenic	Total soil	14%	NA

µm - micrometer

NA - not available

Figures

Note: Total concentration in < 250 micron sized particles

0 250 500 1,000 Feet

N W E S

Figure 2-1
In-Vitro Bioavailability Results for Lead in Soils in Raritan Bay
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CDM

R2-0006149

Note: Total concentration in < 250 micron sized particles

0 250 500 1,000 Feet

N W E S

CDM

Figure 2-2
In-Vitro Bioavailability Results for Lead in Soils in Margaret's Creek
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Note: Total concentration in < 250 micron sized particles

0 250 500 1,000 Feet

N W E S

Figure 2-3
In-Vitro Bioavailability Results for Arsenic in Soils in Raritan Bay
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CDM

R2-0006151

Note: Total concentration in < 250 micron sized particles

0 250 500 1,000 Feet

N W E S

CDM

Figure 2-4
In-Vitro Bioavailability Results for Arsenic in Soils in Margaret's Creek
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

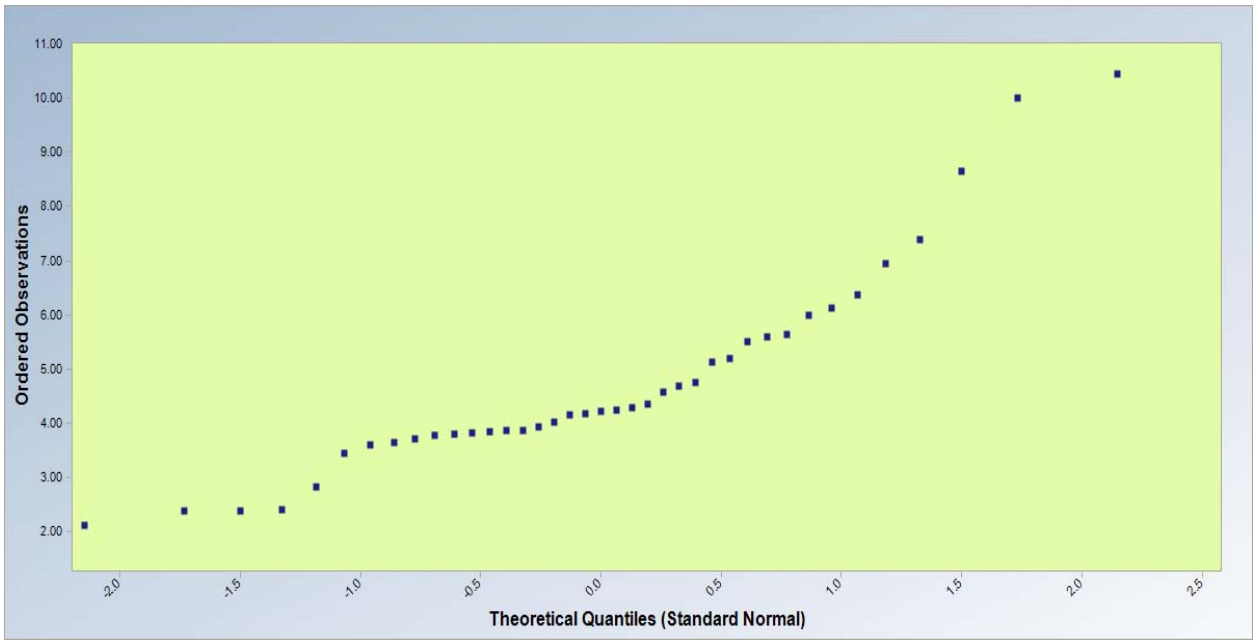


Figure 3-1
Lognormal Q-Q Plot for Lead Concentrations
Raritan Bay Slag Superfund Site
Old Bridge/Syreville, New Jersey

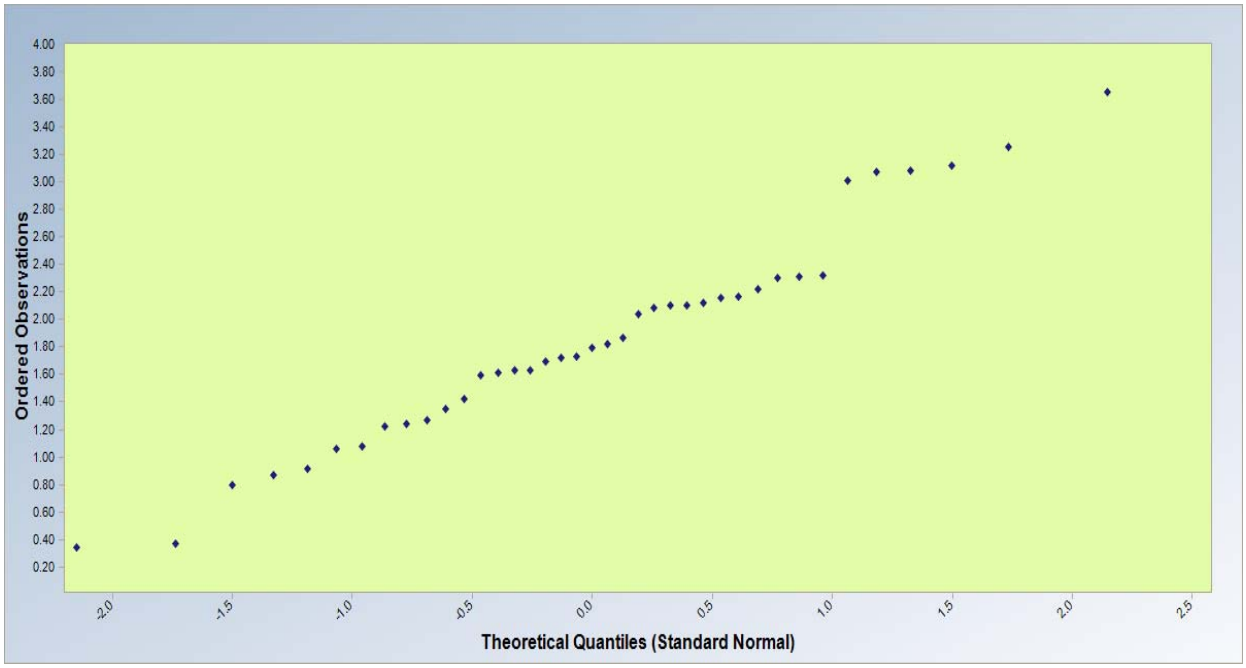


Figure 3-2
Lognormal Q-Q Plot for Arsenic Concentrations
Raritan Bay Slag Superfund Site
Old Bridge/Syreville, New Jersey

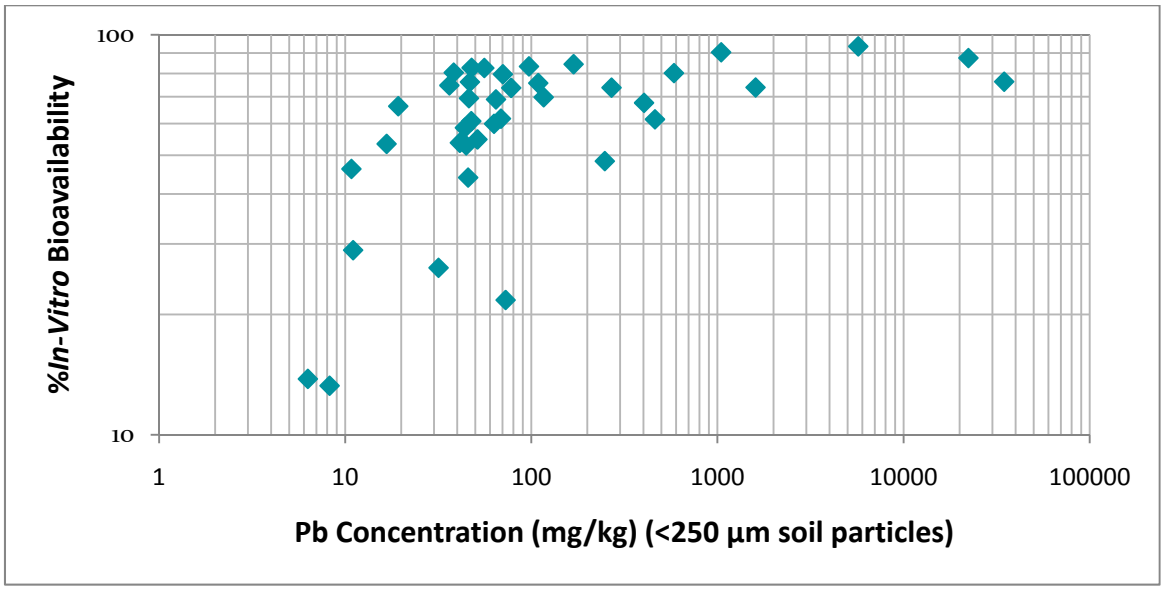


Figure 3-3
Correlation of Total Lead Concentrations with *in-vitro* Bioavailability
Raritan Bay Slag Superfund Site
Old Bridge/Syreville, New Jersey

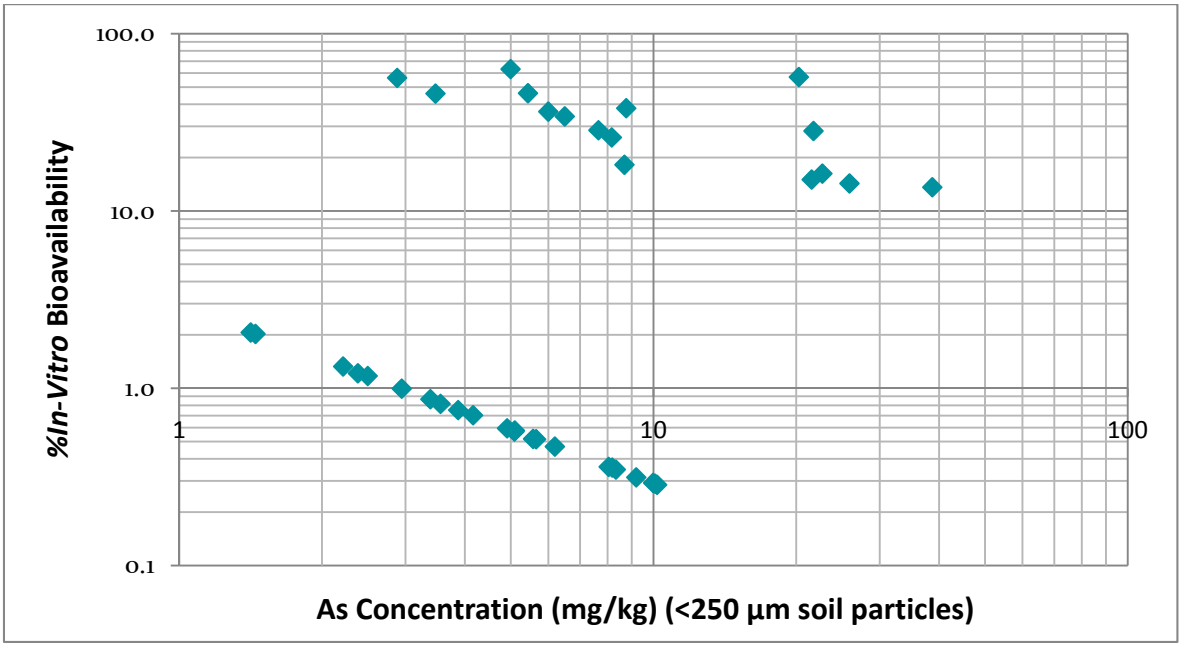


Figure 3-4
Correlation of Total Arsenic Concentrations with *in-vitro* Bioavailability
Raritan Bay Slag Superfund Site
Old Bridge/Syreville, New Jersey

Attachments

Attachment 1

In Vitro Bioavailability Results for Lead and Arsenic in Soils

TABLE 1 . Preliminary Summary of In Vitro Bioassay Results - Lead

Sample	ID	Pb in <250µm bulk soil µg/kg	mass soil (g)	calc Pb #1	ICP Pb (µg/L)	Solution Amount (L)	% Pb IVBA	%RBA
A2-B1	A2-B1	31702	1.00707	31.93	83	0.1	26	23
A2-B2	A2-B2	1601696	1.00014	1601.92	11830	0.1	74	65
A2-B3	A2-B3	583652	0.99376	580.01	4652	0.1	80	70
A2-B4	A2-B4	461448	0.99789	460.47	2830	0.1	61	54
A3-B1	A3-B1	116436	1.00277	116.76	815	0.1	70	61
A3-B2	A3-B2	46184	0.99845	46.11	320	0.1	69	61
A3-B2-D	A3-B2-D	49955	0.99539	49.72	369	0.1	74	65
A3-B3	A3-B3	36256	1.0028	36.36	272	0.1	75	66
A3-B4	A3-B4	47552	1.00265	47.68	290	0.1	61	53
A3-B5	A3-B5	77913	1.00652	78.42	578	0.1	74	65
A3-B6	A3-B6	38260	1.00278	38.37	309	0.1	80	71
A3-B7	A3-B7	46737	1.00458	46.95	358	0.1	76	67
A3-B8	A3-B8	16686	0.99404	16.59	89	0.1	53	47
A3-B9	A3-B9	47740	1.00287	47.88	396	0.1	83	73
A3-B10	A3-B10	43939	1.00325	44.08	258	0.1	59	51
A5-B1	A5-B1	8240	0.99312	8.18	11	0.1	13	12
A5-B2	A5-B2	68638	0.9979	68.49	423	0.1	62	54
A5-B3	A5-B3	55884	0.99855	55.80	461	0.1	83	72
A5-B4	A5-B4	70307	0.99067	69.65	555	0.1	80	70
A5-B5	A5-B5	269693	1.00796	271.84	2005	0.1	74	65
A5-B6	A5-B6	63024	0.99795	62.89	377	0.1	60	53
A5-B7	A5-B7	403188	0.99764	402.24	2719	0.1	68	59
A5-B8	A5-B8	248180	1.00519	249.47	1205	0.1	48	42
A6-B1	A6-B1	11021	0.99302	10.94	32	0.1	29	25
A6-B2	A6-B2	10795	0.99411	10.73	50	0.1	46	41
A6-B3	A6-B3	6295	0.99048	6.23	8.6	0.1	14	12
A6-B3-D	A6-B3-D	6109	1.00532	6.14	9.4	0.1	15	13
A9-B1	A9-B1	72737	0.99219	72.17	157	0.1	22	19
A9-B2	A9-B2	45723	0.99758	45.61	201	0.1	44	39
A9-B3	A9-B3	1046478	0.99837	1044.77	9445	0.1	90	79
A9-B4	A9-B4	5704349	1.00606	5738.92	53692	0.1	94	82
A9-B5	A9-B5	44657	1.00893	45.06	238	0.1	53	46
A9-B6	A9-B6	41274	0.98848	40.80	219	0.1	54	47
A9-B7	A9-B7	22287242	1.00467	22391.32	195892	0.1	87	77
A9-B8	A9-B8	51328	1.00492	51.58	282	0.1	55	48
A9-B9	A9-B9	64520	1.00376	64.76	446	0.1	69	60
A9-B10	A9-B10	34697451	1.00678	34932.70	266681	0.1	76	67
A2-B5	A2-B5	97037	0.99815	96.86	807	0.1	83	73
A5-B9	A5-B9	108839	1.00358	109.23	827	0.1	76	66
A5-B10	A5-B10	168629	1.00107	168.81	1425	0.1	84	74
A6-B4	A6-B4	19263	0.99706	19.21	127	0.1	66	58
A6-B4-D	A6-B4-D	17101	1.00733	17.23	100	0.1	58	51

Pb over range

TABLE 2 . Preliminary Summary of In Vitro Bioassay Results - Arsenic

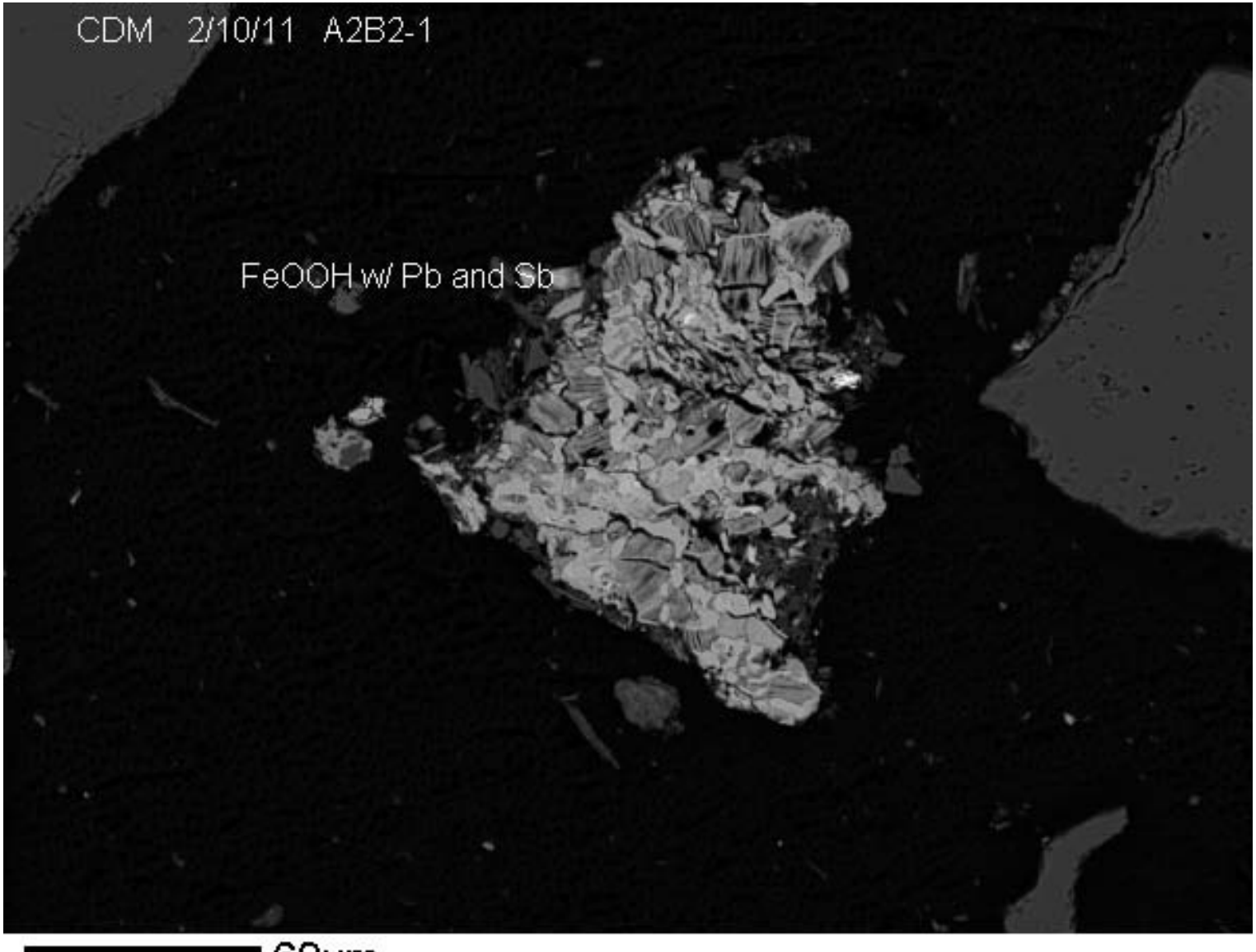
Sample	ID	As in <250µm bulk soil µg/kg	mass soil (g)	calc As #1	ICP As (µg/L)	Solution Amount (L)	%As IVBA
A2-B1	A2-B1	2380	1.00707	2.40	0.29	0.1	1
A2-B2	A2-B2	38707	1.00014	38.71	52.68	0.1	14
A2-B3	A2-B3	25892	0.99376	25.73	36.80	0.1	14
A2-B4	A2-B4	8758	0.99789	8.74	33.21	0.1	38
A3-B1	A3-B1	6194	1.00277	6.21	0.29	0.1	0
A3-B2	A3-B2	7654	0.99845	7.64	21.82	0.1	29
A3-B2-D	A3-B2-D	6992	0.99539	6.96	27.31	0.1	39
A3-B3	A3-B3	2880	1.0028	2.89	16.28	0.1	56
A3-B4	A3-B4	3555	1.00265	3.56	0.29	0.1	1
A3-B5	A3-B5	8683	1.00652	8.74	15.94	0.1	18
A3-B6	A3-B6	6499	1.00278	6.52	22.27	0.1	34
A3-B7	A3-B7	8164	1.00458	8.20	21.33	0.1	26
A3-B8	A3-B8	2496	0.99404	2.48	0.29	0.1	1
A3-B9	A3-B9	5435	1.00287	5.45	25.18	0.1	46
A3-B10	A3-B10	5090	1.00325	5.11	0.29	0.1	1
A5-B1	A5-B1	4165	0.99312	4.14	0.29	0.1	1
A5-B2	A5-B2	4912	0.9979	4.90	0.29	0.1	1
A5-B3	A5-B3	5656	0.99855	5.65	0.29	0.1	1
A5-B4	A5-B4	3469	0.99067	3.44	15.80	0.1	46
A5-B5	A5-B5	9194	1.00796	9.27	0.29	0.1	0
A5-B6	A5-B6	3873	0.99795	3.87	0.29	0.1	1
A5-B7	A5-B7	10076	0.99764	10.05	0.29	0.1	0
A5-B8	A5-B8	8329	1.00519	8.37	0.29	0.1	0
A6-B1	A6-B1	1448	0.99302	1.44	0.29	0.1	2
A6-B2	A6-B2	2945	0.99411	2.93	0.29	0.1	1
A6-B3	A6-B3	2216	0.99048	2.19	0.29	0.1	1
A6-B3-D	A6-B3-D	1796	1.00532	1.81	0.29	0.1	2
A9-B1	A9-B1	3384	0.99219	3.36	0.29	0.1	1
A9-B2	A9-B2	8182	0.99758	8.16	0.29	0.1	0
A9-B3	A9-B3	9979	0.99837	9.96	0.29	0.1	0
A9-B4	A9-B4	20251	1.00606	20.37	116.13	0.1	57
A9-B5	A9-B5	5571	1.00893	5.62	0.29	0.1	1
A9-B6	A9-B6	5099	0.98848	5.04	0.29	0.1	1
A9-B7	A9-B7	22694	1.00467	22.80	37.07	0.1	16
A9-B8	A9-B8	8043	1.00492	8.08	0.29	0.1	0
A9-B9	A9-B9	10174	1.00376	10.21	0.29	0.1	0
A9-B10	A9-B10	21543	1.00678	21.69	32.62	0.1	15
A2-B5	A2-B5	5999	0.99815	5.99	21.77	0.1	36
A5-B9	A5-B9	21741	1.00358	21.82	61.70	0.1	28
A5-B10	A5-B10	4996	1.00107	5.00	31.60	0.1	63
A6-B4	A6-B4	1414	0.99706	1.41	0.29	0.1	2
A6-B4-D	A6-B4-D	1268	1.00733	1.28	0.29	0.1	2

machine detection limit .291

Attachment 2

Electron Microprobe Analysis Results for Lead and Arsenic in Soils

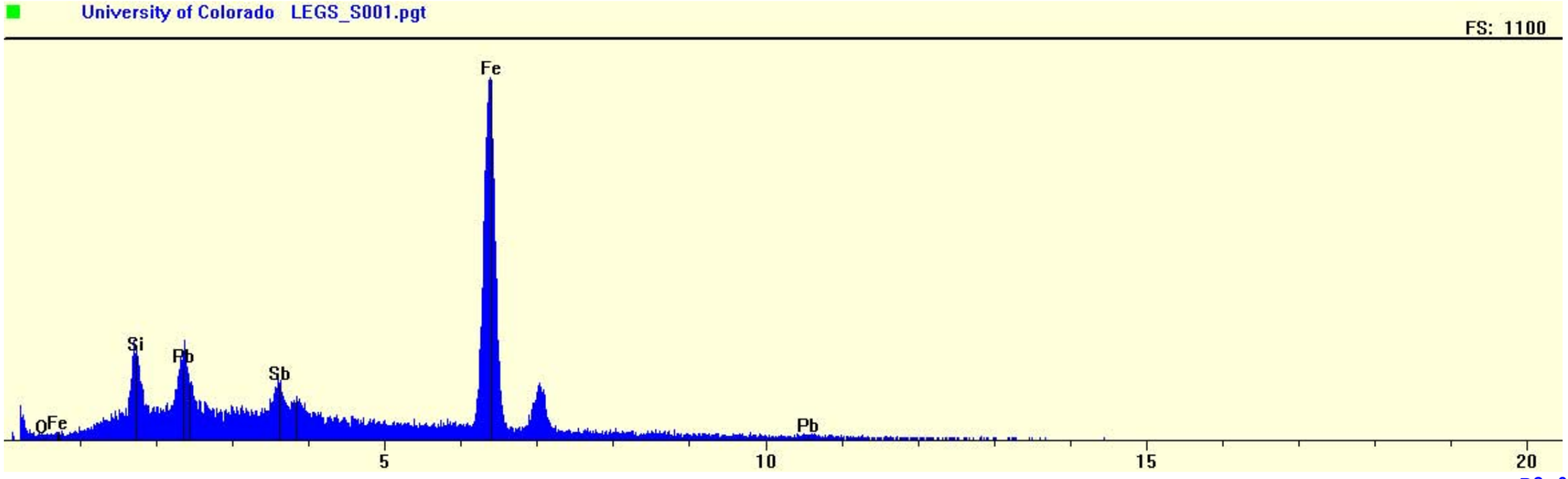
A2B2



60µm

BEI

R2-0006161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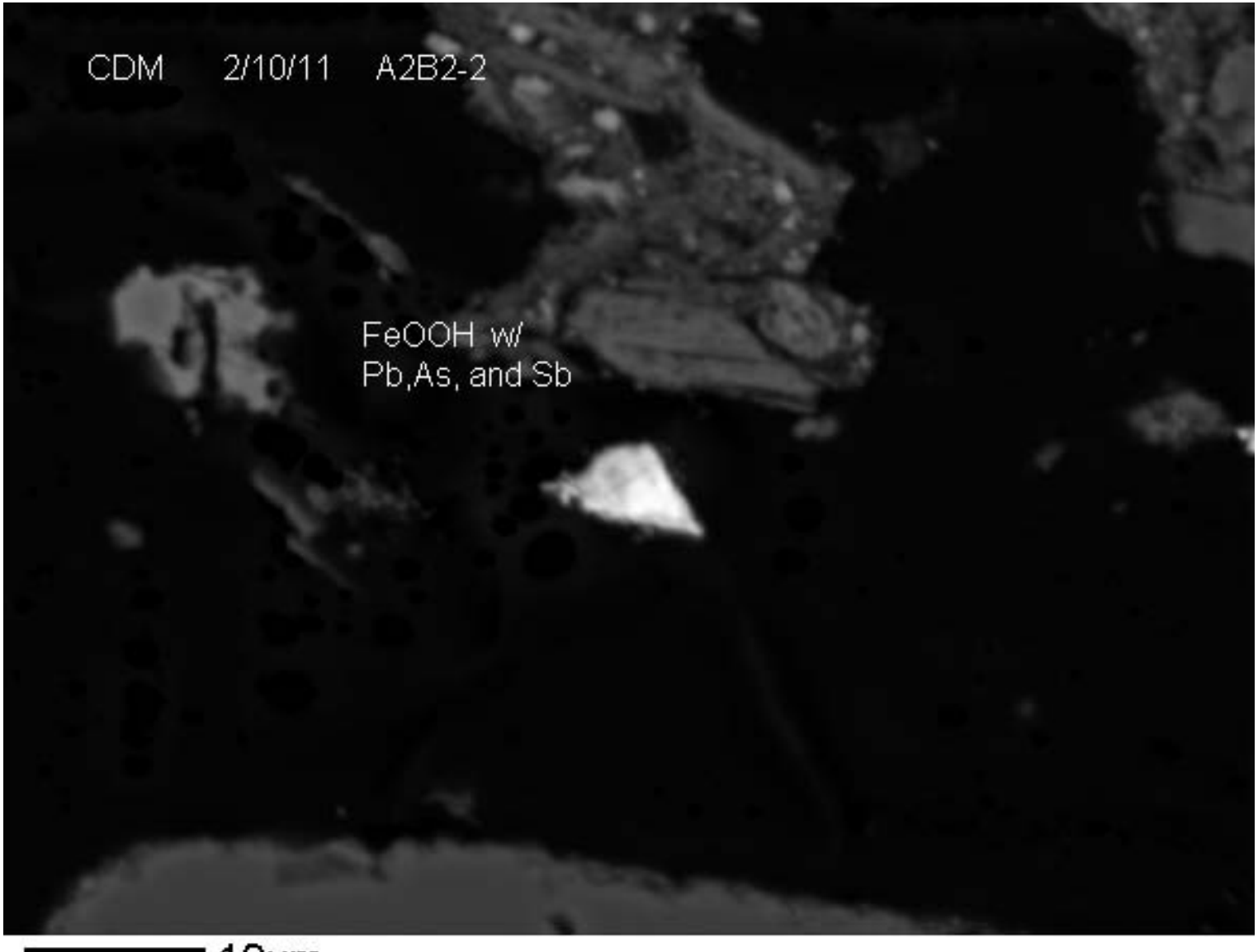
FS: 1100
Fe
Si
Pb
Sb
O
Fe
Pb
5
10
15
20

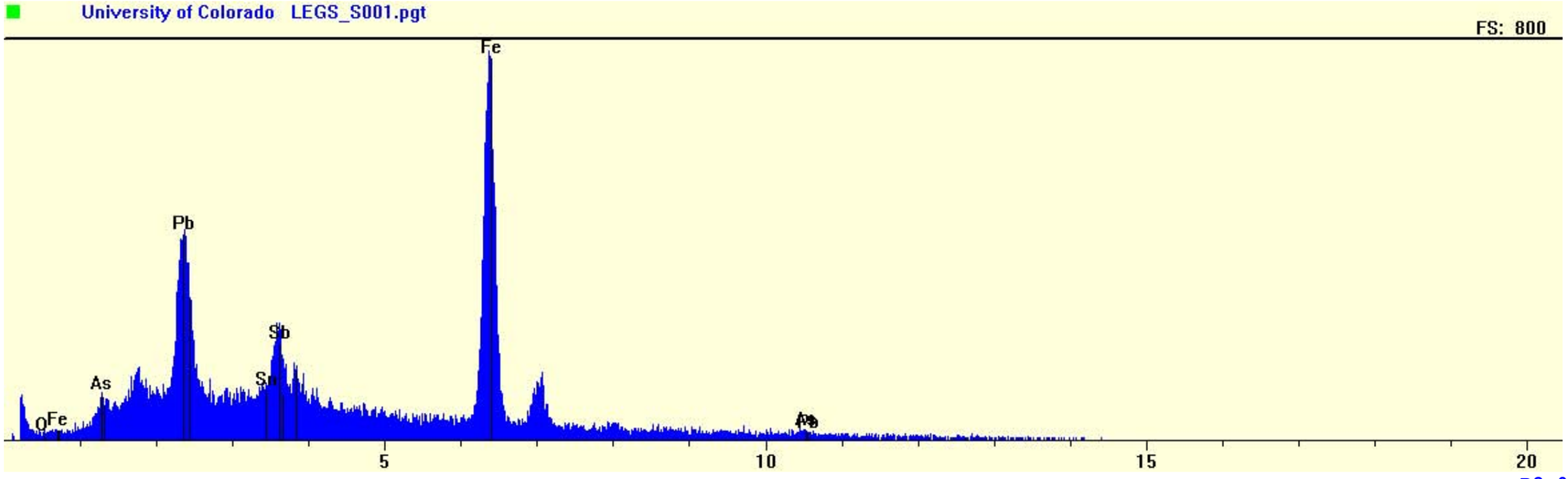
R2-0006162



10µm

BEI

R2-0006163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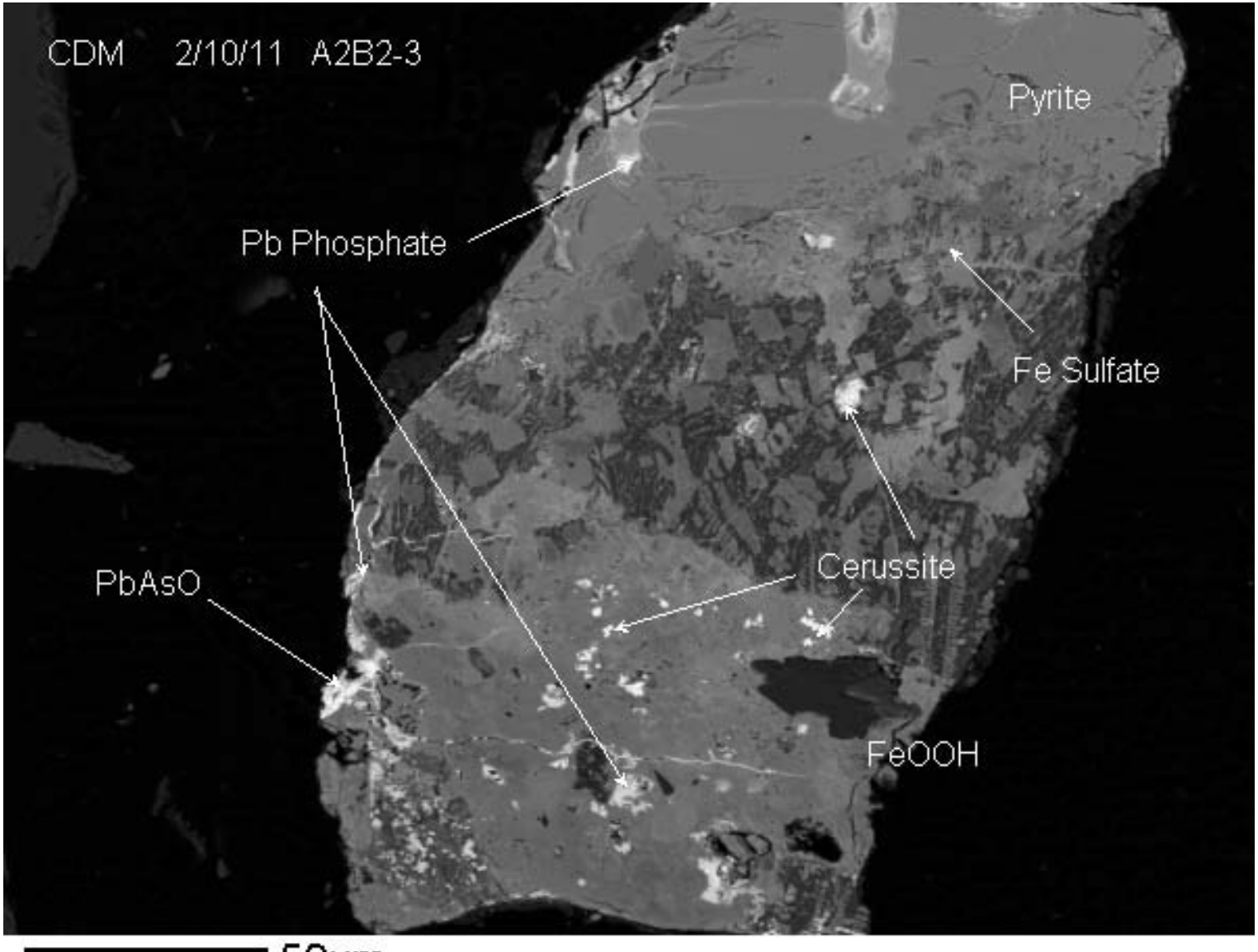
FS: 800
Fe
Pb
Sb
Sn
As
O
Fe
Pb
5
10
15
20

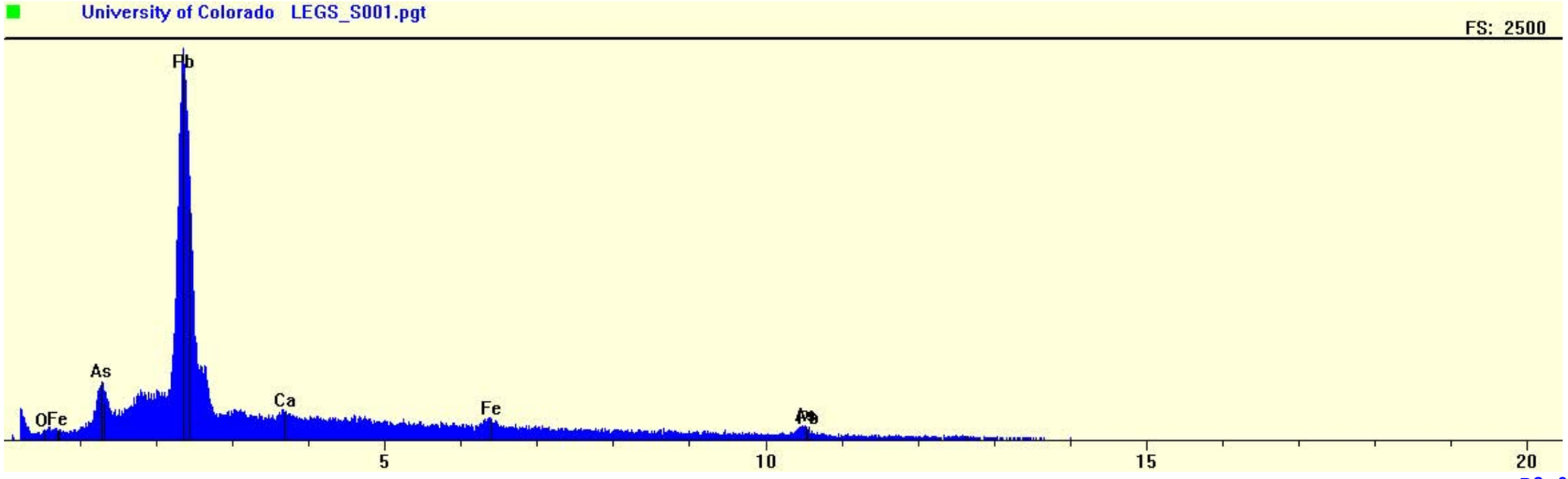
R2-0006164



50µm

BEI

R2-0006165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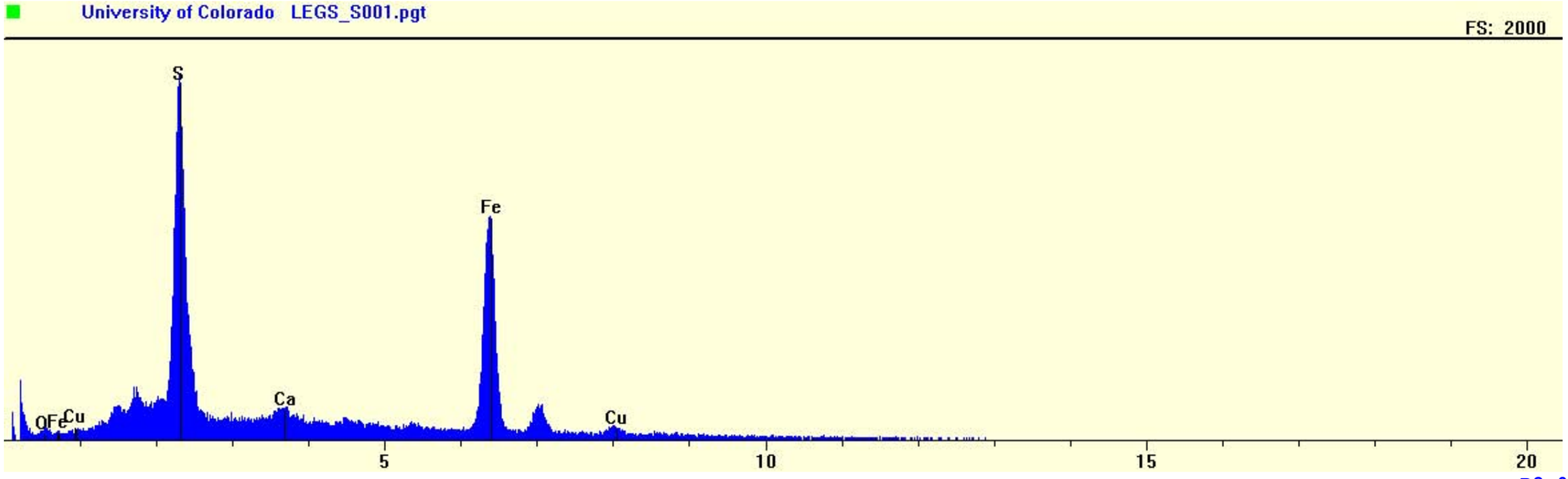
As
OFe
Ca
Fe
5
10
15
20

R2-0006166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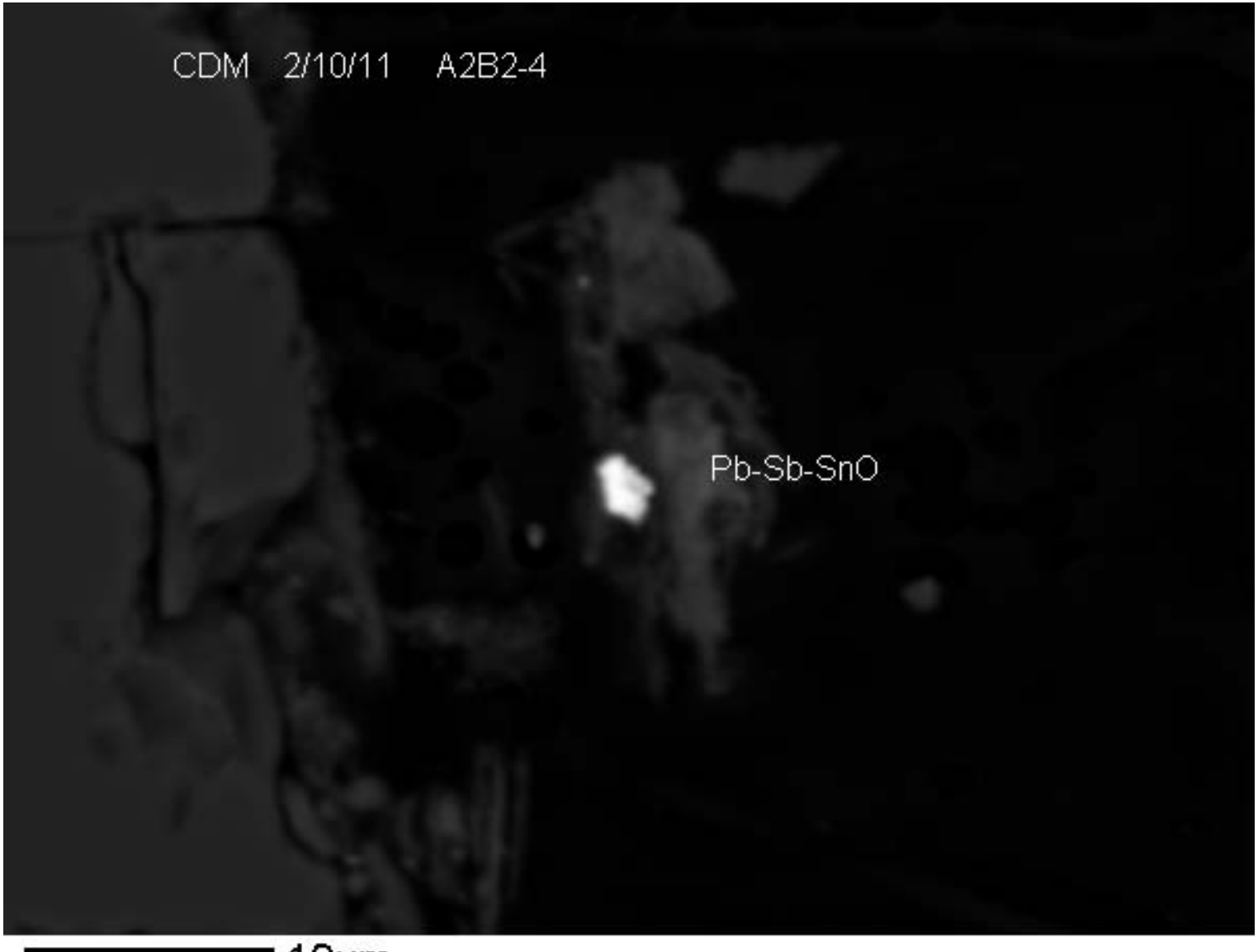
FS: 2000
S
Fe
Ca
Cu
OFe
Cu
5
10
15
20

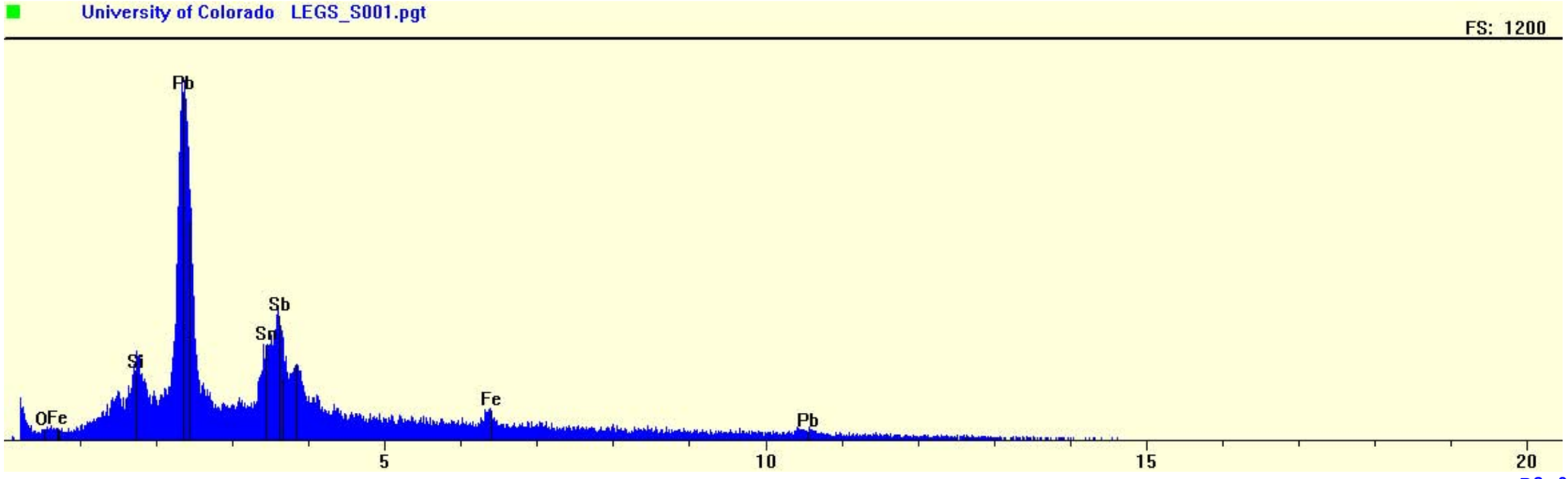
R2-0006167



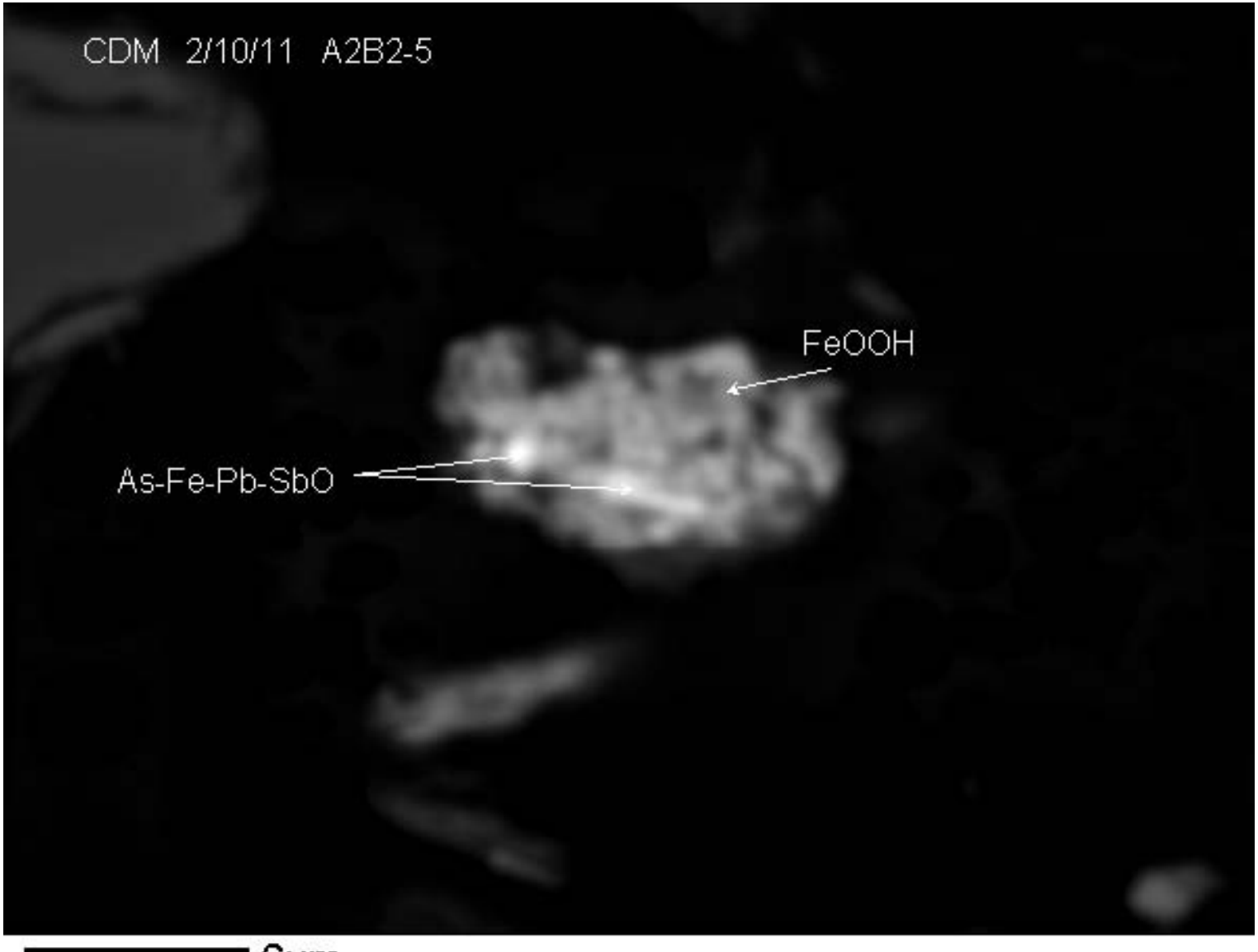
10µm

BEI

R2-0006168


University of Colorado LEGS_S001.pgt
FS: 1200
Pb
Sb
Sn
Si
OFe
Fe
Pb
5
10
15
20

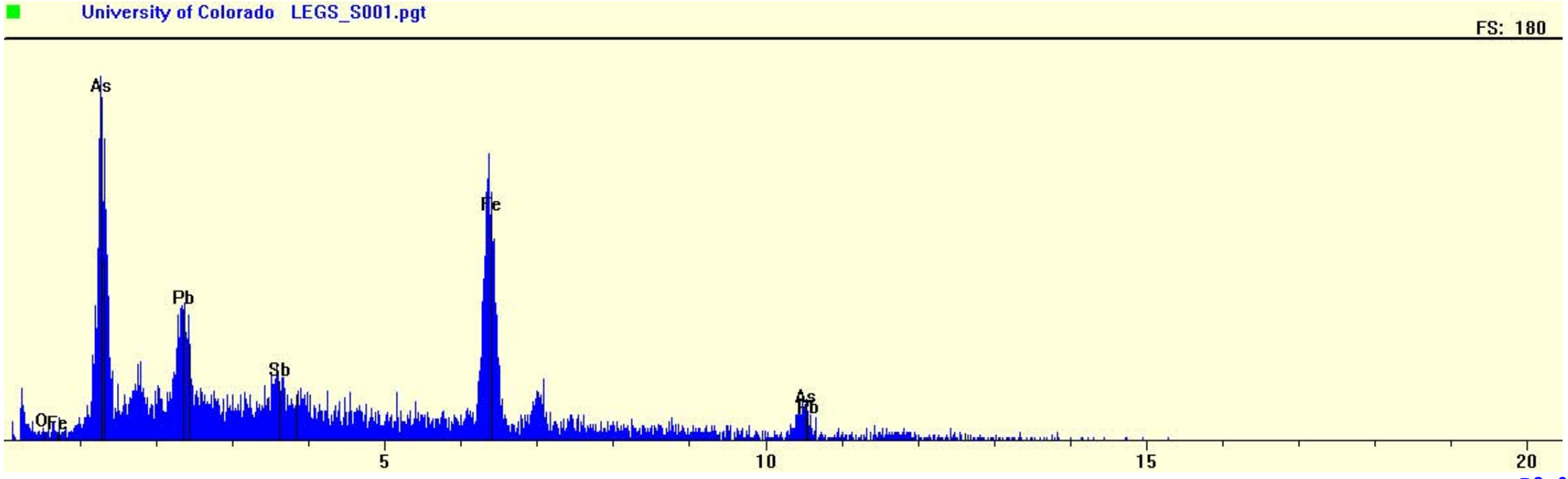
R2-0006169



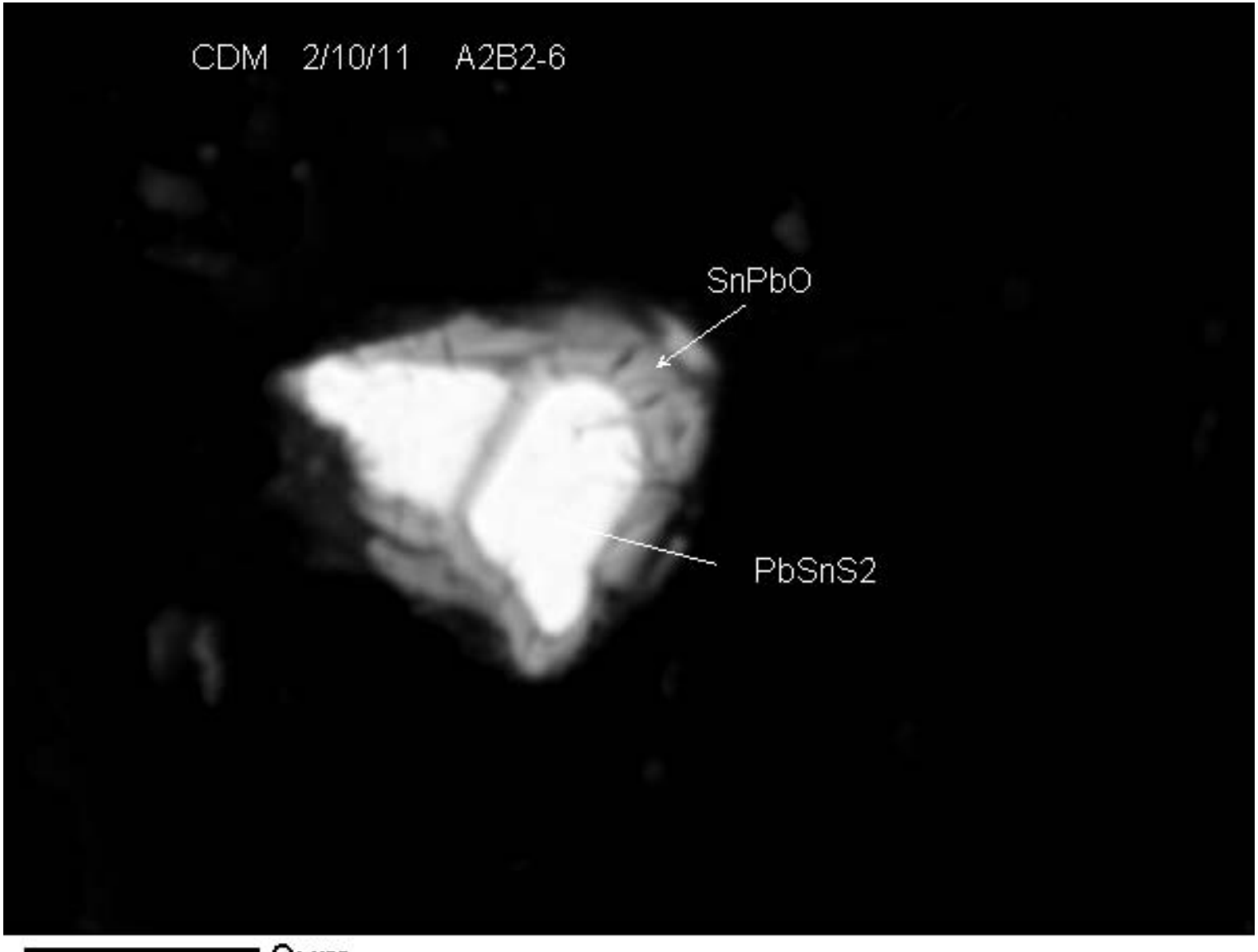
6µm

BEI

R2-0006170


University of Colorado LEGS_S001.pgt
FS: 180
As
Pb
Sb
Fe
O
Fe
As
Pb
5
10
15
20

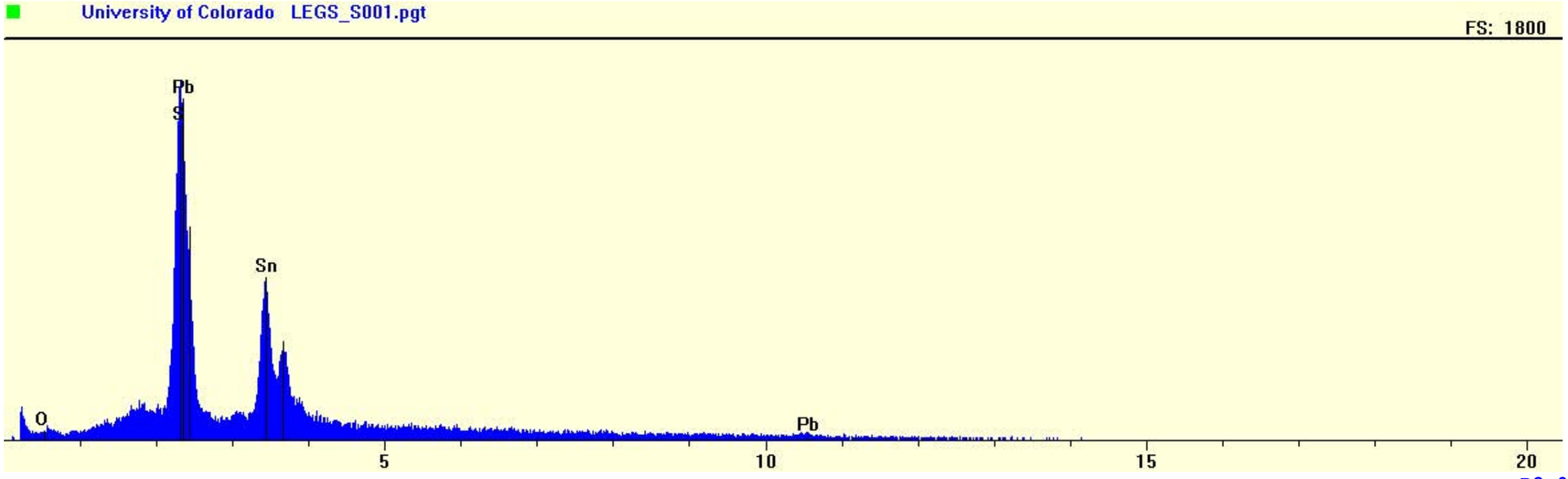
R2-0006171



9µm

BEI

R2-0006172

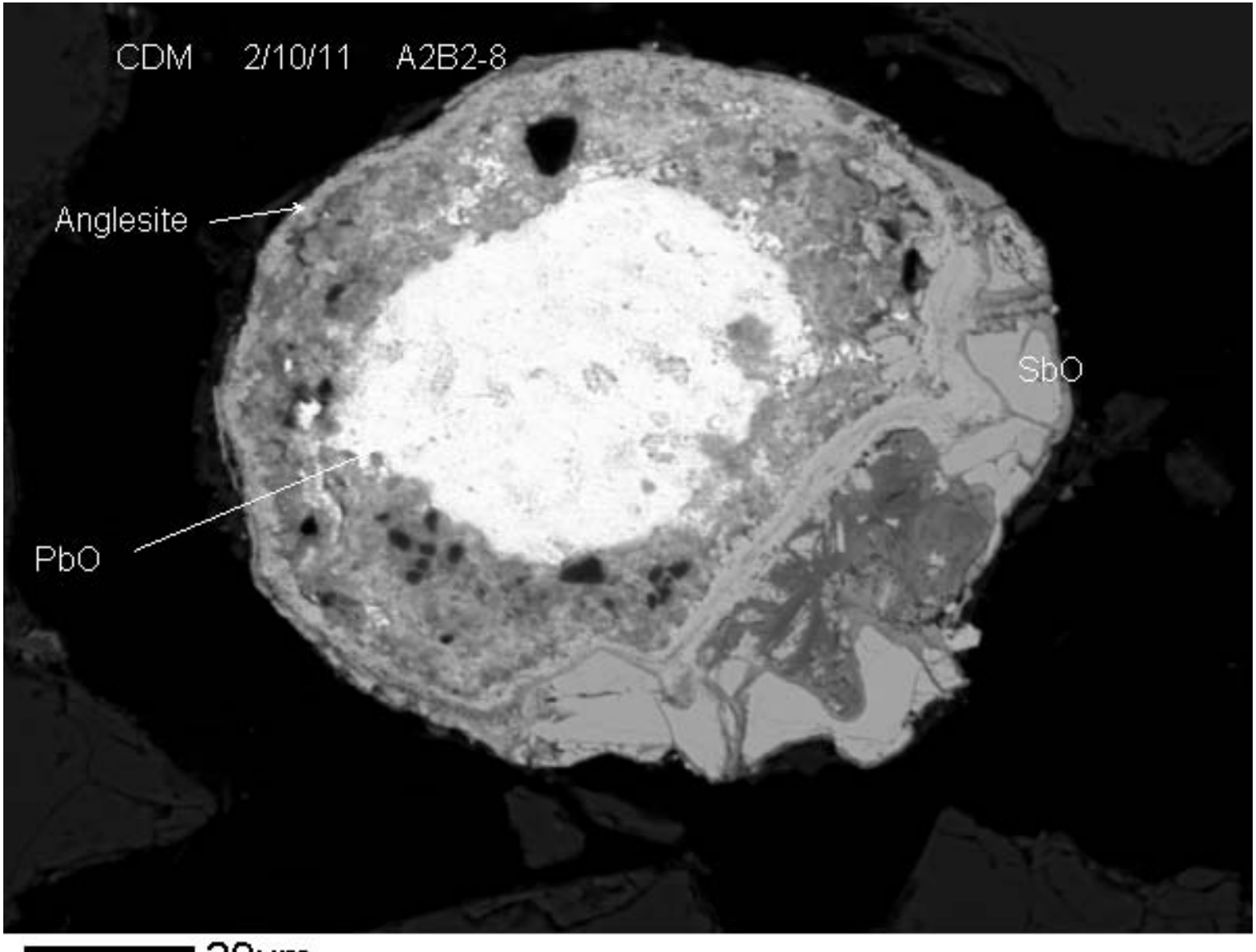

University of Colorado LEGS_S001.pgt
FS: 1800
Pb
S
Sn
O
Pb
5
10
15
20

R2-0006173

40µm

BEI

R2-0006174



20µm

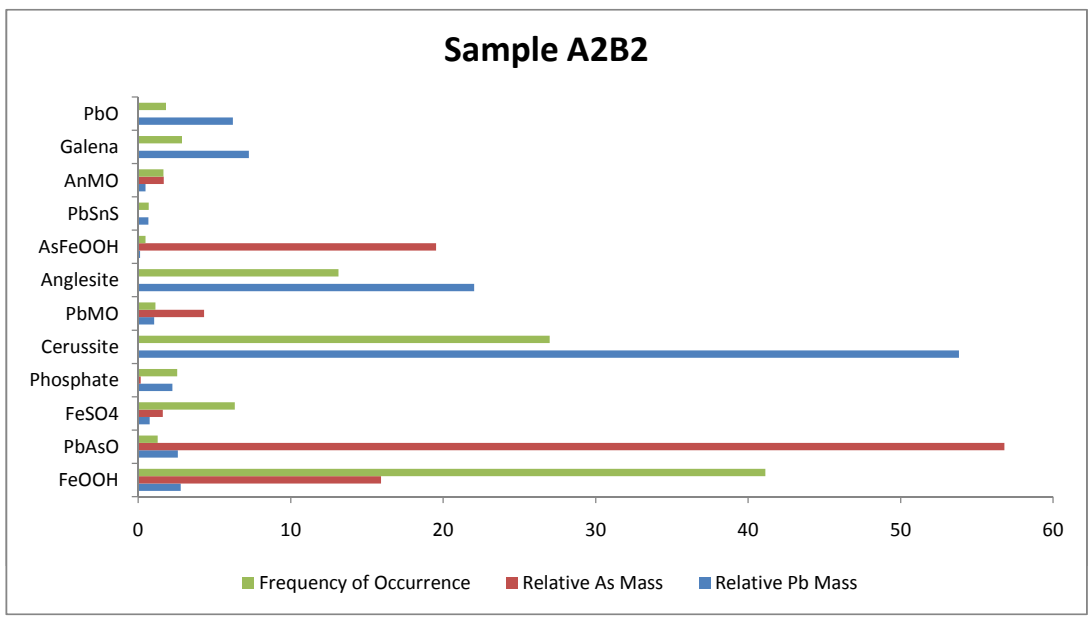
BEI

R2-0006175

Form	Association	Size (microns)
Fe	Liberated	4
Fe	Liberated	2
Fe	Rimming	100
Fe	Liberated	7
Fe	Liberated	5
Fe	Liberated	105
Fe	Liberated	140
Fe	Rimming	50
Fe	Rimming	50
Fe	Rimming	50
Fe	Liberated	7
Fe	Liberated	6
Fe	Liberated	21
PbAsO	Rimming	14
Fe	Liberated	90
Sulf	Cemented	55
Phos	Rimming	6
Phos	Rimming	6
Phos	Rimming	3
Phos	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	5
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Phos	Inclusion	8
Phos	Cemented	6
Phos	Inclusion	3
Phos	Inclusion	3
Phos	Inclusion	3
Phos	Inclusion	3
Phos	Inclusion	3
PbMO	Liberated	2
PbMO	Liberated	2
Sulf	Liberated	5
Ang	Liberated	3
PbMO	Cemented	1
Ang	Liberated	4
Fe	Liberated	27
Ang	Liberated	12
Fe	Liberated	6
Cer	Cemented	2
Fe	Liberated	6
Fe	Liberated	5
Fe	Liberated	5
Fe	Liberated	5
Fe	Liberated	5
asfe	Inclusion	2
asfe	Inclusion	1
Fe	Liberated	8
Ang	Liberated	5
Fe	Liberated	5
Fe	Liberated	4
Sulf	Liberated	8
Cer	Liberated	3
asfe	Liberated	6
pbsns	Inclusion	8
pbsns	Rimming	5
snmo	Rimming	12
Ga	Inclusion	3
Ga	Inclusion	5
Ga	Inclusion	13
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1

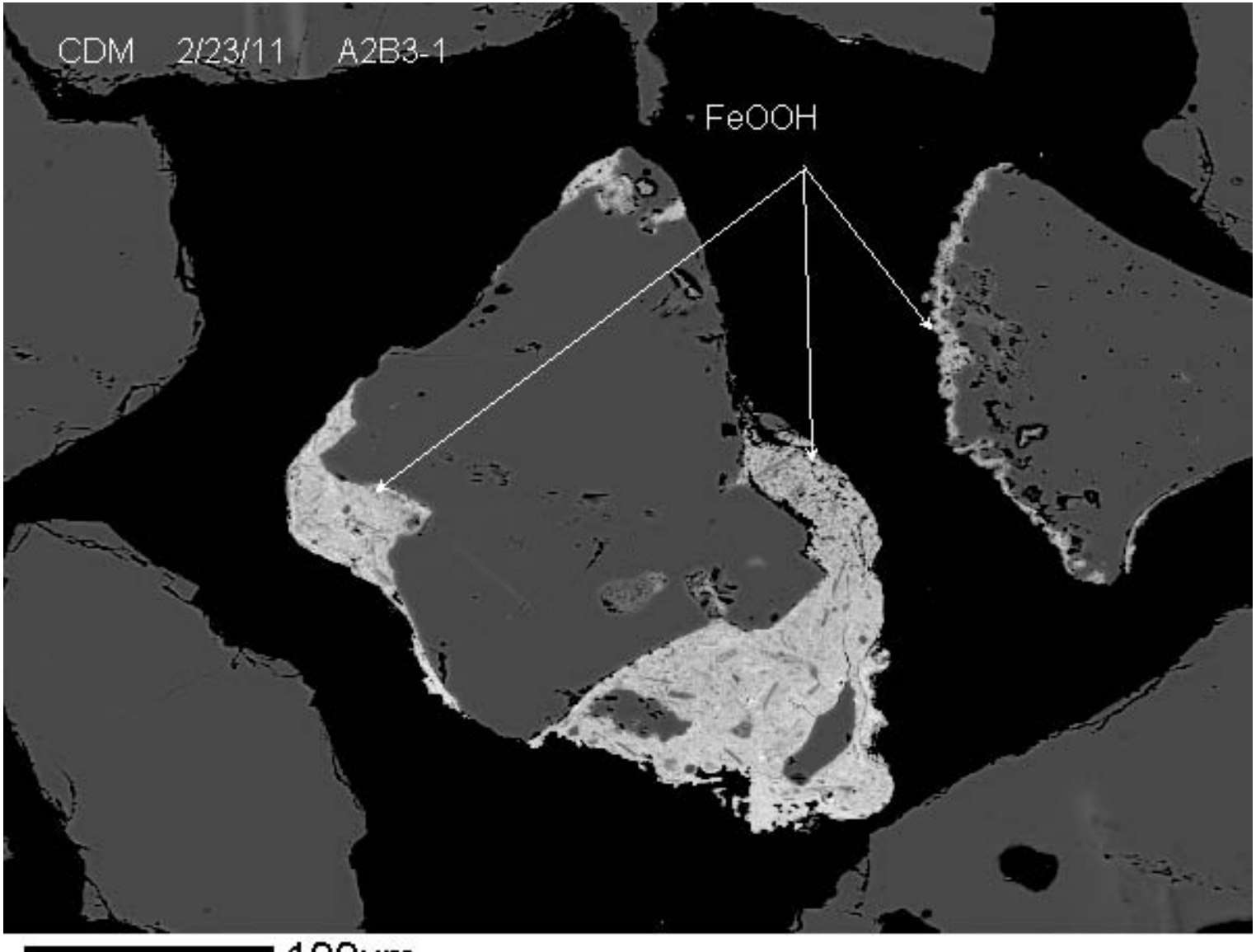
Form	Number	Mean	Std-Dev	Range low	Range high
total	175	10.75	21.09	1	140
FeOOH	26	29.77	38.78	2	140
PbAsO	3	8	5.29	4	14
FeSO4	5	23.8	23.06	5	55
Phosphate	11	4.36	1.8	3	8
Cerussite	46	11.04	19.65	1	90
PbMO	5	4.2	3.49	1	8
Anglesite	35	7.06	11.73	1	55
AsFeOOH	3	3	2.65	1	6
PbSnS	2	6.5	2.12	5	8
AnMO	2	15.5	4.95	12	19
Galena	36	1.5	2.1	1	13
PbO	1	34	ND	34	34

Form	(linear) freq	Bio freq	Rrm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	41.13	46.88	2.79	3.78	15.93	21.55	7.29
PbAsO	1.28	1.09	2.6	2.62	56.8	61.61	1.66
FeSO4	6.32	7.21	0.75	1.02	1.6	2.17	3.61
Phosphate	2.55	1.27	2.24	1.44	0.15	0.09	2.34
Cerussite	26.99	24.77	53.83	58.76	0	0	6.58
PbMO	1.12	1.27	1.04	1.41	4.32	5.84	1.56
Anglesite	13.12	14.96	22.02	29.86	0	0	5
AsFeOOH	0.48	0.36	0.12	0.14	19.54	6.49	1.02
PbSnS	0.69	0.3	0.67	0.32	0	0	1.23
AnMO	1.65	1.88	0.48	0.65	1.66	2.25	1.89
Galena	2.87	0	7.26	0	0	0	2.47
PbO	1.81	0	6.21	0	0	0	1.97



Form	Association	Size (microns)
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Cer	Cemented	4
Cer	Liberated	6
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
PbMO	Liberated	8
Sulf	Liberated	9
Ang	Cemented	2
Ang	Cemented	4
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Fe	Cemented	52
Cer	Liberated	9
Ang	Cemented	4
PbAsO	Liberated	4
Ang	Liberated	5
snmo	Liberated	19
Sulf	Liberated	42
PbAsO	Inclusion	6
Cer	Rimming	20
Cer	Rimming	35
Cer	Cemented	15
Cer	Cemented	68
Cer	Inclusion	10
Cer	Inclusion	10
Cer	Inclusion	10
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
PbMO	Liberated	8
Ang	Cemented	6
Ang	Cemented	6
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	14
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Liberated	8
Fe	Liberated	9
Ang	Liberated	3
Ang	Liberated	6
Ang	Liberated	12
Cer	Liberated	61
Cer	Liberated	52
Ang	Liberated	3
Cer	Cemented	35
Ang	Liberated	10
Cer	Liberated	9
Ang	Liberated	49
Cer	Liberated	90
PbO	Inclusion	34
Ang	Cemented	55

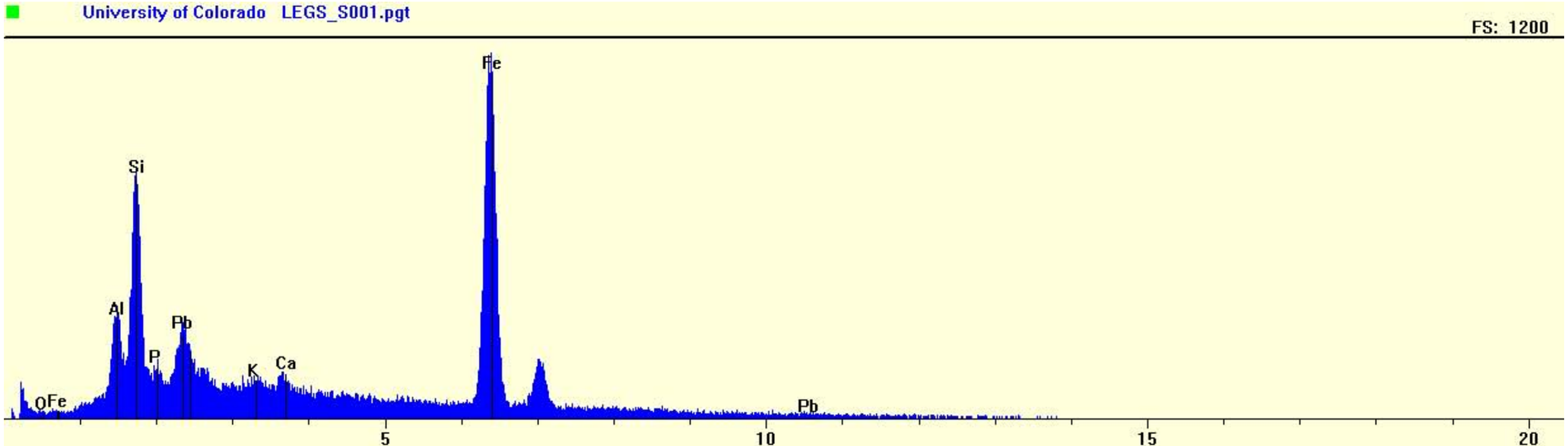
A2B3



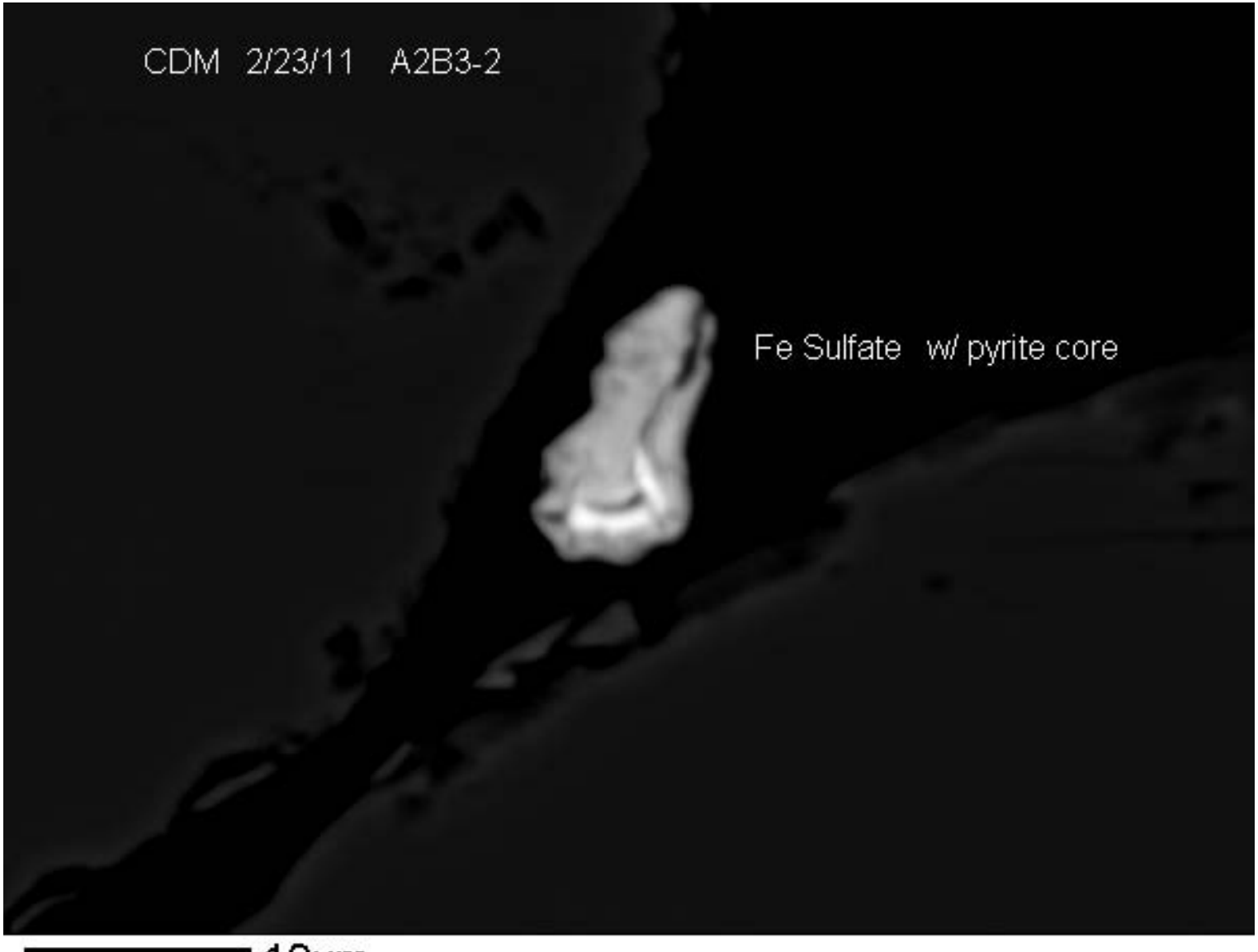
100µm

BEI

R2-0006179


University of Colorado LEGS_S001.pgt
FS: 1200
Fe
Si
Al
Pb
P
K
Ca
QFe
Pb
5
10
15
20

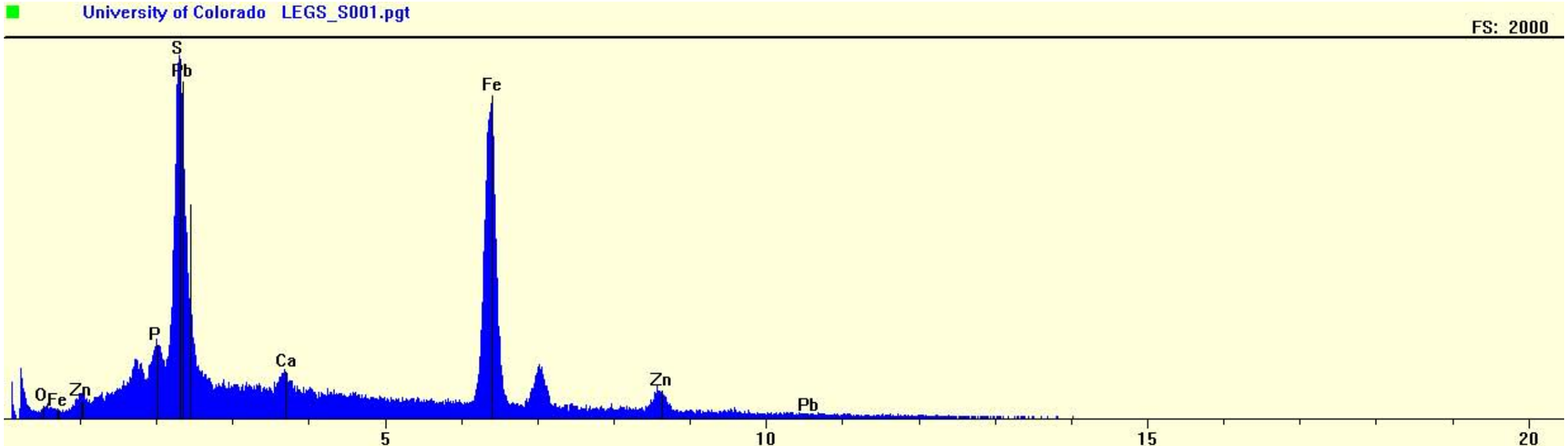
R2-0006180



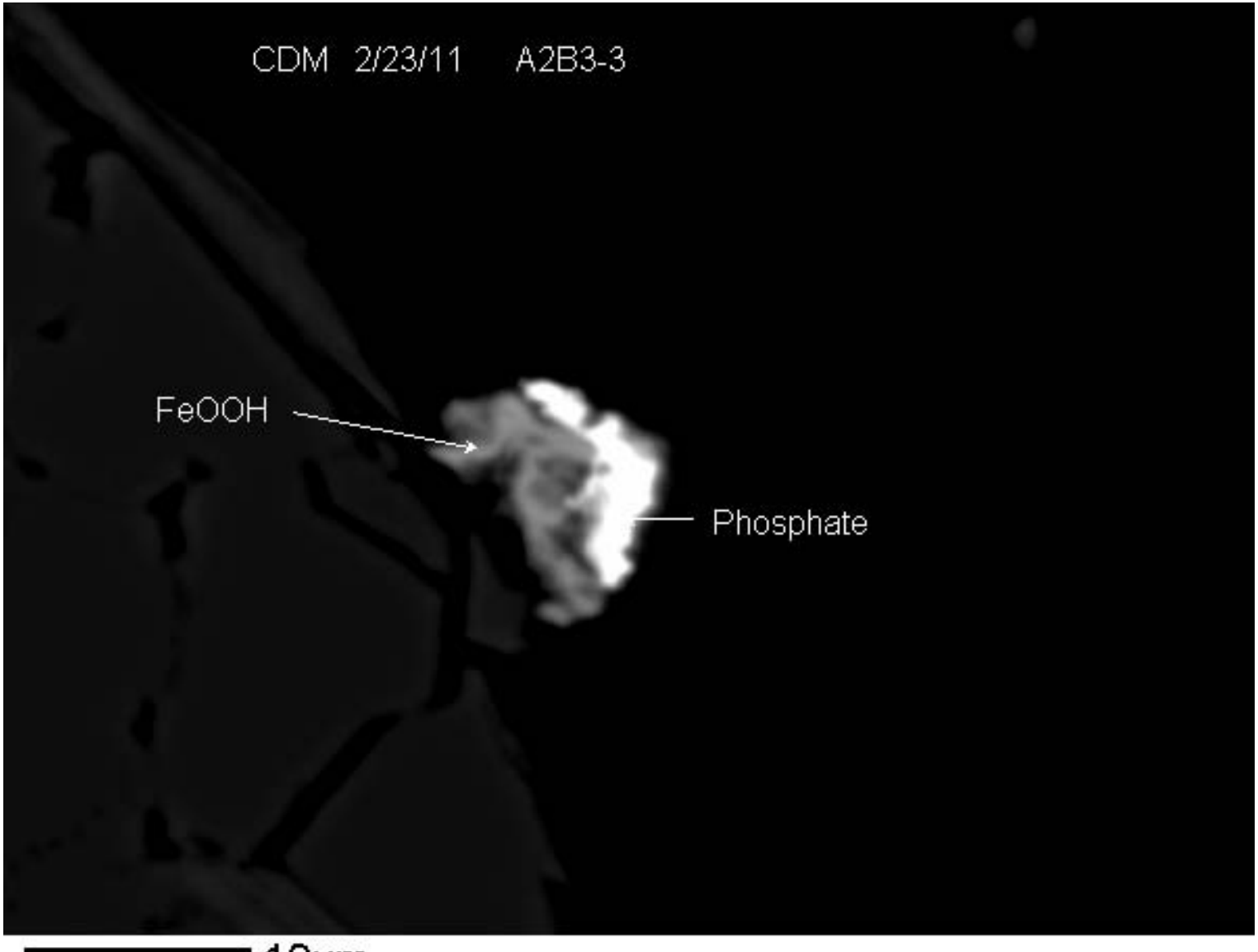
10µm

BEI

R2-0006181


University of Colorado LEGS_S001.pgt
FS: 2000
S
Pb
Fe
P
Ca
Zn
O
Fe
Zn
Pb
5
10
15
20

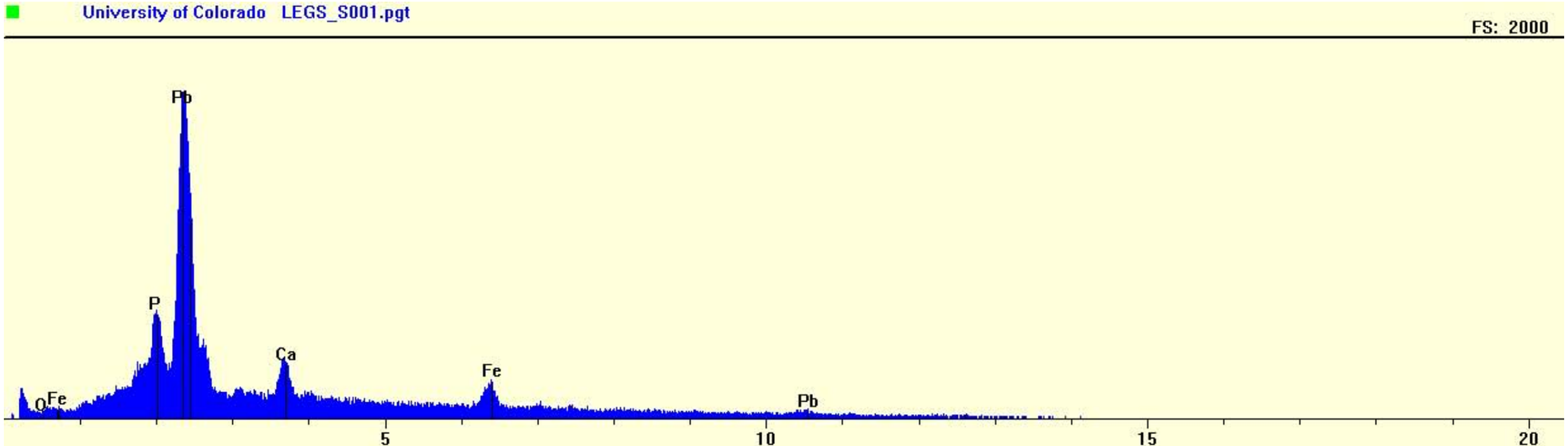
R2-0006182



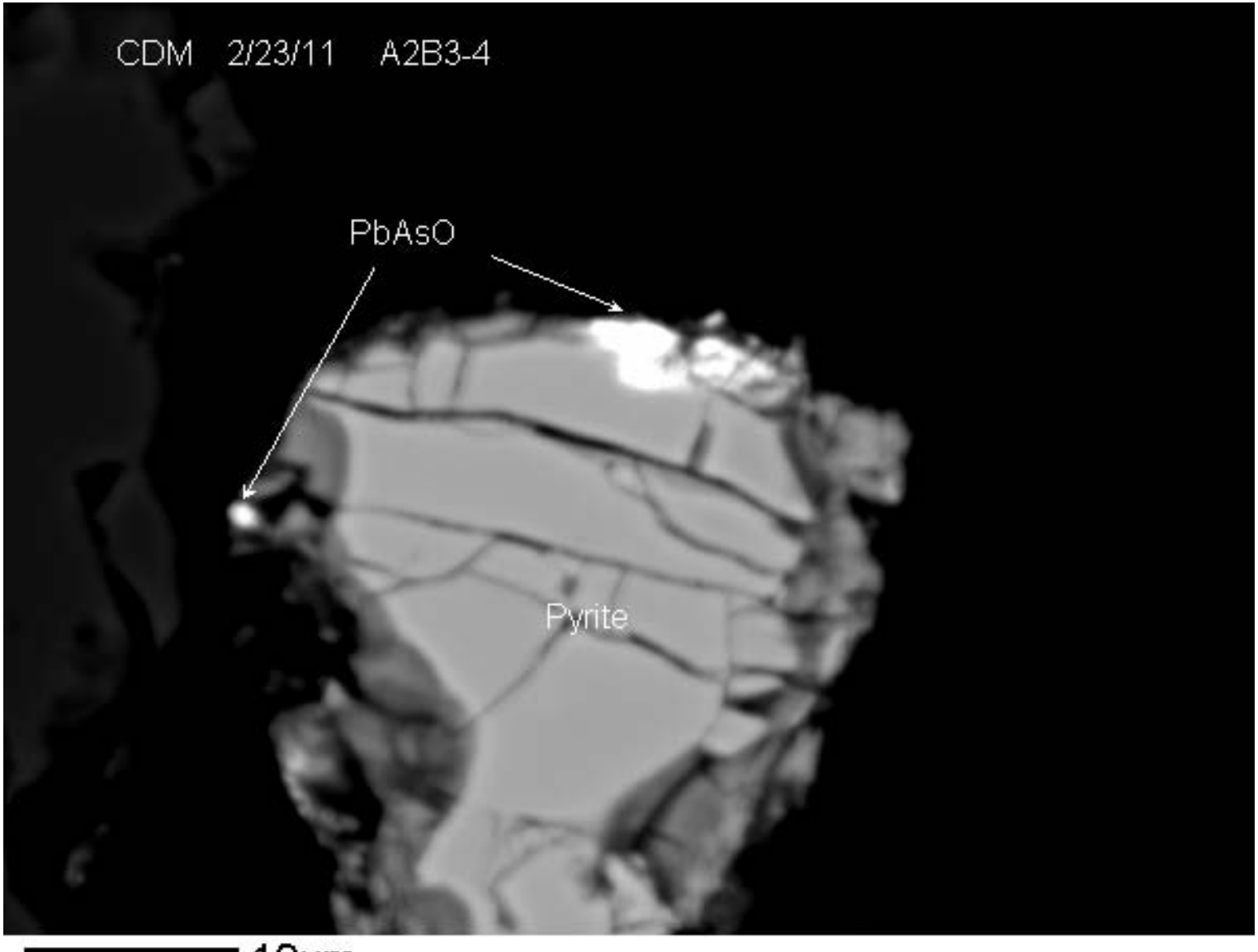
10µm

BEI

R2-0006183


University of Colorado LEGS_S001.pgt
FS: 2000
Pb
P
Ca
Fe
O
Fe
Pb
5
10
15
20

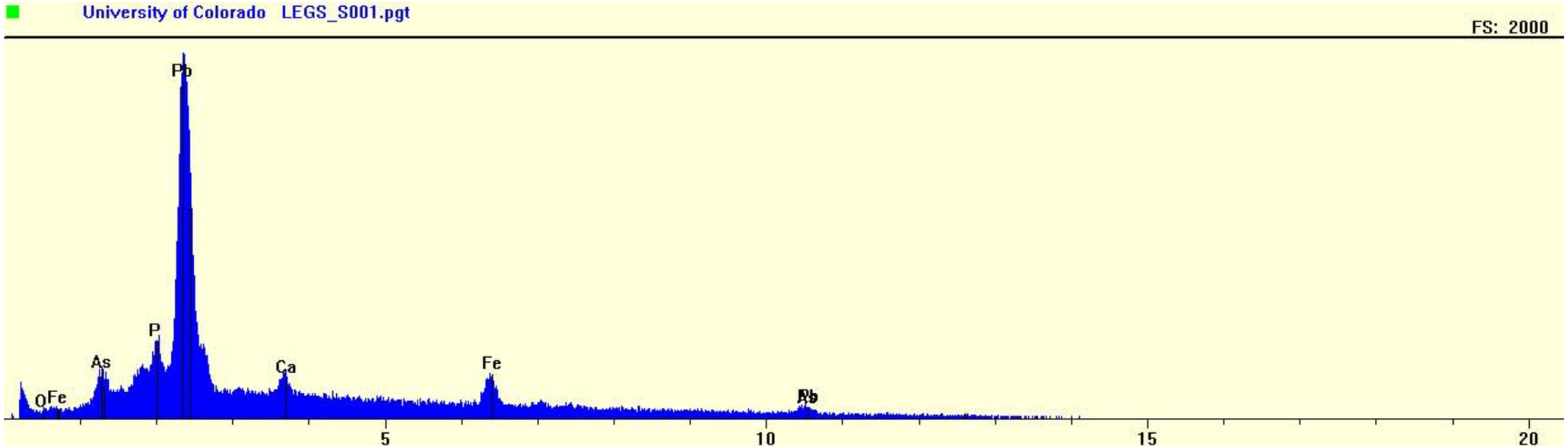
R2-0006184



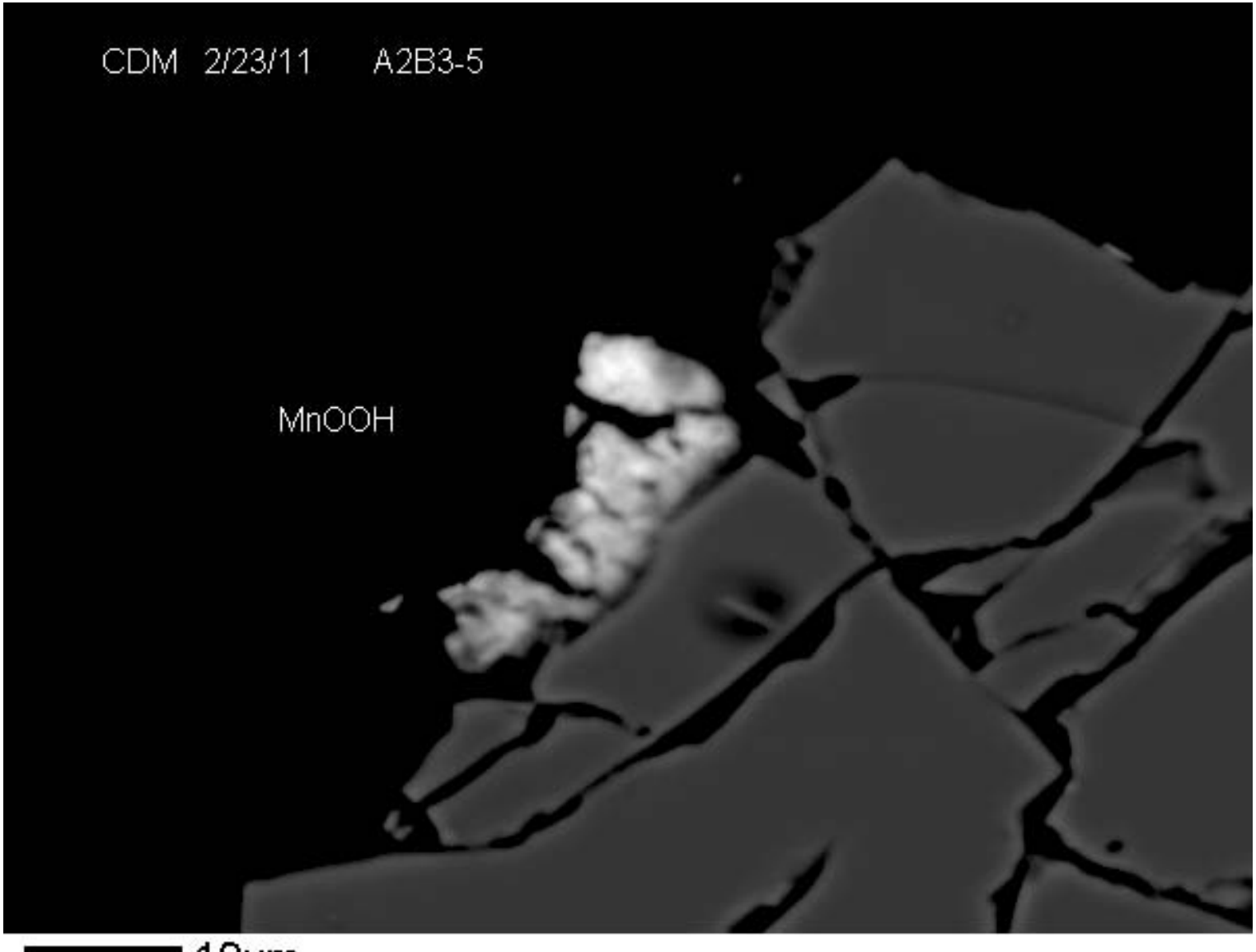
10µm

BEI

R2-0006185


University of Colorado LEGS_S001.pgt
FS: 2000
Pb
P
As
Ca
Fe
O
Fe
Pb
5
10
15
20

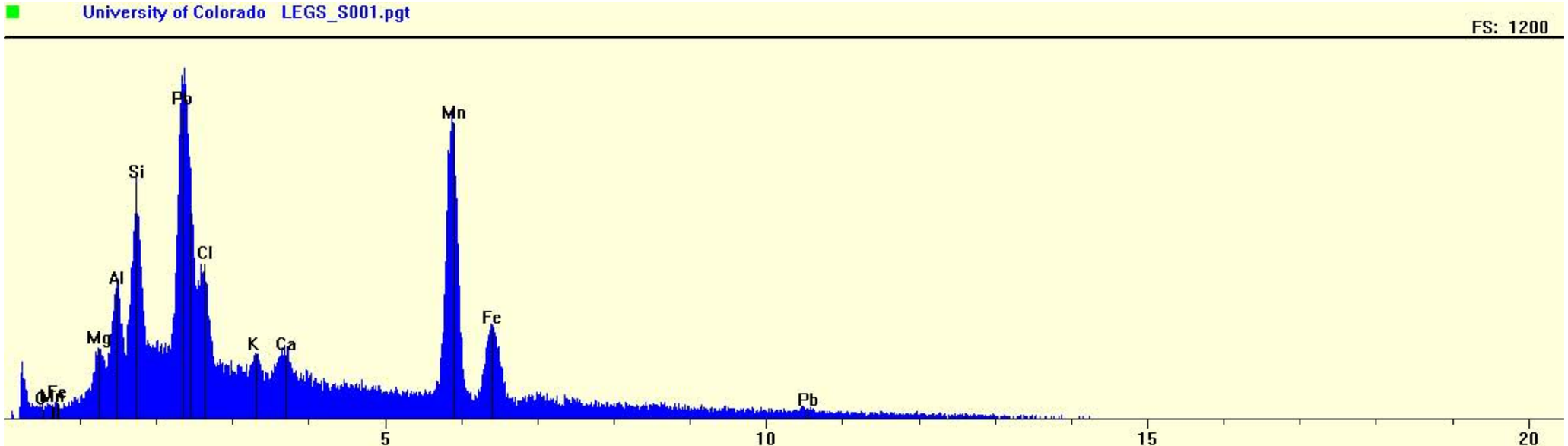
R2-0006186



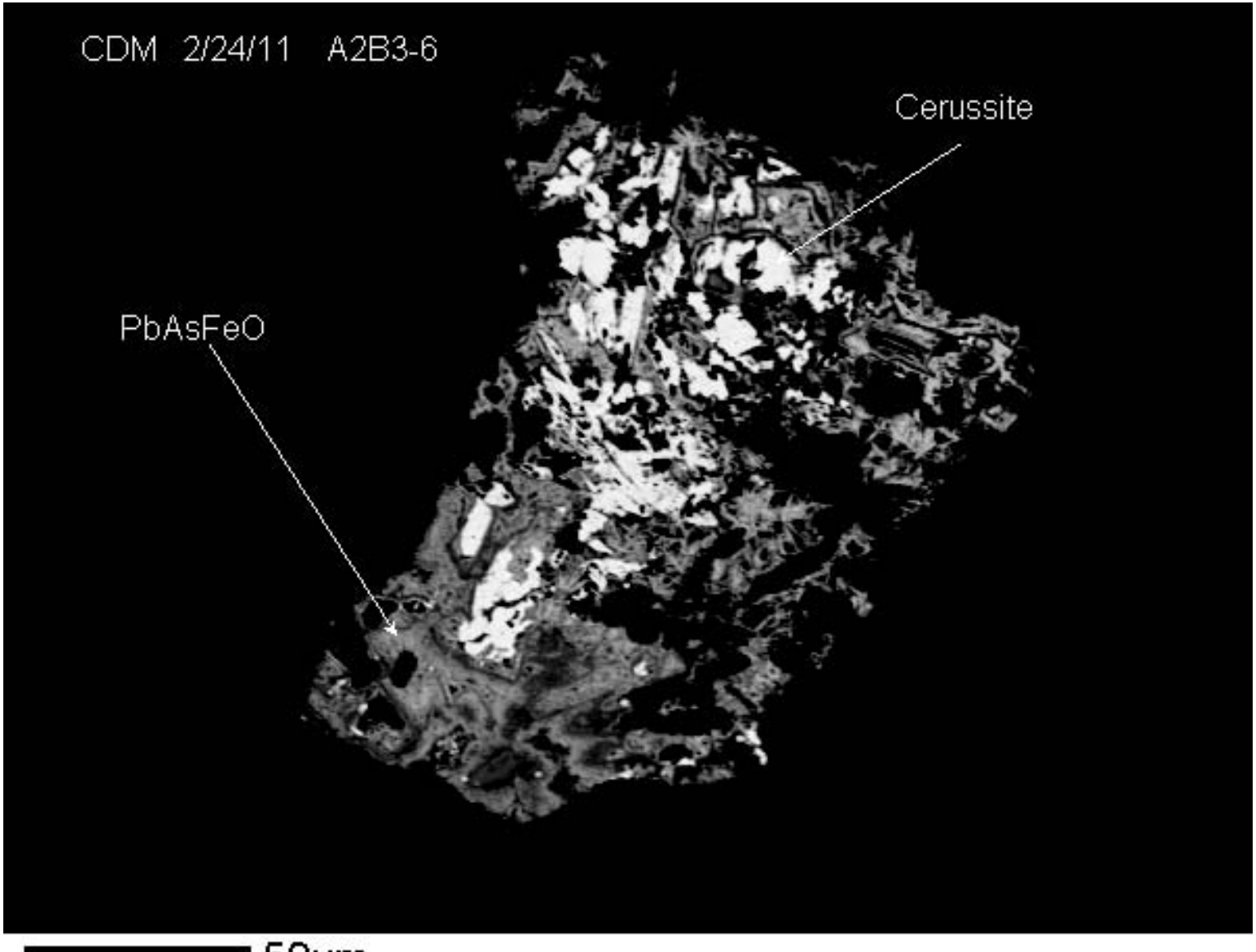
10µm

BEI

R2-0006187


University of Colorado LEGS_S001.pgt
FS: 1200
Pb
Mn
Si
Cl
Al
Fe
Mg
K
Ca
Pb
5
10
15
20

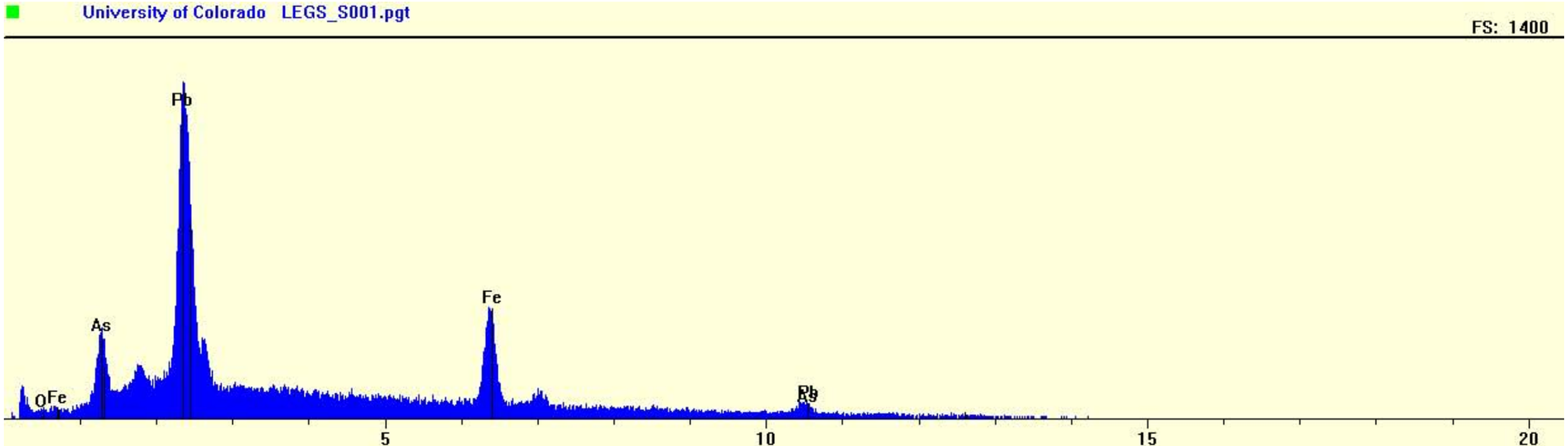
R2-0006188



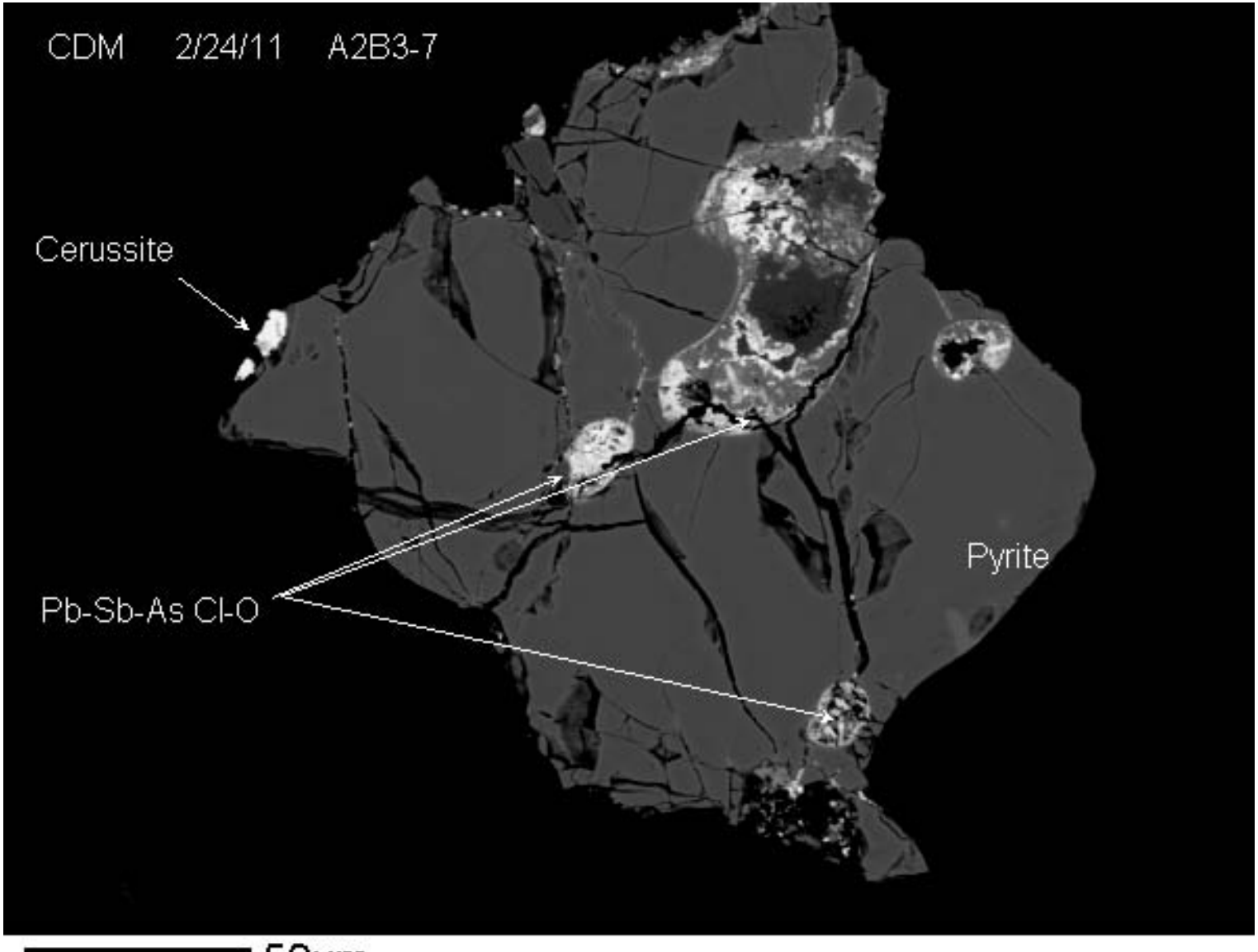
50µm

BEI

R2-0006189


University of Colorado LEGS_S001.pgt
FS: 1400
Pb
Fe
As
O
Fe
Pb
As
5
10
15
20

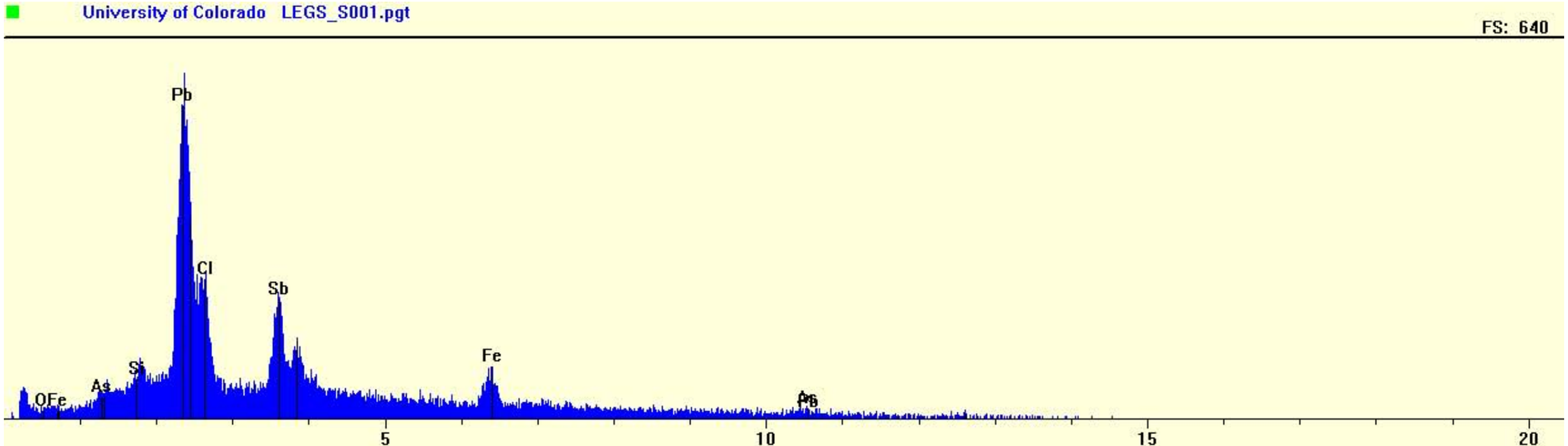
R2-0006190



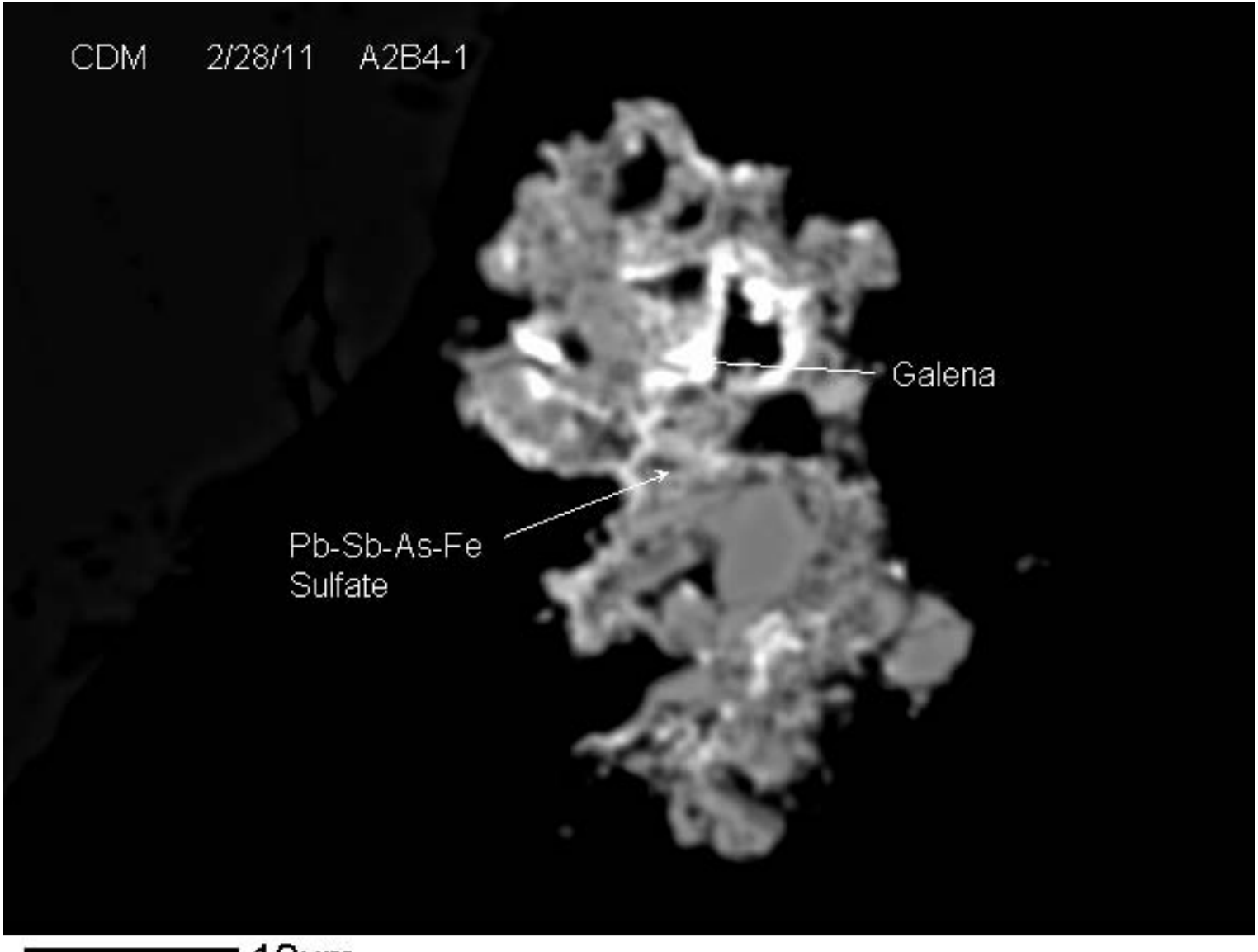
50µm

BEI

R2-0006191


University of Colorado LEGS_S001.pgt
FS: 640
Pb
Cl
Sb
Fe
Si
As
OFe
Pb
5
10
15
20

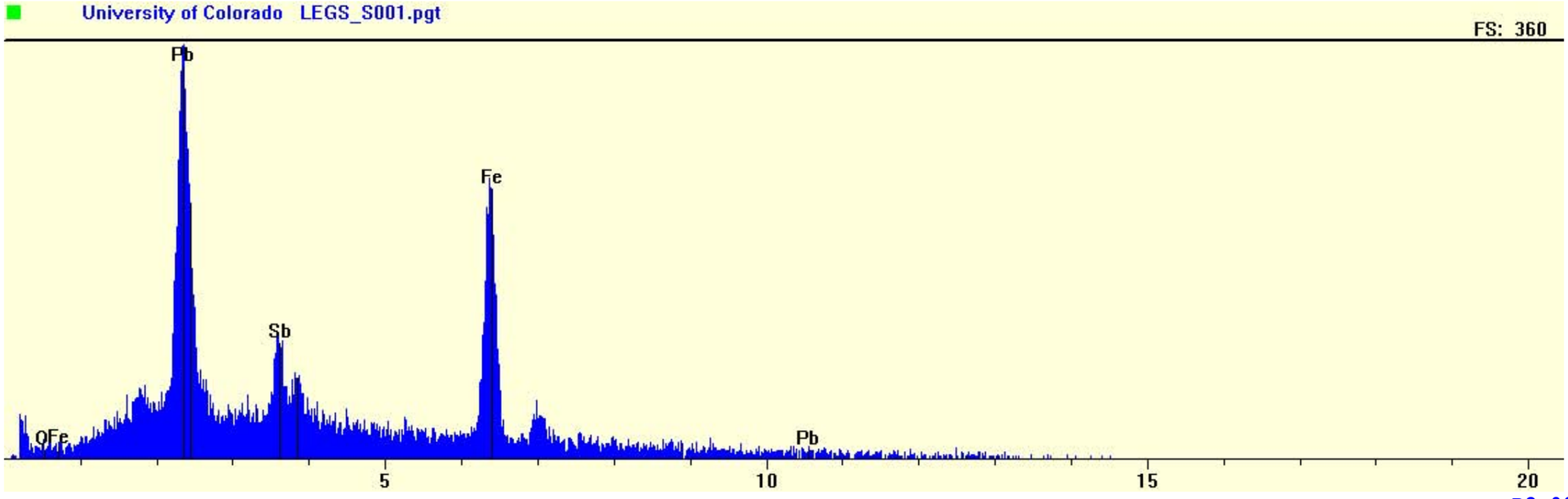
R2-0006192



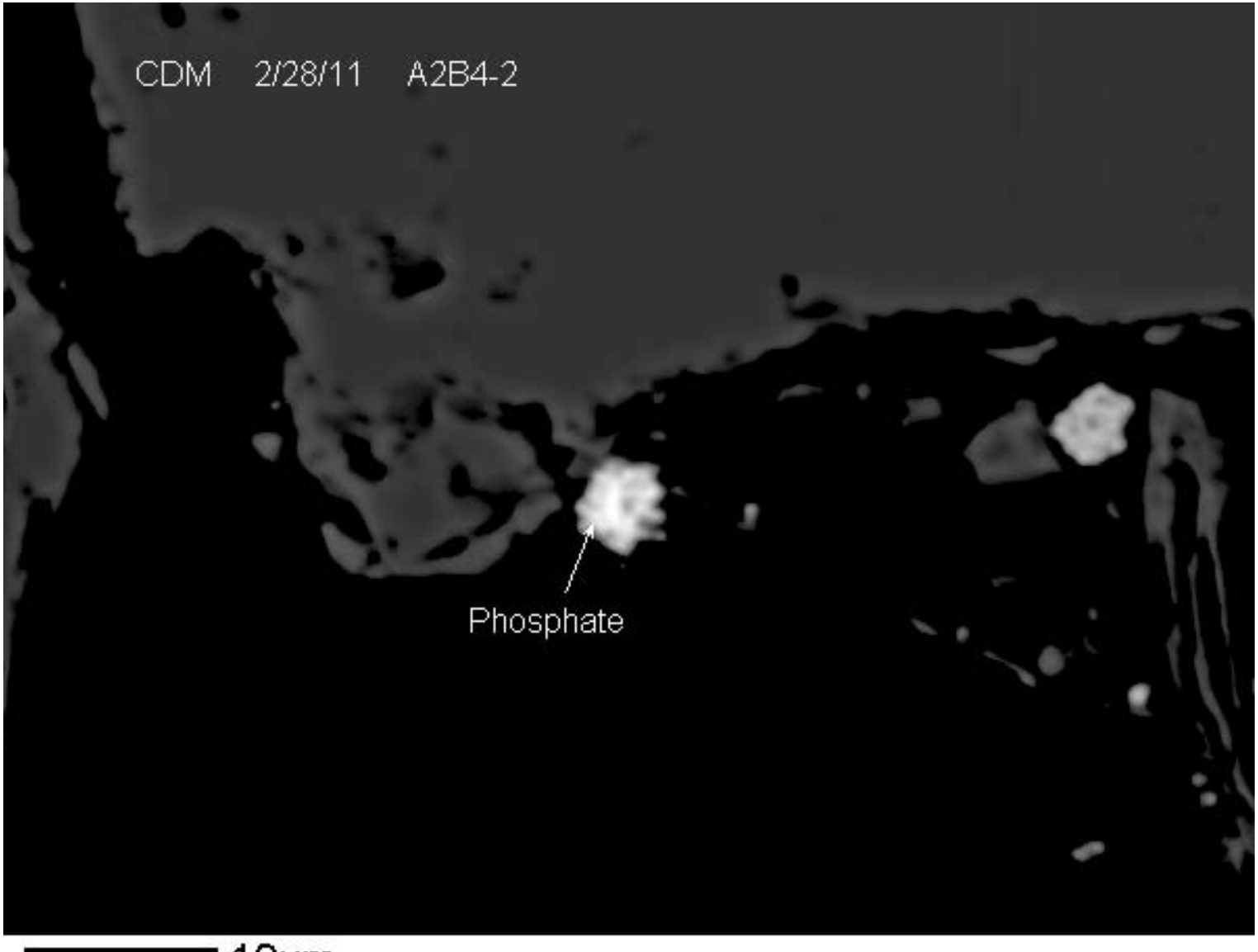
10µm

BEI

R2-0006193


University of Colorado LEGS_S001.pgt
FS: 360
Pb
Fe
Sb
QFe
Pb
5
10
15
20

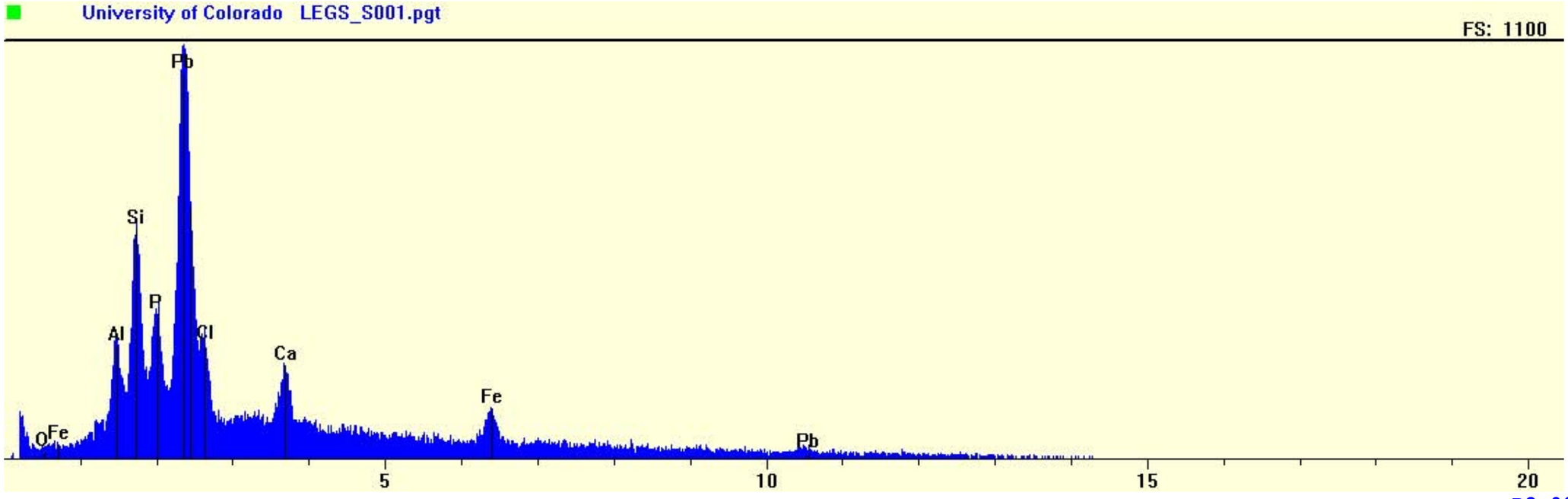
R2-0006194



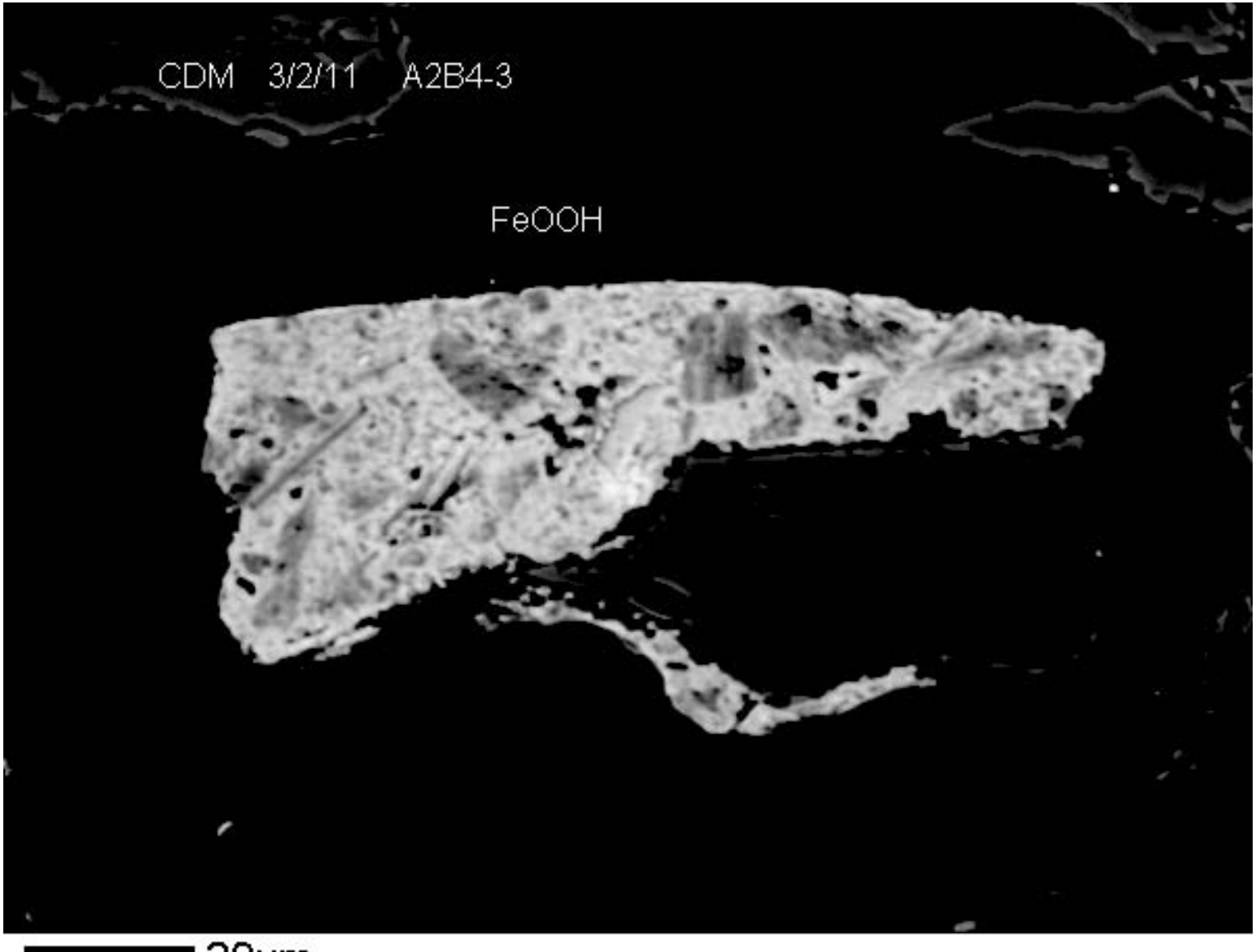
10µm

BEI

R2-0006195


University of Colorado LEGS_S001.pgt
FS: 1100
Pb
Si
P
Al
Cl
Ca
Fe
O
Fe
Pb
5
10
15
20

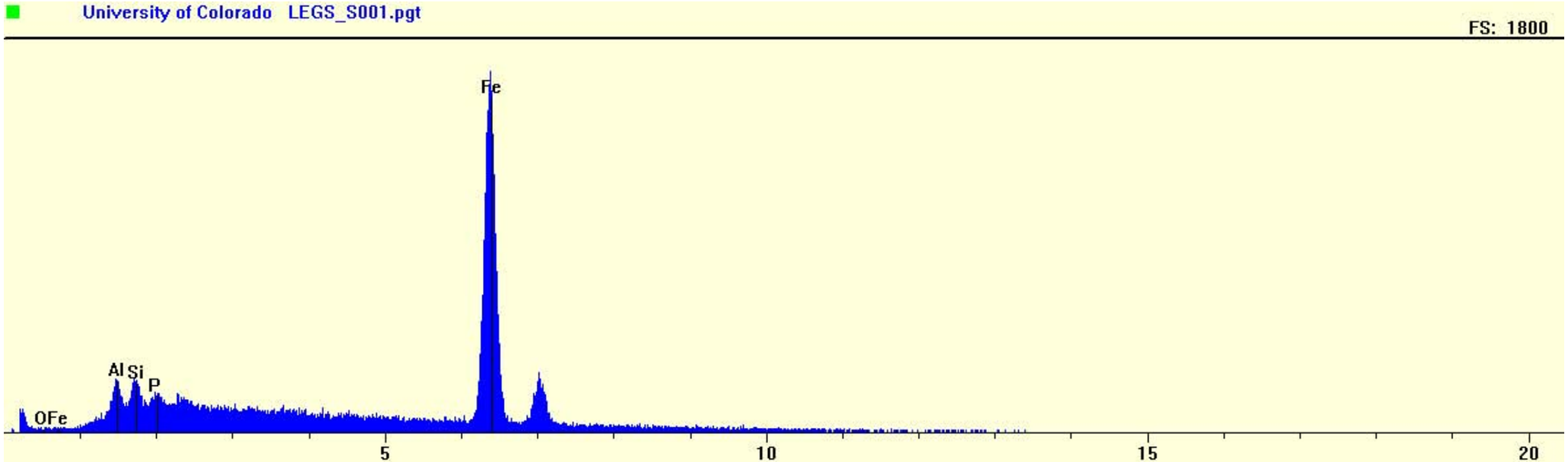
R2-0006196



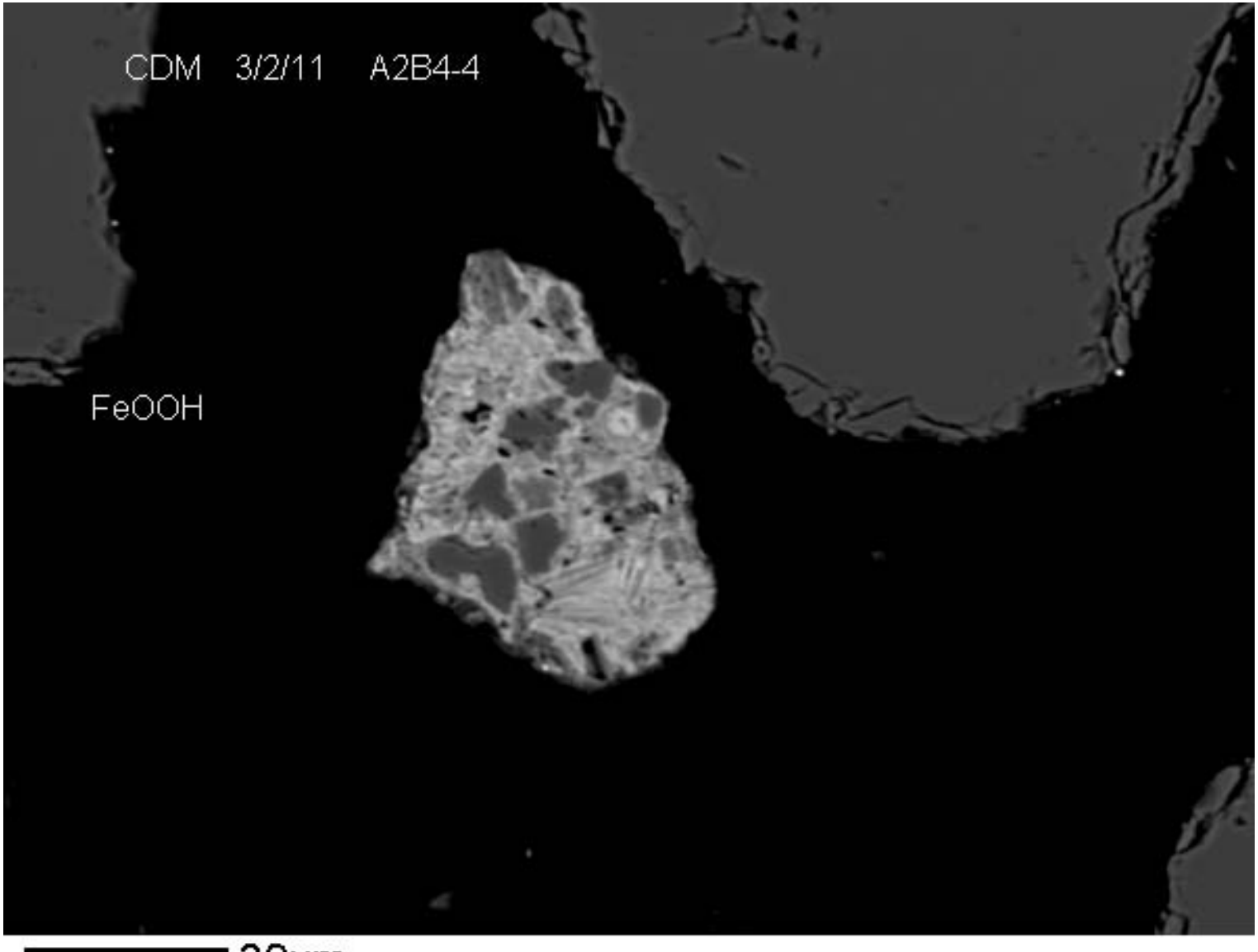
20µm

BEI

R2-0006197


University of Colorado LEGS_S001.pgt
FS: 1800
Fe
Al
Si
P
OFe
5
10
15
20

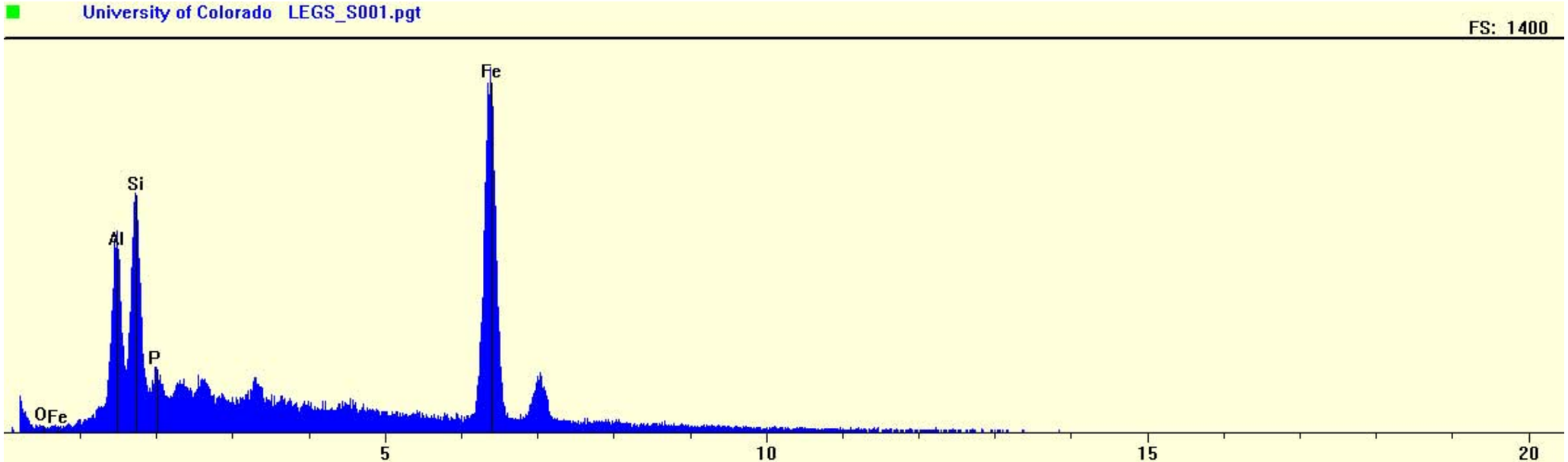
R2-0006198



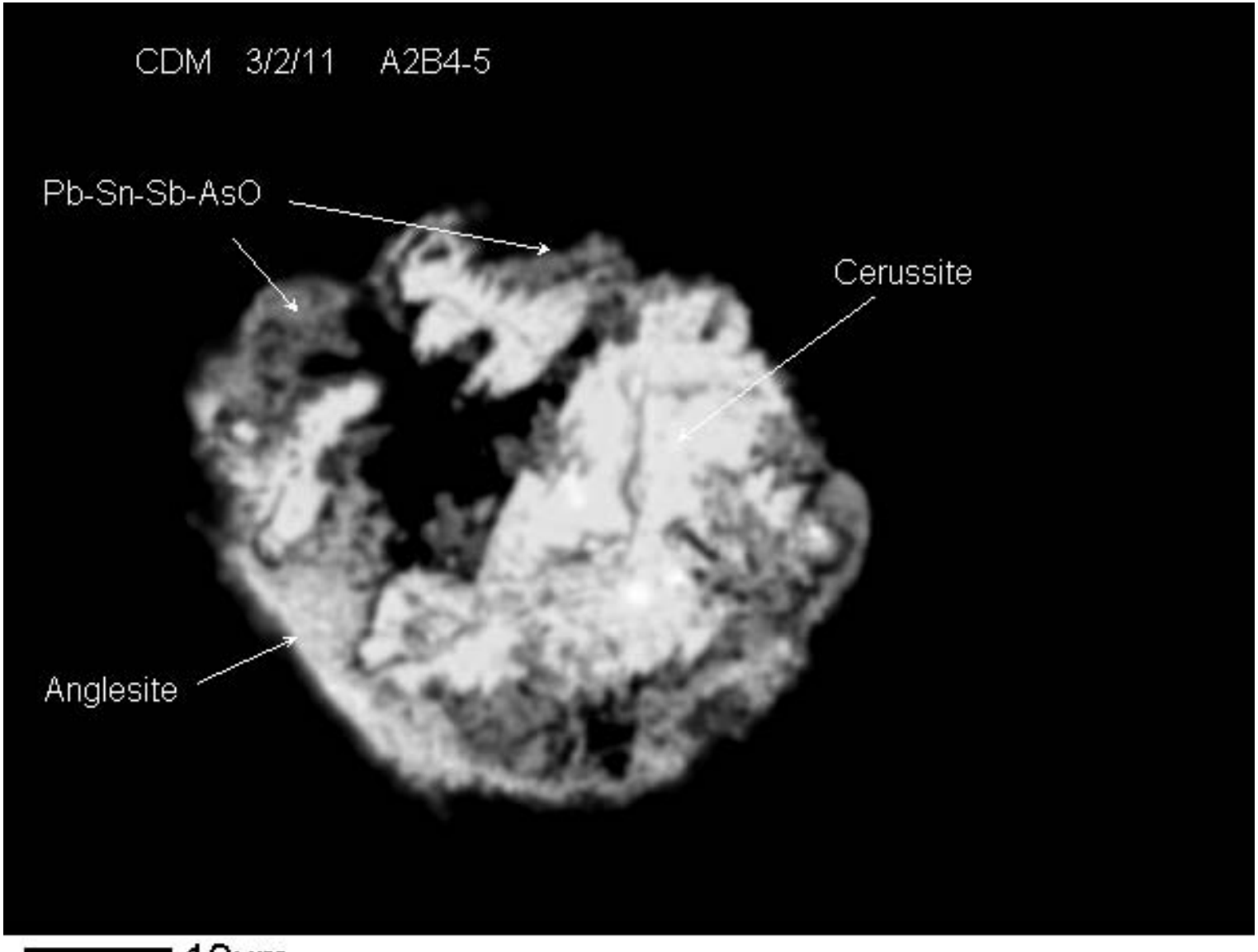
30µm

BEI

R2-0006199


University of Colorado LEGS_S001.pgt
FS: 1400
Fe
Si
Al
P
O
Fe
5
10
15
20

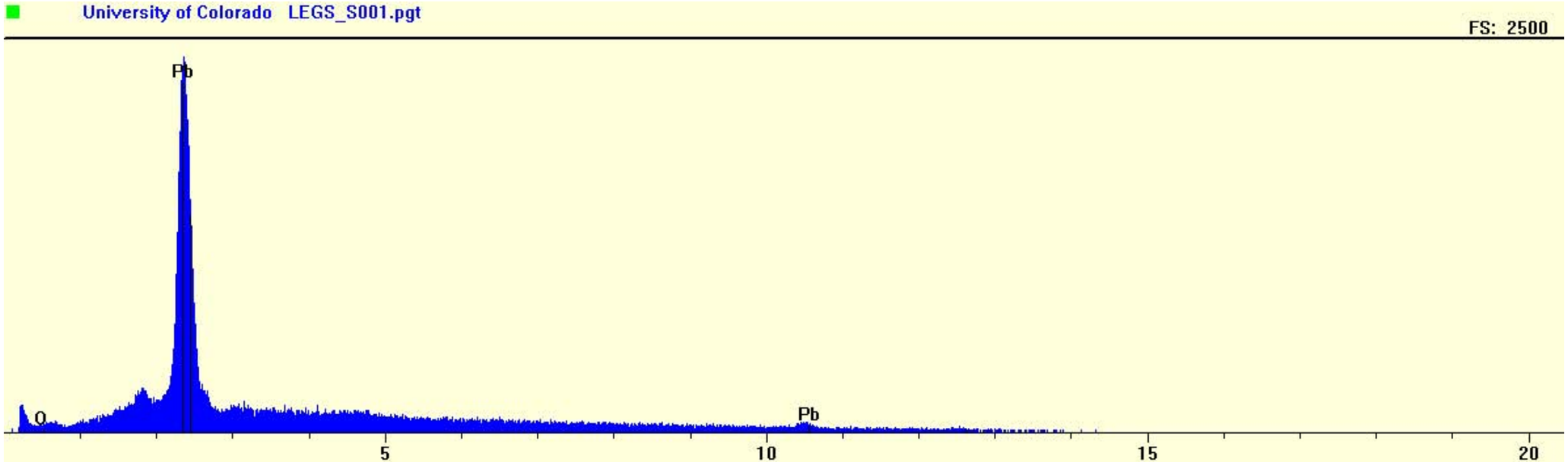
R2-0006200



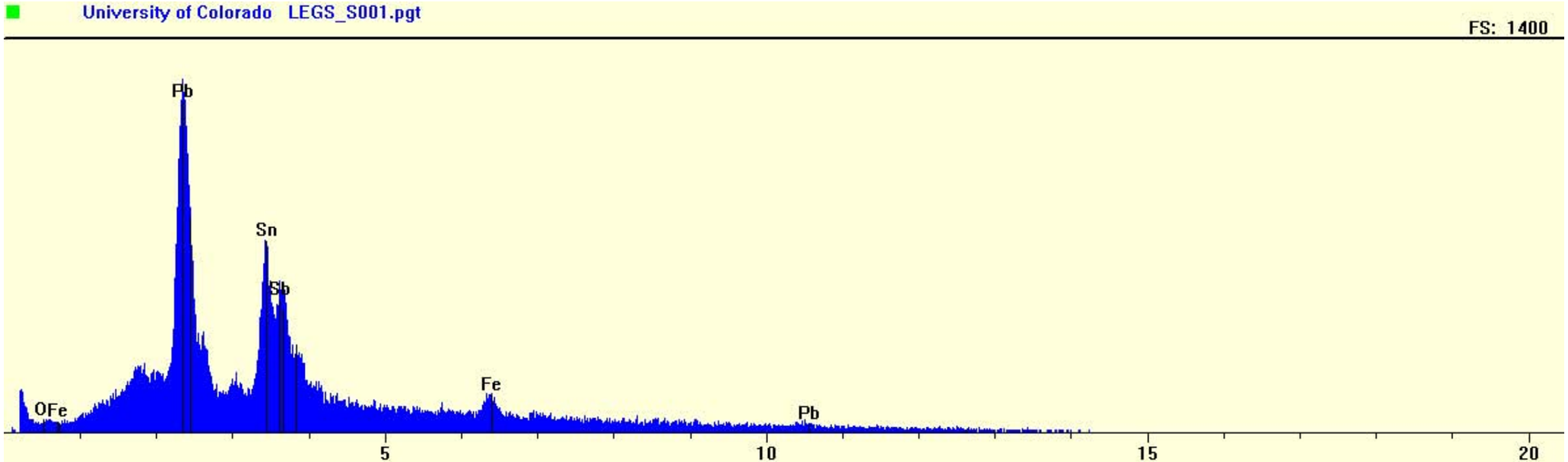
10µm

BEI

R2-0006201



R2-0006202

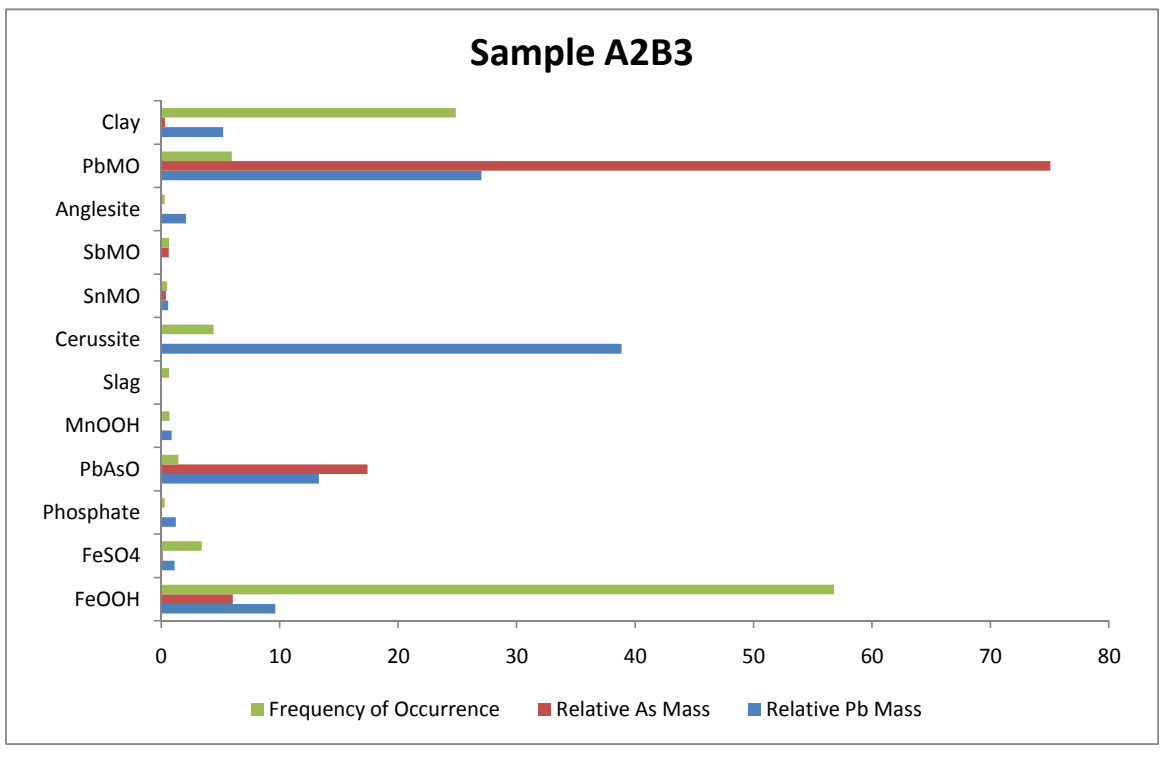

University of Colorado LEGS_S001.pgt
FS: 1400
Pb
Sn
Sb
OFe
Fe
Pb
5
10
15
20

R2-0006203

Form	Association	Size (microns)
Fe	Liberated	7
Fe	Rimming	4
Sulf	Liberated	22
Fe	Rimming	125
Fe	Rimming	80
Fe	Rimming	25
Fe	Rimming	130
Fe	Rimming	20
Fe	Rimming	25
Fe	Rimming	25
Fe	Rimming	25
Fe	Rimming	25
Sulf	Liberated	9
Phos	Liberated	3
Fe	Liberated	5
Fe	Liberated	4
Sulf	Rimming	2
Fe	Liberated	12
Phos	Rimming	8
Fe	Rimming	9
Fe	Rimming	8
Fe	Liberated	6
PbAsO	Rimming	4
PbAsO	Liberated	1
PbAsO	Rimming	2
Mn	Rimming	12
Mn	Liberated	4
Mn	Liberated	5
Sulf	Liberated	4
Fe	Liberated	12
Fe	Liberated	4
Fe	Liberated	16
Fe	Liberated	8
Sulf	Liberated	4
Fe	Liberated	26
Fe	Liberated	80
Fe	Rimming	30
Fe	Rimming	25
Fe	Rimming	25
Slag	Liberated	26
Fe	Rimming	11
Fe	Rimming	4
Fe	Rimming	12
Fe	Rimming	3
Fe	Rimming	17
Fe	Rimming	12
Cer	Liberated	8
Sulf	Liberated	4
Fe	Liberated	10
Fe	Rimming	52
Sulf	Rimming	6
Fe	Rimming	5
Fe	Liberated	135
Sulf	Liberated	8
Sulf	Liberated	9
Sulf	Liberated	5
Mn	Rimming	6
Fe	Rimming	70
Fe	Rimming	35
Fe	Liberated	30
Fe	Liberated	28
Fe	Liberated	23
Fe	Liberated	25
Sulf	Liberated	7
Fe	Liberated	85
Fe	Rimming	50
Fe	Rimming	115
Fe	Rimming	85
Fe	Rimming	10
Fe	Rimming	10
Fe	Rimming	10
Fe	Rimming	35
snmo	Liberated	8
Fe	Liberated	150
Fe	Rimming	26
Fe	Rimming	8
Sulf	Liberated	9
snmo	Rimming	5
Cer	Inclusion	7
Cer	Inclusion	2
Cer	Inclusion	4
Fe	Liberated	85
Sulf	Rimming	4
Fe	Cemented	125
PbAsO	Inclusion	3
PbAsO	Inclusion	4
PbAsO	Inclusion	1
PbAsO	Inclusion	2
PbAsO	Inclusion	2

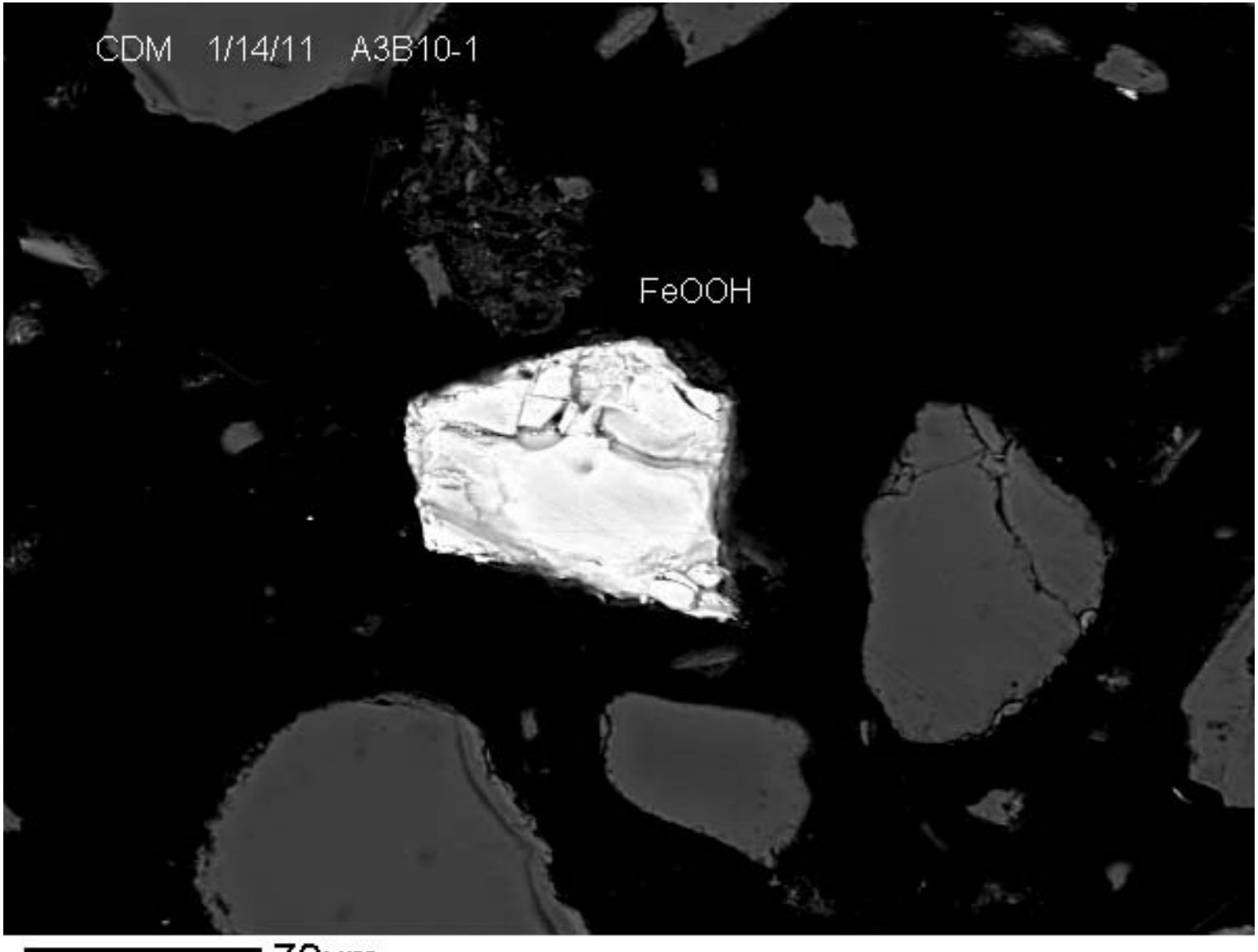
Form	Number	Mean	Std-Dev	Range low	Range high
total	150	26	38.65	1	165
FeOOH	60	36.92	38.77	3	150
FeSO4	15	8.87	6.88	2	26
Phosphate	2	5.5	3.54	3	8
PbAsO	23	2.48	2.23	1	8
MnOOH	4	6.75	3.59	4	12
Slag	1	26	ND	26	26
Cerussite	19	9.05	4.86	2	20
SnMO	3	6.67	1.53	5	8
SbMO	6	4.33	1.63	1	5
Anglesite	1	11	ND	11	11
PbMO	8	70	54	3	125
Clay	8	121.25	38.87	58	165

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	56.79	57.76	9.63	10.71	6.03	6.41	7.93
FeSO4	3.41	3.47	1.12	1.24	0.12	0.13	2.9
Phosphate	0.28	0.29	1.22	1.36	0.03	0.03	0.85
PbAsO	1.46	1.17	13.3	11.66	17.41	14.61	1.92
MnOOH	0.69	0.7	0.89	0.99	0.03	0.03	1.33
Slag	0.67	0.68	0.03	0.03	0	0	1.3
Cerussite	4.41	4.15	38.87	39.96	0	0	3.29
SnMO	0.51	0.52	0.57	0.63	0.38	0.4	1.14
SbMO	0.67	0.52	0.02	0.01	0.63	0.33	1.3
Anglesite	0.28	0.29	2.09	2.33	0	0	0.85
PbMO	5.95	5.16	27.03	25.27	75.07	77.74	2.71
Clay	24.87	25.29	5.23	5.82	0.3	0.32	6.92



Sulf	Liberated	26
Cer	Rimming	3
Sulf	Liberated	14
sbmo	Inclusion	5
sbmo	Inclusion	1
Fe	Liberated	24
snmo	Rimming	7
Fe	Liberated	31
Ang	Liberated	11
sbmo	Rimming	5
sbmo	Rimming	5
sbmo	Rimming	5
sbmo	Rimming	5
Fe	Liberated	80
pbmo	Liberated	125
Cer	Cemented	20
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	10
Cer	Cemented	20
PbMO	Inclusion	3
PbMO	Inclusion	12
PbMO	Inclusion	14
Cer	Rimming	6
Cer	Rimming	2
PbAsO	Cemented	8
PbAsO	Cemented	7
PbAsO	Cemented	6
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbAsO	Cemented	1
PbMO	Rimming	6
PbMO	Inclusion	5
PbMO	Rimming	5
Fe	Liberated	28
PbAsO	Rimming	6
AlSi	Liberated	160
AlSi	Liberated	135
AlSi	Liberated	58
AlSi	Liberated	85
AlSi	Liberated	132
AlSi	Liberated	165
AlSi	Rimming	145
AlSi	Liberated	90
PbMO	Liberated	62

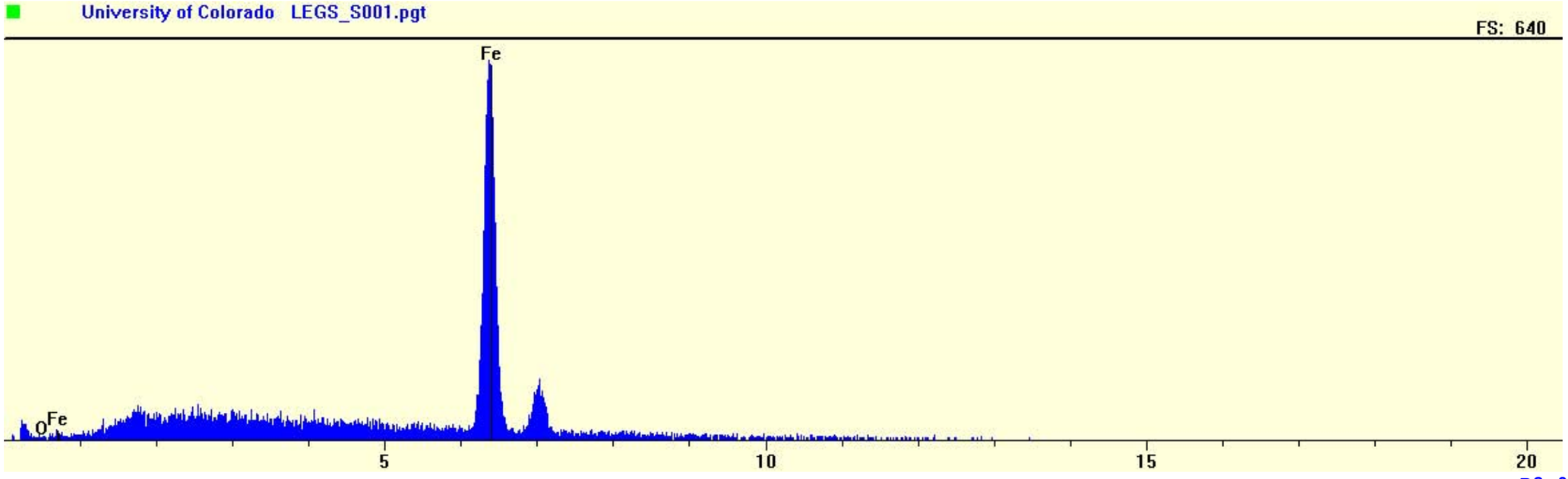
A3B10



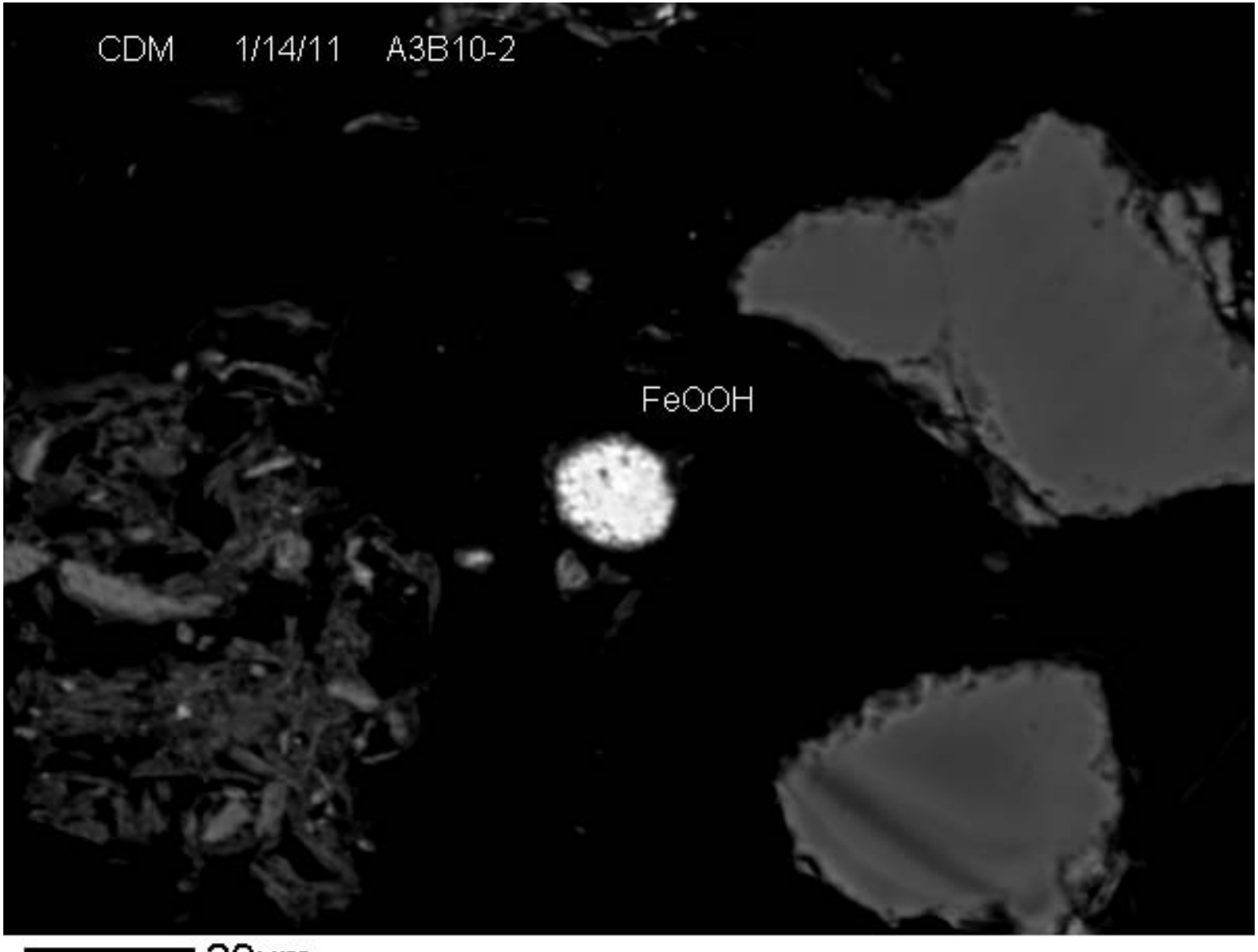
70µm

BEI

R2-0006207



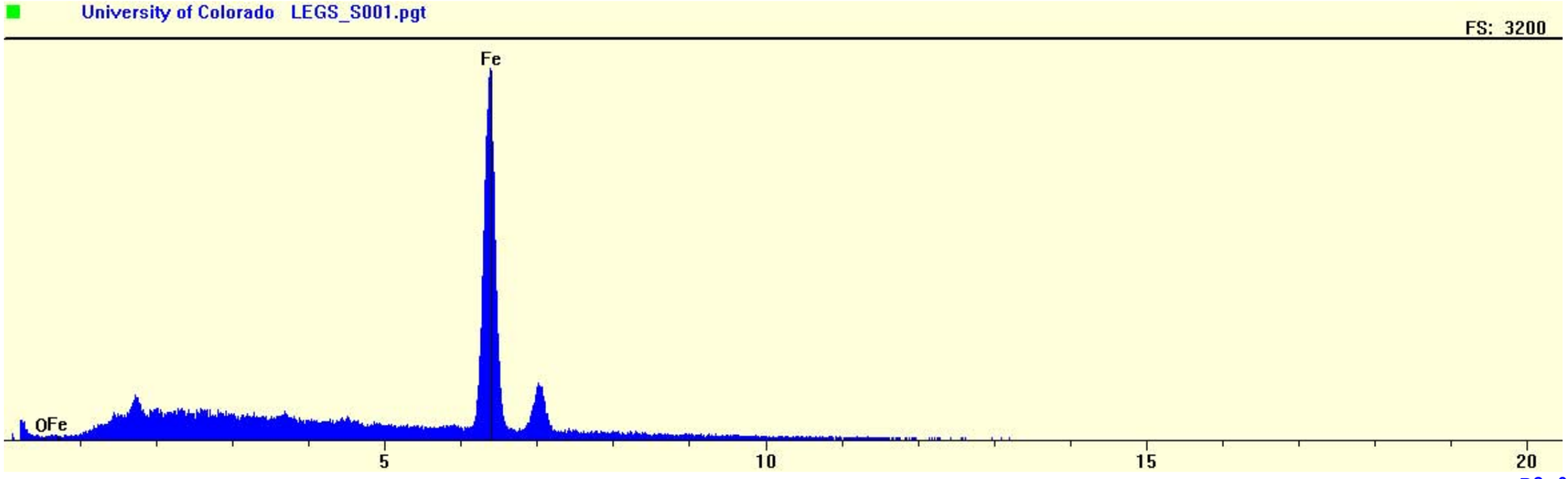
R2-0006208



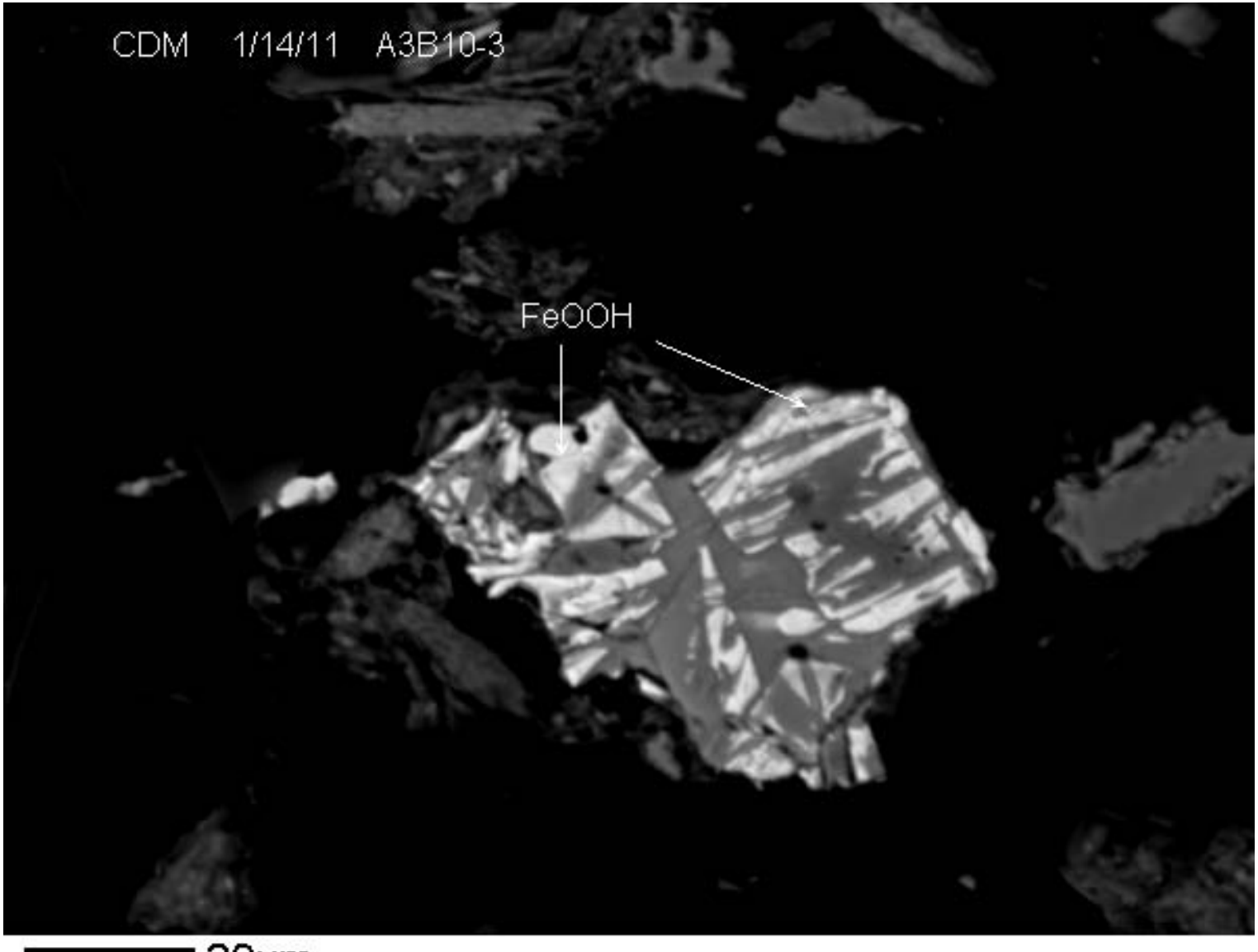
20µm

BEI

R2-0006209



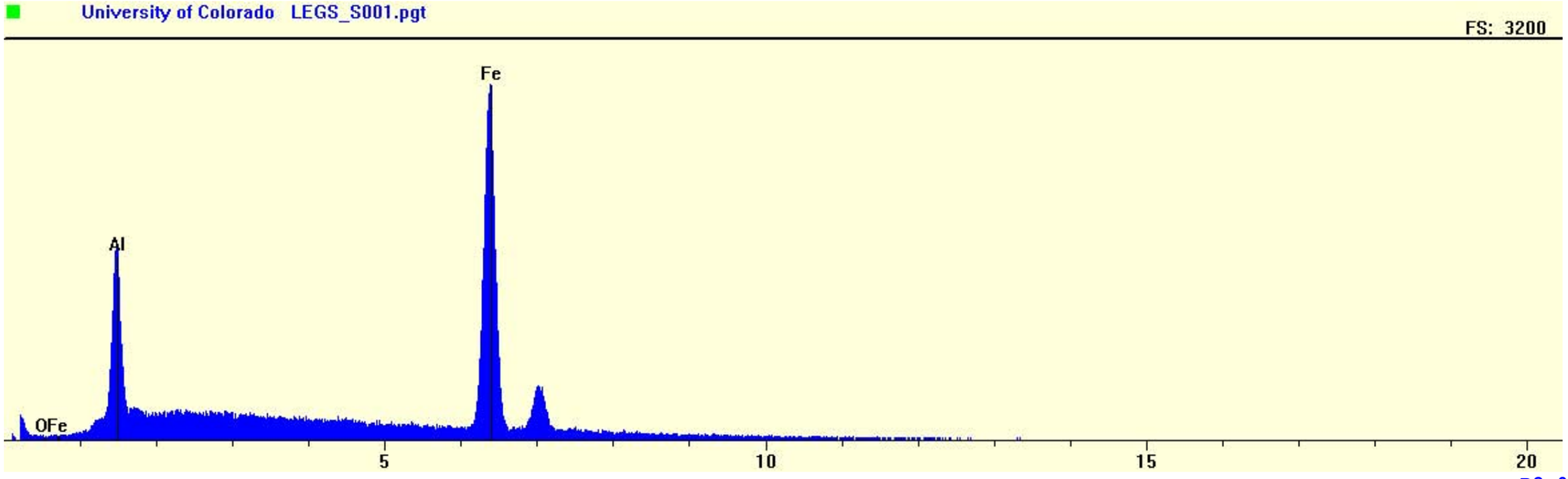
R2-0006210



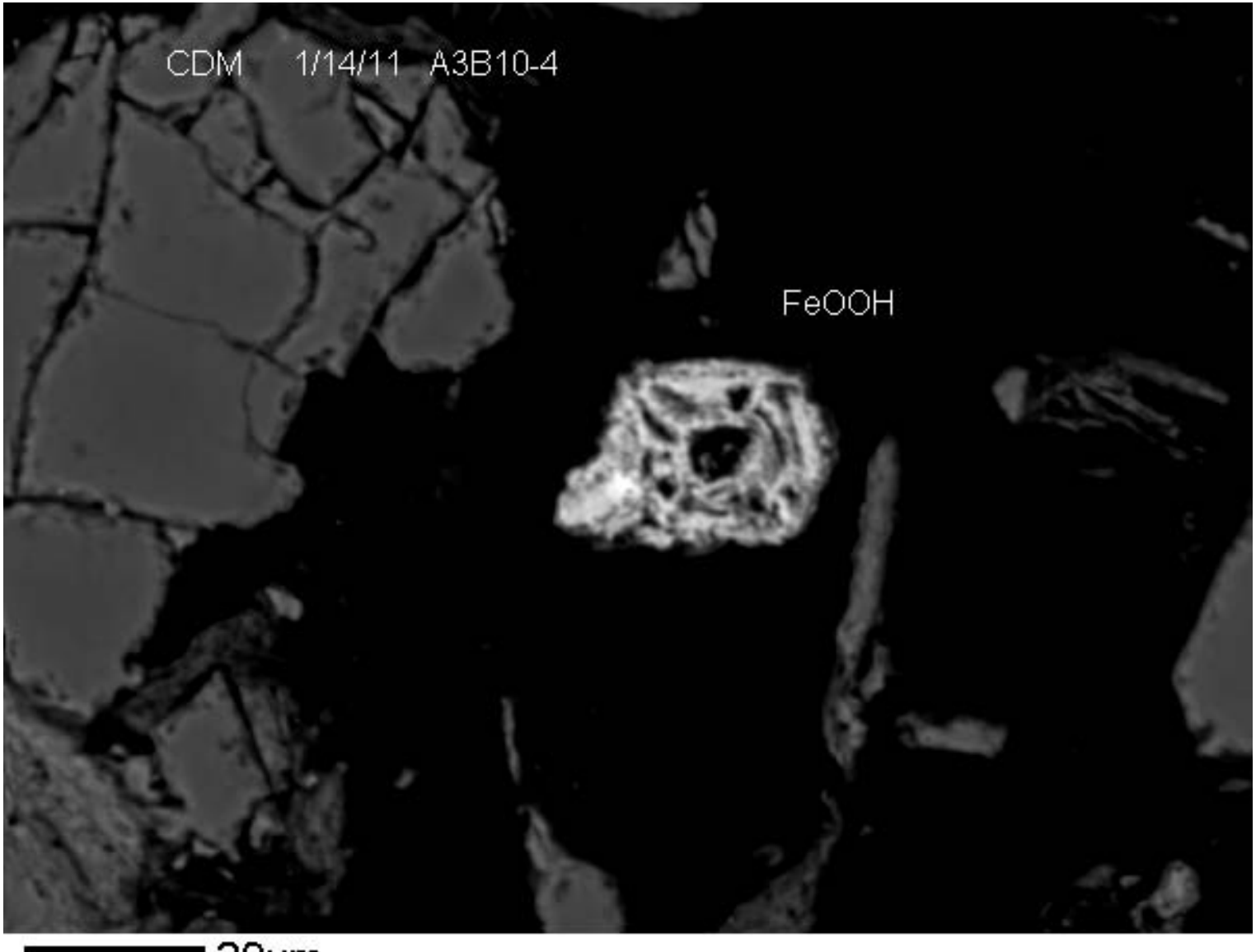
20µm

BEI

R2-0006211


University of Colorado LEGS_S001.pgt
FS: 3200
Fe
Al
OFe
5
10
15
20

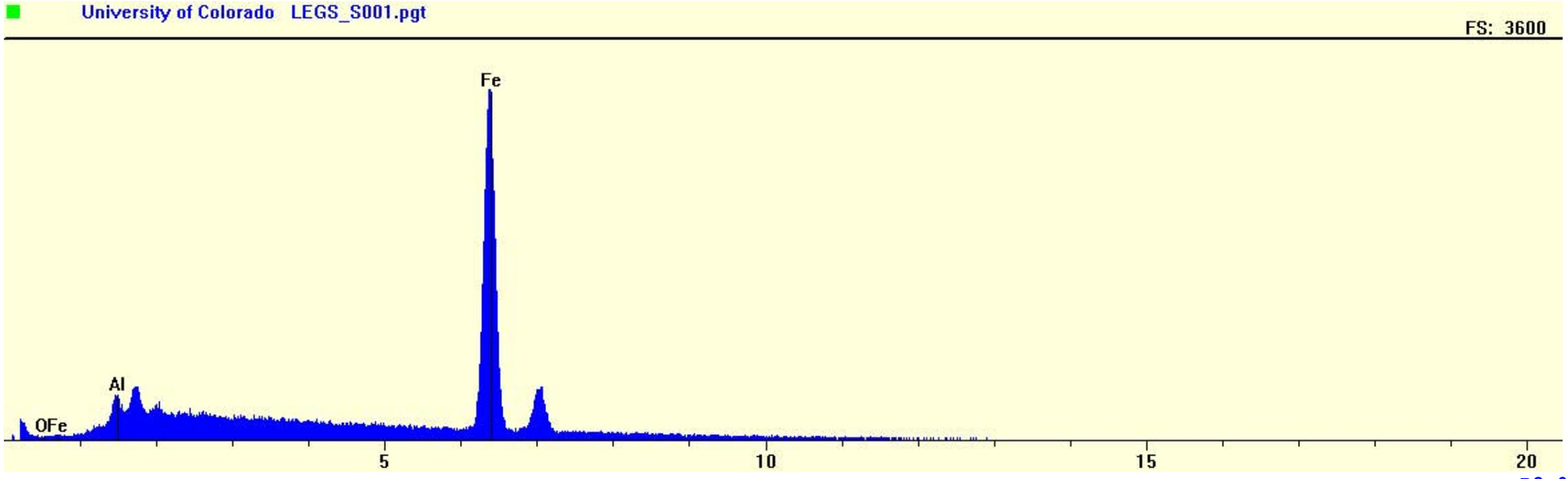
R2-0006212



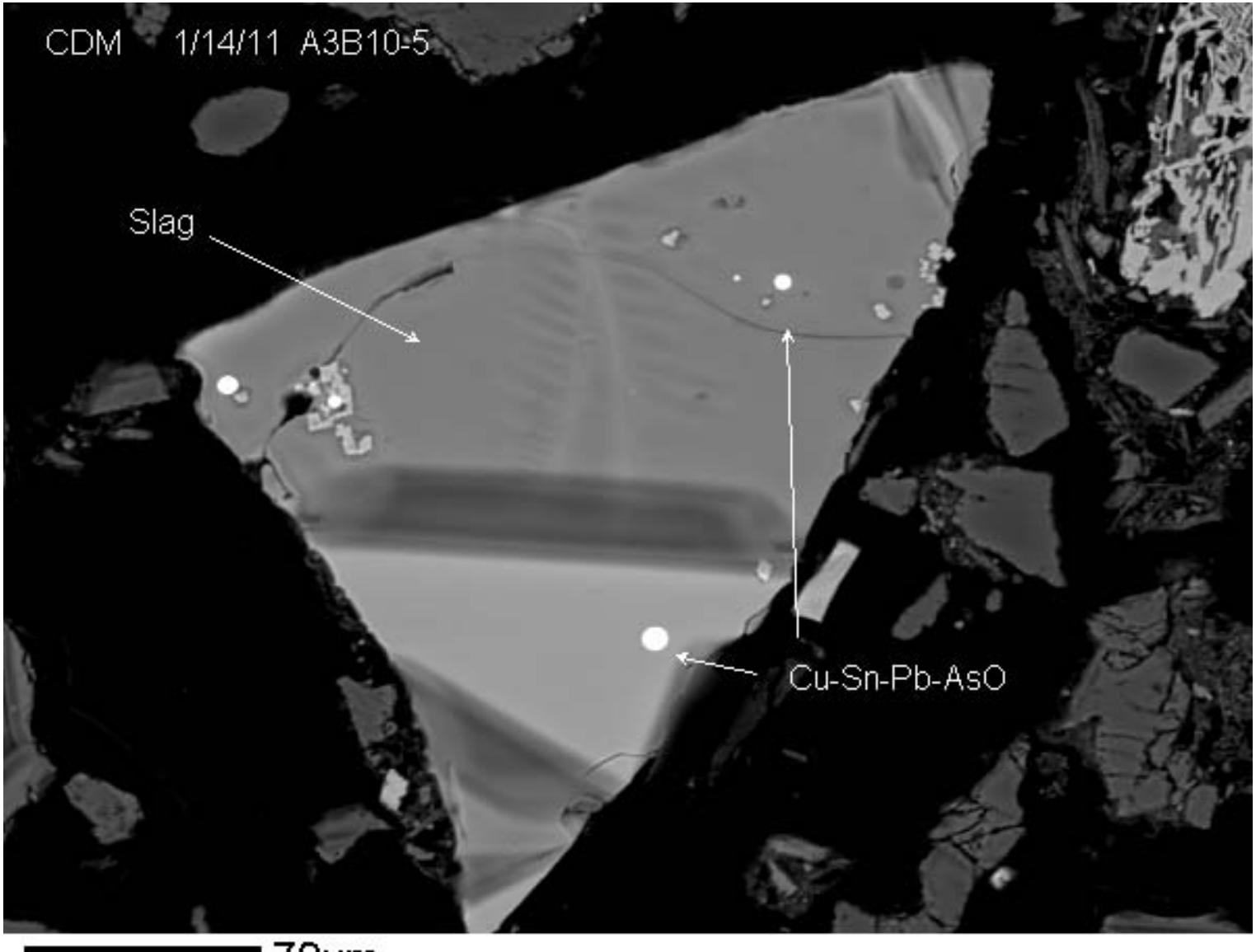
20µm

BEI

R2-0006213


University of Colorado LEGS_S001.pgt
FS: 3600
Fe
Al
OFe
5
10
15
20

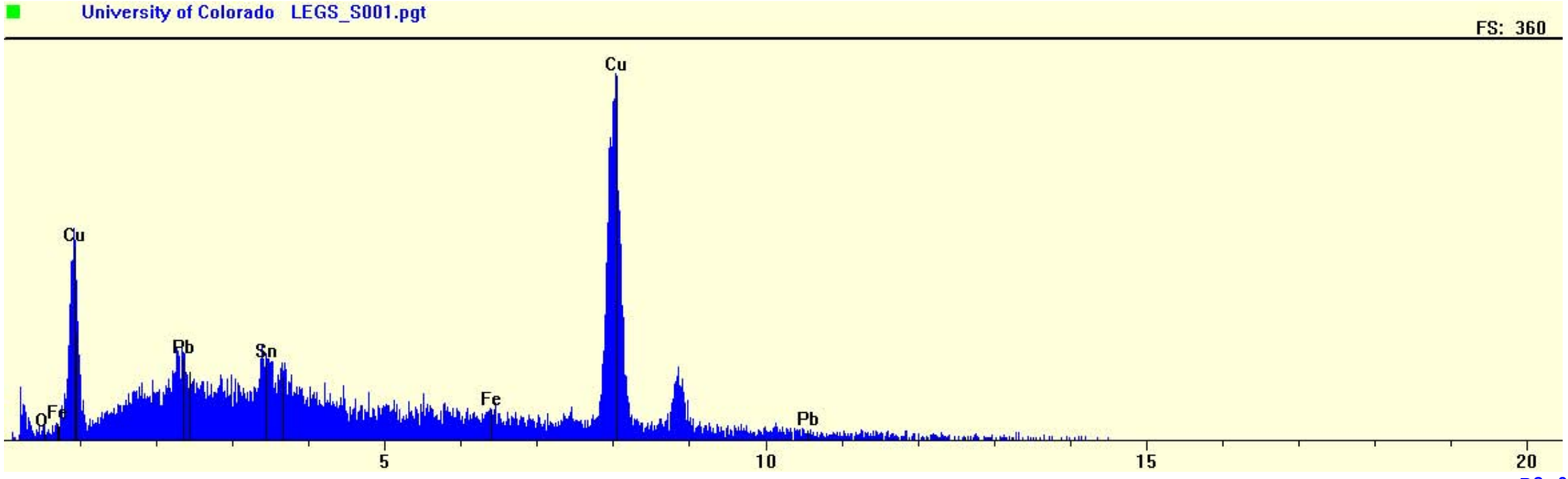
R2-0006214



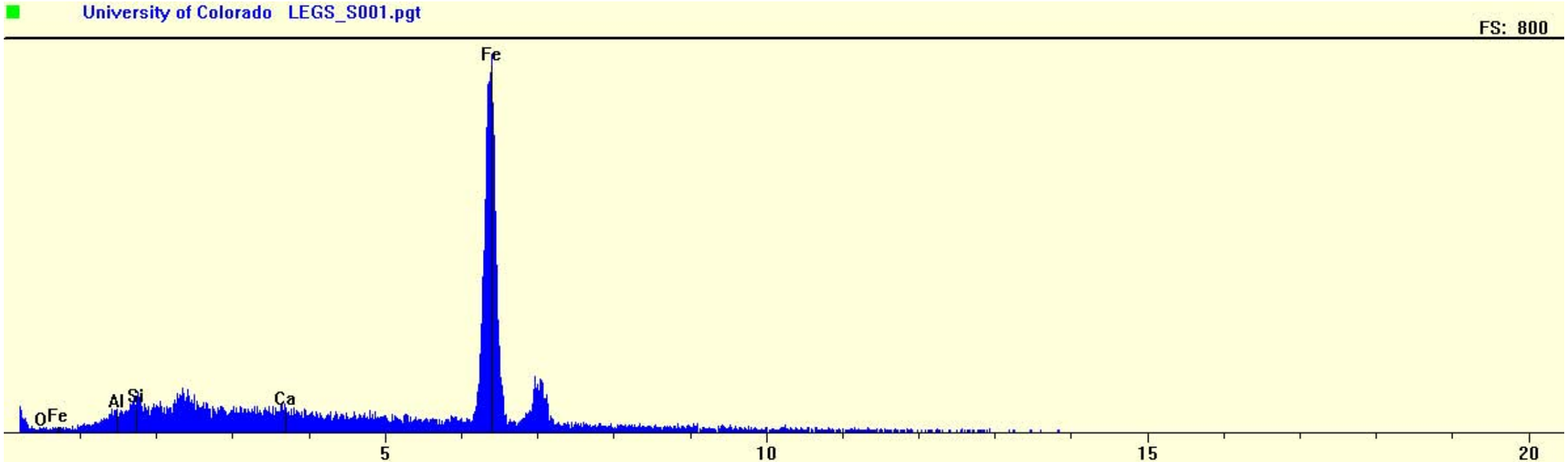
70µm

BEI

R2-0006215


University of Colorado LEGS_S001.pgt
FS: 360
Cu
Cu
Pb
Sn
Fe
O
Fe
Pb
5
10
15
20

R2-0006216

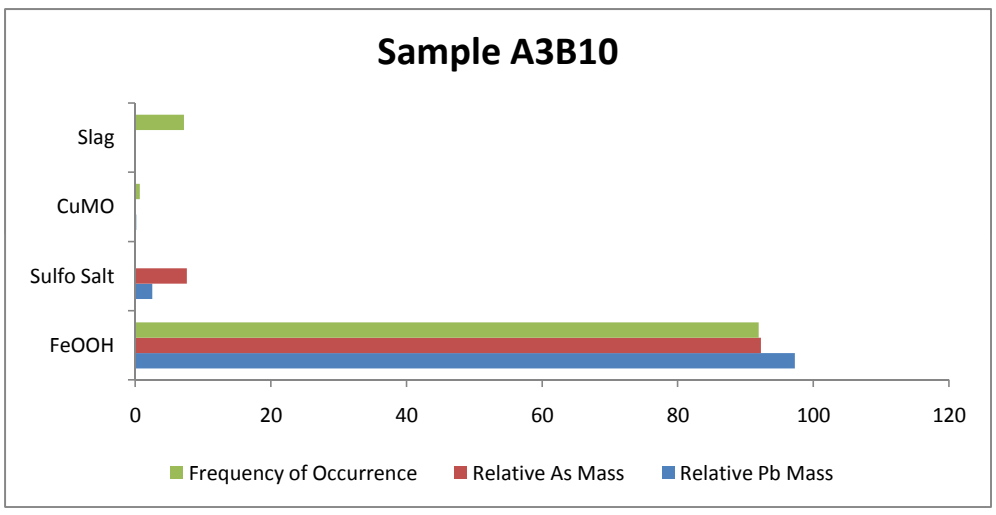

University of Colorado LEGS_S001.pgt
FS: 800
Fe
O
Fe
Al
Si
Ca
5
10
15
20

R2-0006217

Form	Association	Size (microns)
Fe	Liberated	88
Fe	Liberated	12
Fe	Liberated	16
Fe	Liberated	3
Fe	Liberated	52
Fe	Liberated	17
Fe	Liberated	80
Fe	Liberated	12
Fe	Cemented	10
Fe	Liberated	9
Fe	Liberated	60
Fe	Rimming	5
Fe	Liberated	7
Fe	Liberated	8
Fe	Liberated	88
Fe	Rimming	4
Fe	Liberated	21
Fe	Liberated	95
Fe	Liberated	128
Fe	Liberated	19
Fe	Liberated	7
Fe	Liberated	10
Fe	Rimming	41
Fe	Rimming	85
Fe	Cemented	9
Fe	Liberated	14
Fe	Liberated	58
Fe	Liberated	60
Fe	Liberated	5
Fe	Liberated	20
Fe	Liberated	10
Fe	Liberated	43
Fe	Cemented	24
Fe	Liberated	13
Fe	Liberated	16
Fe	Liberated	13
Fe	Liberated	15
Fe	Liberated	16
Fe	Liberated	14
Fe	Cemented	28
Fe	Liberated	13
Fe	Liberated	12
Fe	Liberated	65
Fe	Liberated	10
Fe	Liberated	9
Fe	Liberated	8
Fe	Liberated	3
Fe	Liberated	8
Fe	Liberated	7
Fe	Liberated	19
Fe	Cemented	7
Fe	Cemented	6
Fe	Liberated	6
Fe	Liberated	21
Fe	Liberated	7
Fe	Liberated	8
Fe	Liberated	32
Fe	Liberated	4
Fe	Liberated	55
Fe	Liberated	6
Fe	Liberated	12
Fe	Liberated	12
Fe	Liberated	14
Fe	Liberated	13
Fe	Liberated	7
Fe	Liberated	22
Fe	Liberated	34
Fe	Liberated	90
Fe	Liberated	19
Fe	Liberated	52
Fe	Liberated	4
Fe	Liberated	6
Fe	Liberated	6
Fe	Liberated	14
Fe	Liberated	24
Fe	Liberated	115
Fe	Liberated	33
SS	Liberated	4
Fe	Liberated	105
Fe	Rimming	65
Fe	Liberated	22
Fe	Liberated	19
Fe	Liberated	11
Fe	Liberated	22
Fe	Liberated	32
Fe	Liberated	15
Fe	Liberated	13
Fe	Liberated	6
Fe	Liberated	9
Fe	Liberated	52
Fe	Liberated	44

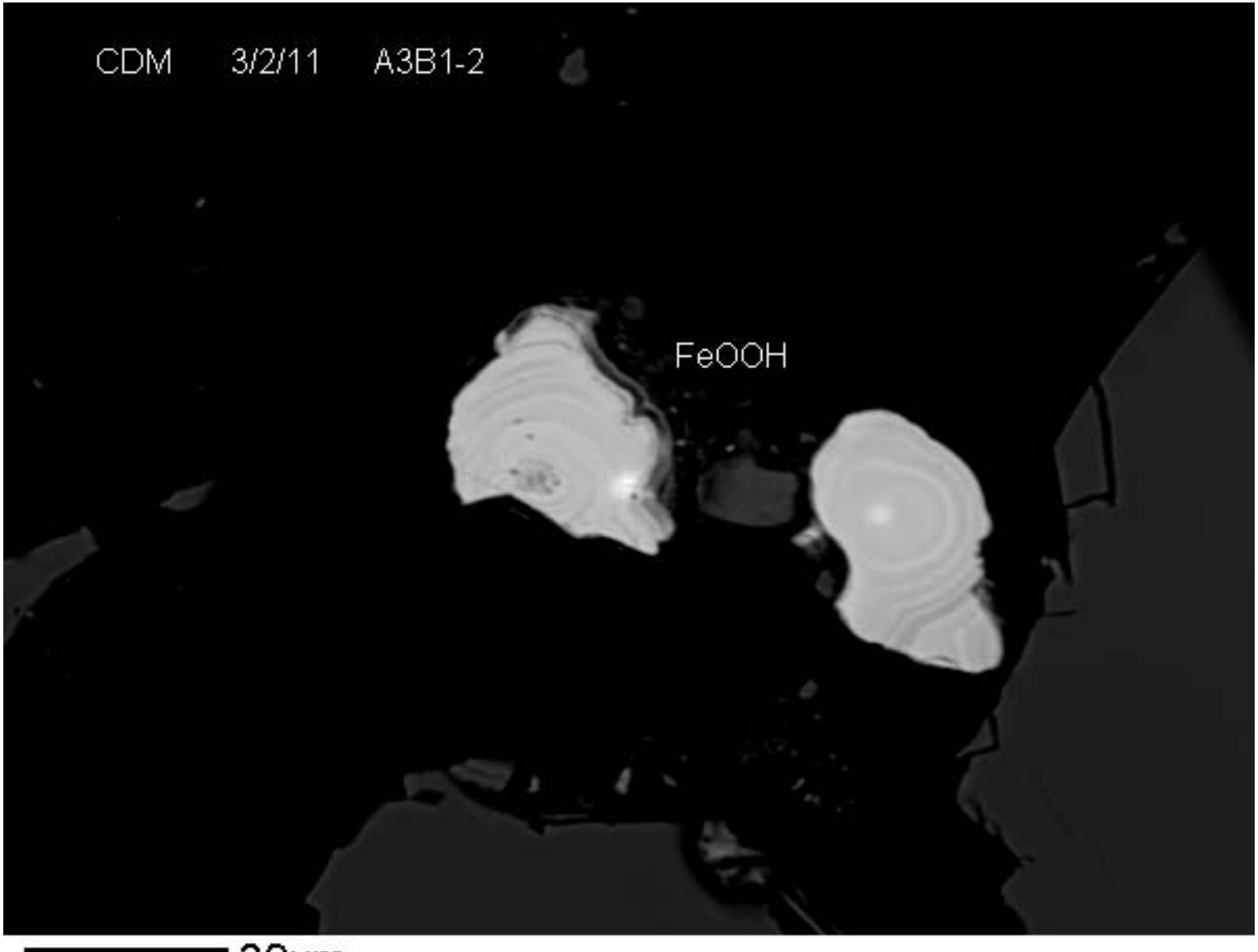
Form	Number	Mean	Std-Dev	Range low	Range high
total	104	26.67	32.17	3	200
FeOOH	98	26.03	27.64	3	128
Sulfo Salt	1	4	ND	4	4
CuMO	4	4.75	0.5	4	5
Slag	1	200	ND	200	200

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	91.96	92.6	97.26	97.44	92.27	92.39	5.23
Sulfo Salt	0.14	0.15	2.53	2.53	7.6	7.61	0.73
CuMO	0.68	0	0.18	0	0.13	0	1.59
Slag	7.21	7.26	0.03	0.03	0	0	4.97



Fe	Liberated	14
Fe	Liberated	18
Fe	Liberated	5
Fe	Liberated	14
Fe	Liberated	16
Fe	Liberated	17
Fe	Liberated	26
Fe	Liberated	8
cumo	Inclusion	5
cumo	Inclusion	5
cumo	Inclusion	5
Slag	Liberated	200
cumo	Inclusion	4

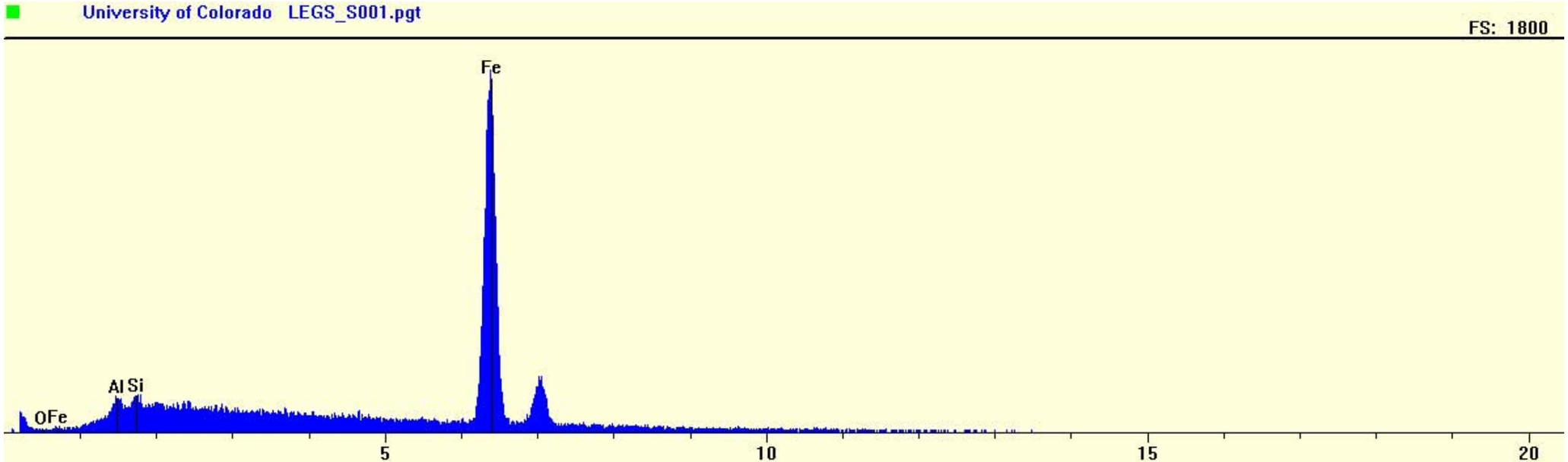
A3B1



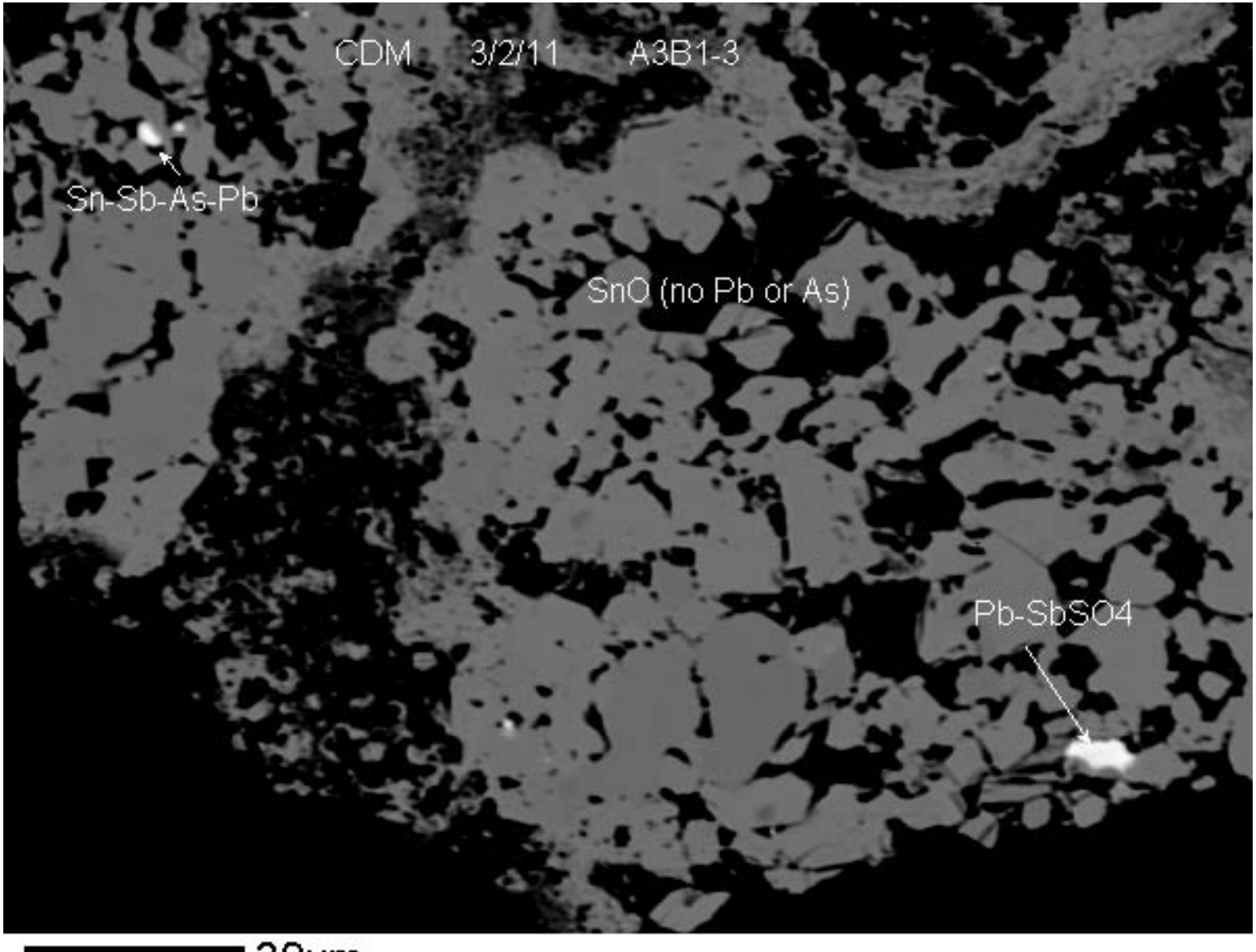
30µm

BEI

R2-0006221


University of Colorado LEGS_S001.pgt
FS: 1800
Fe
Al Si
OFe
5
10
15
20

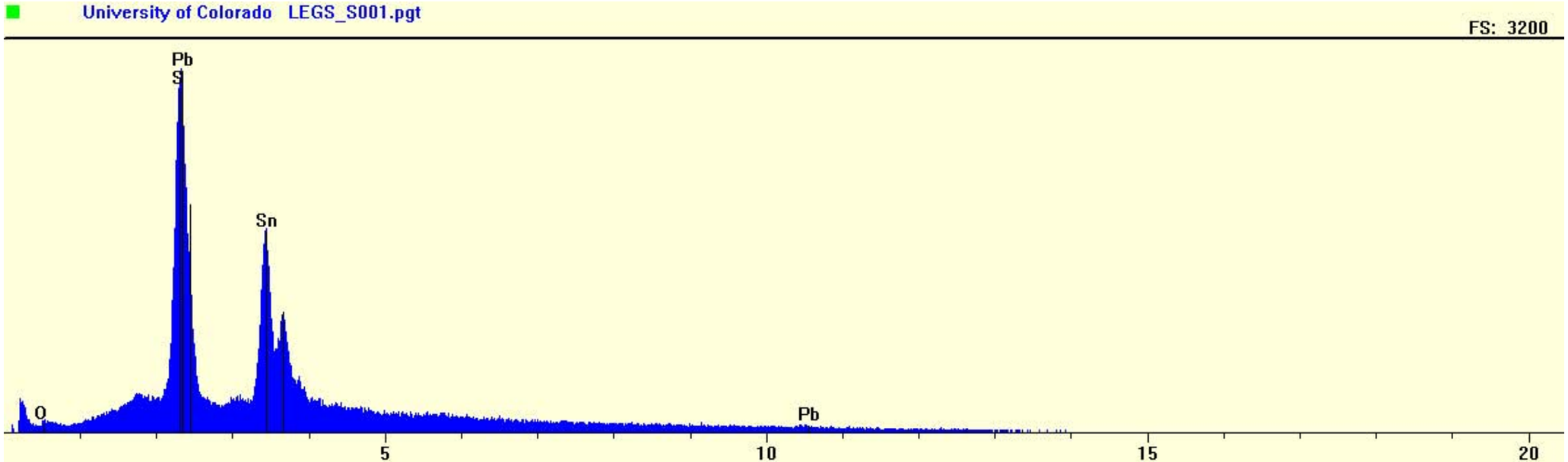
R2-0006222



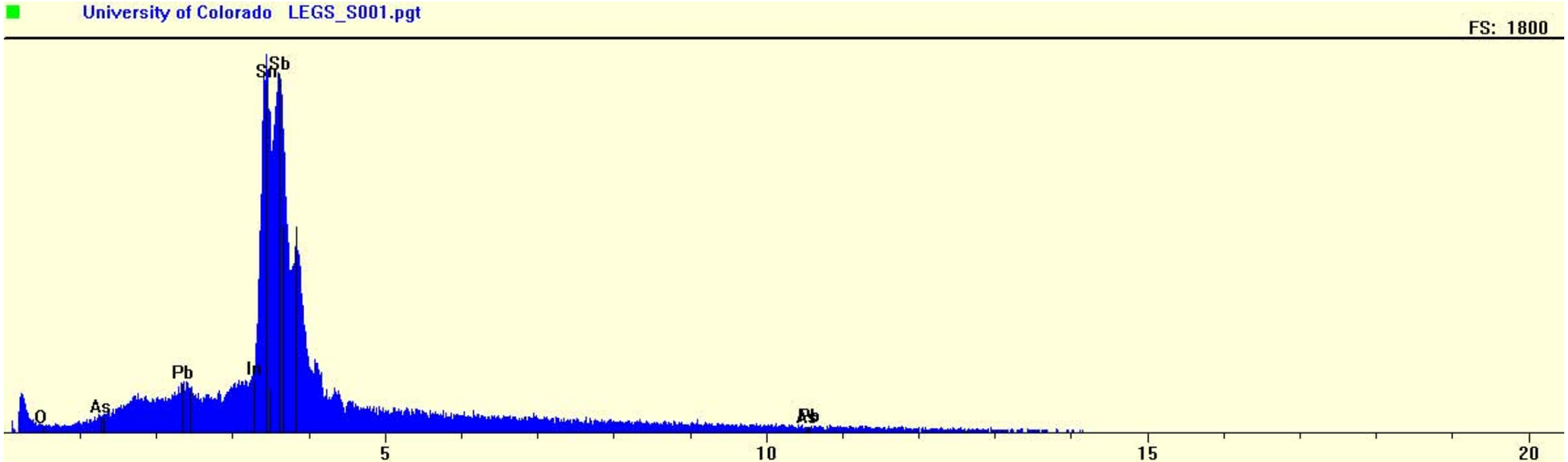
30µm

BEI

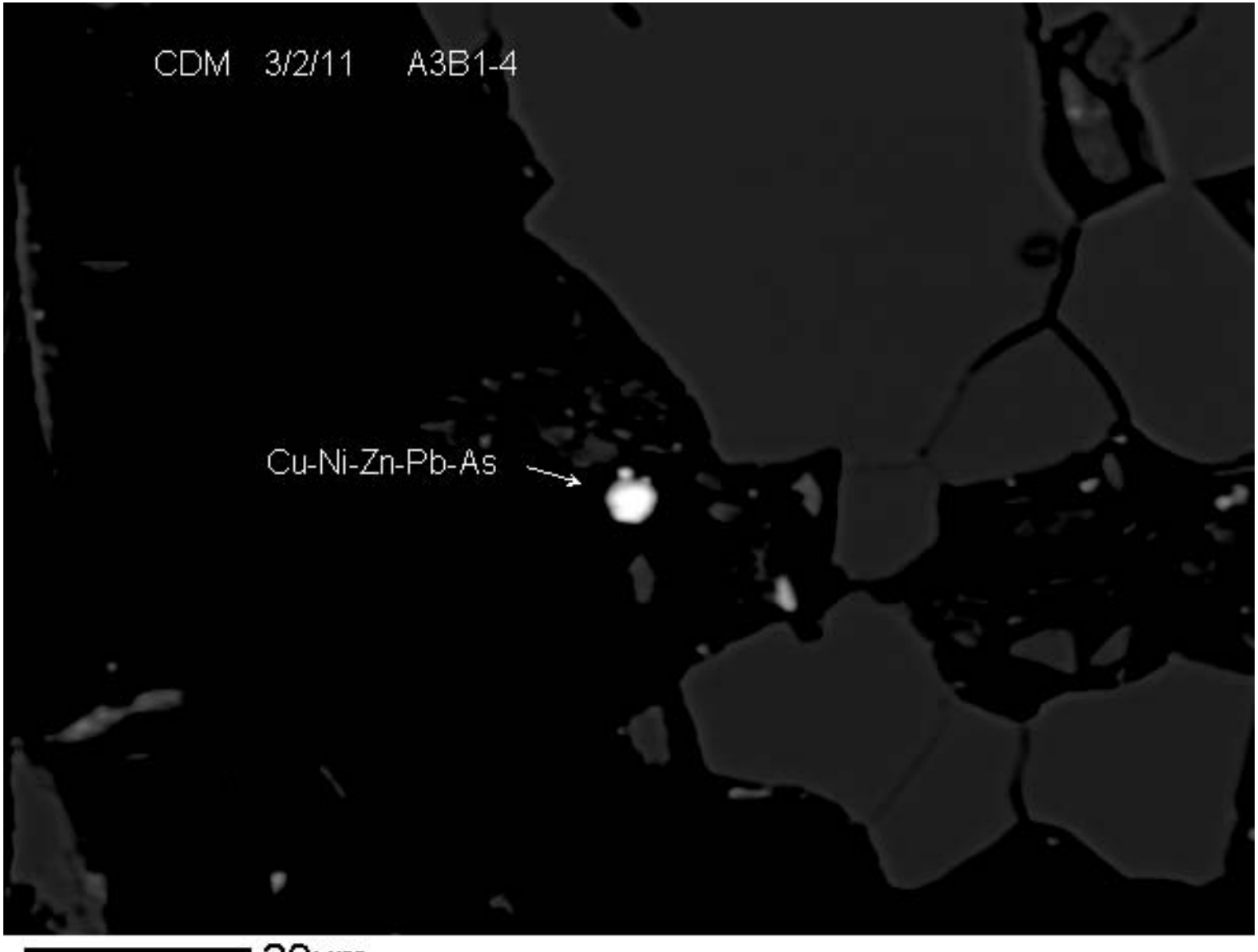
R2-0006223


University of Colorado LEGS_S001.pgt
FS: 3200
Pb
S
Sn
O
Pb
5
10
15
20

R2-0006224


University of Colorado LEGS_S001.pgt
FS: 1800
Sn
Sb
Pb
In
O
As
Pb
As
5
10
15
20

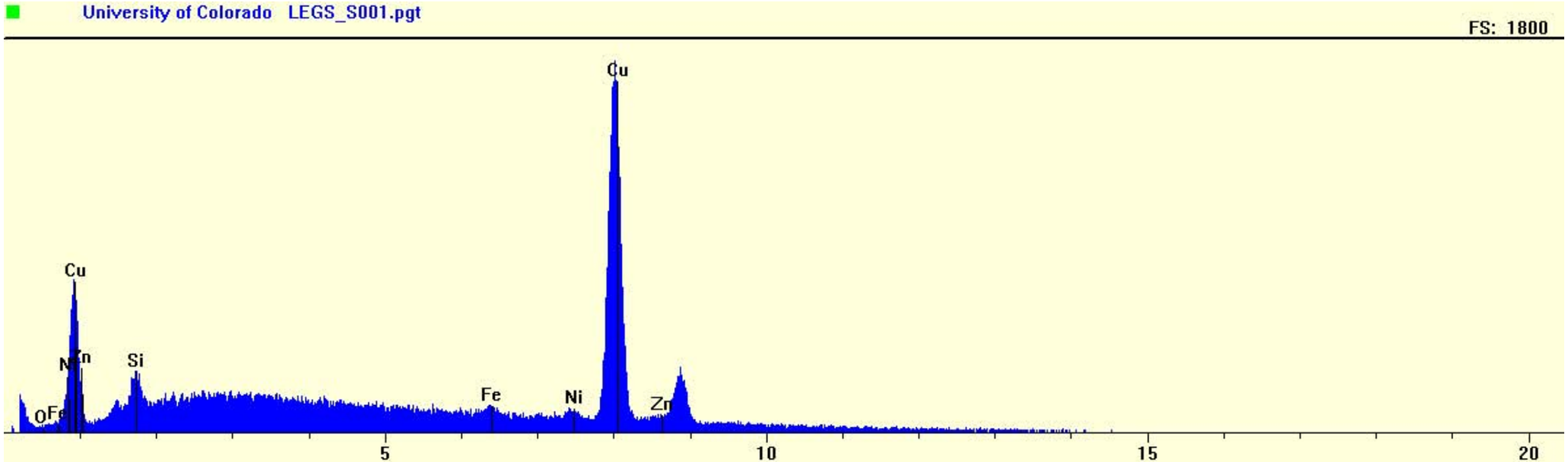
R2-0006225



20µm

BEI

R2-0006226

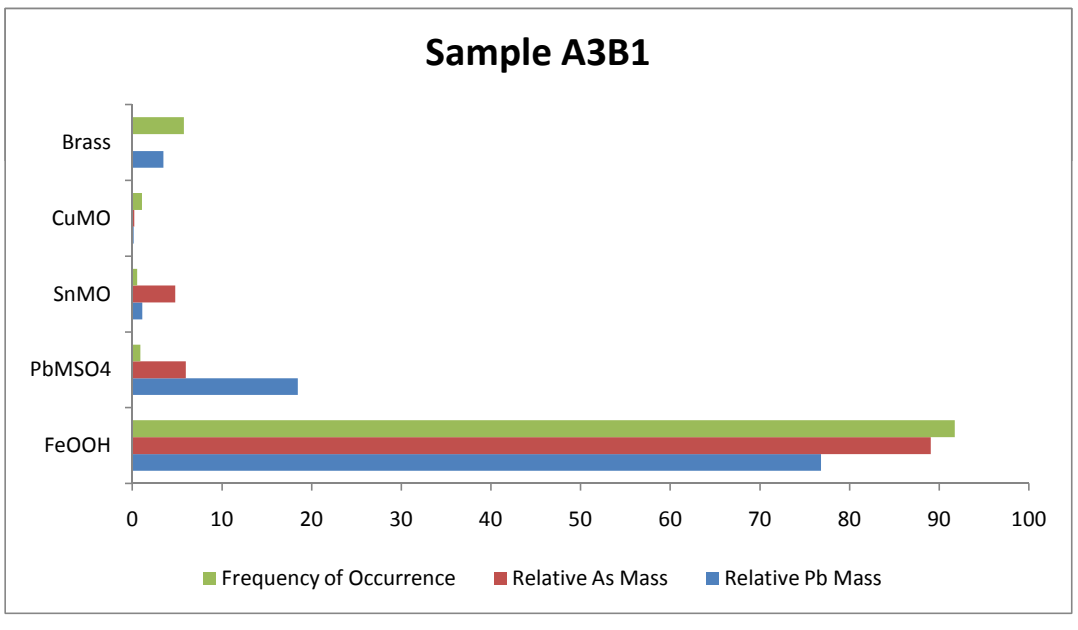

University of Colorado LEGS_S001.pgt
FS: 1800
Cu
Cu
N
Zn
Si
O
Fe
Fe
Ni
Zn
5
10
15
20

R2-0006227

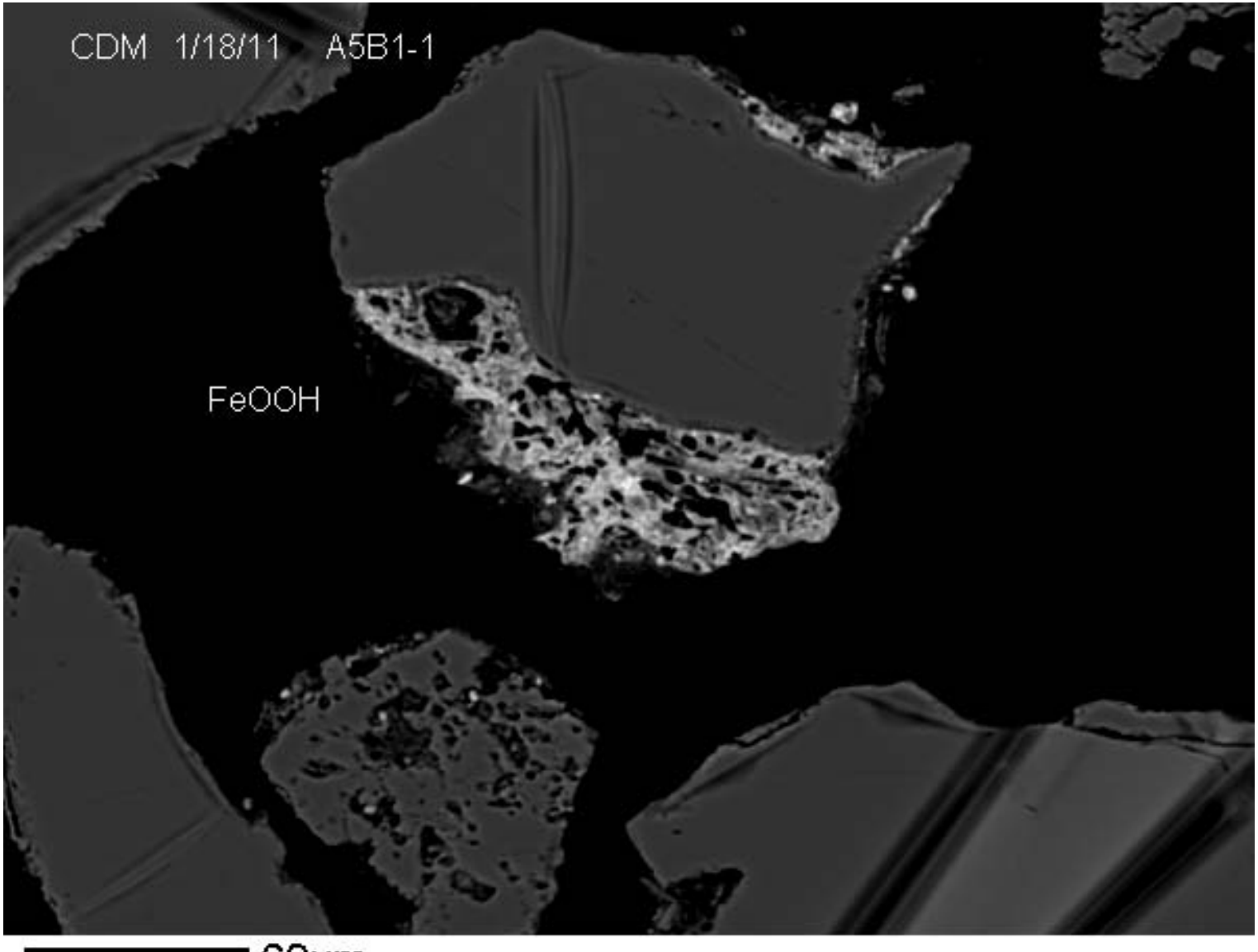
Form	Association	Size (microns)
Fe	Liberated	13
Fe	Liberated	7
Fe	Liberated	16
Fe	Liberated	14
Fe	Cemented	4
Fe	Cemented	4
Fe	Liberated	3
Fe	Liberated	5
Fe	Liberated	7
Fe	Liberated	32
Fe	Liberated	3
Fe	Liberated	10
Fe	Liberated	4
Fe	Liberated	5
Fe	Liberated	3
Fe	Liberated	4
Fe	Liberated	29
Fe	Liberated	30
Fe	Liberated	8
Fe	Cemented	3
Fe	Cemented	3
Fe	Liberated	22
Fe	Liberated	8
pbmso4	Inclusion	5
snmo	Inclusion	2
snmo	Inclusion	1
Fe	Liberated	5
Fe	Liberated	5
Fe	Liberated	5
Fe	Liberated	4
Fe	Cemented	4
Fe	Liberated	5
Fe	Rimming	100
Fe	Liberated	7
Fe	Liberated	13
Fe	Liberated	14
Fe	Rimming	15
cumo	Liberated	4
Fe	Liberated	9
brass	Liberated	32
Fe	Liberated	12
Fe	Liberated	23
Fe	Liberated	41
cumo	Liberated	2
Fe	Liberated	12

Form	Number	Mean	Std-Dev	Range low	Range high
total	45	12.38	16.43	1	100
FeOOH	39	13.1	17.02	3	100
PbMSO4	1	5	ND	5	5
SnMO	2	1.5	0.71	1	2
CuMO	2	3	1.41	2	4
Brass	1	32	ND	32	32

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	91.74	93.08	76.82	95.49	89.05	99.76	8.04
PbMSO4	0.9	0	18.44	0	5.96	0	2.76
SnMO	0.54	0	1.11	0	4.78	0	2.14
CuMO	1.08	1.09	0.15	0.18	0.21	0.24	3.02
Brass	5.75	5.83	3.48	4.32	0	0	6.8



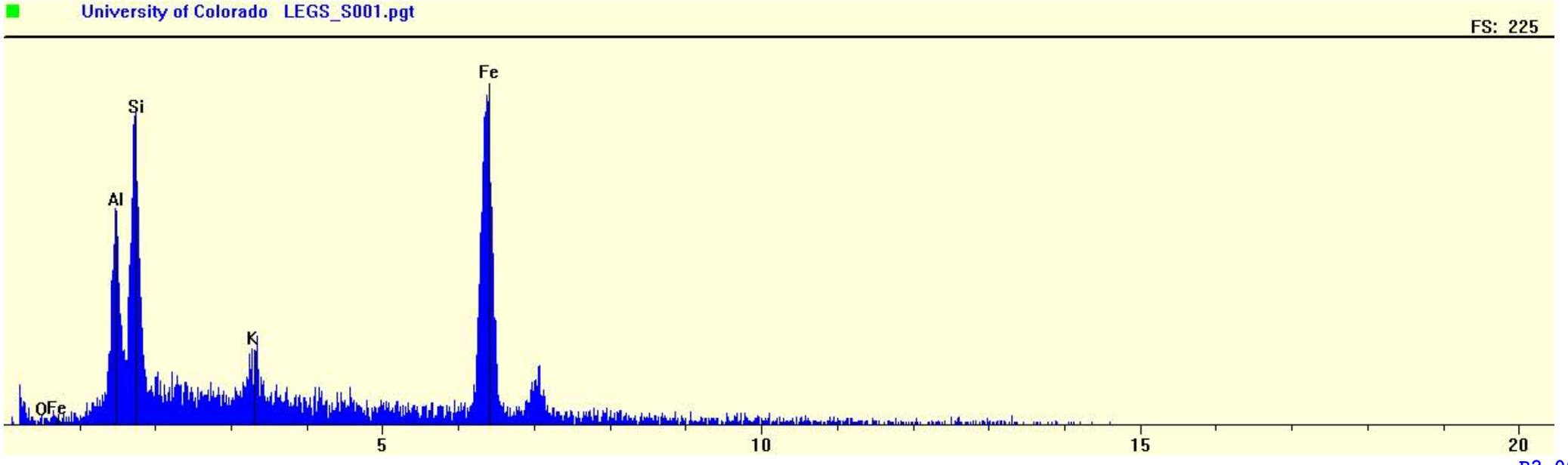
A5B1



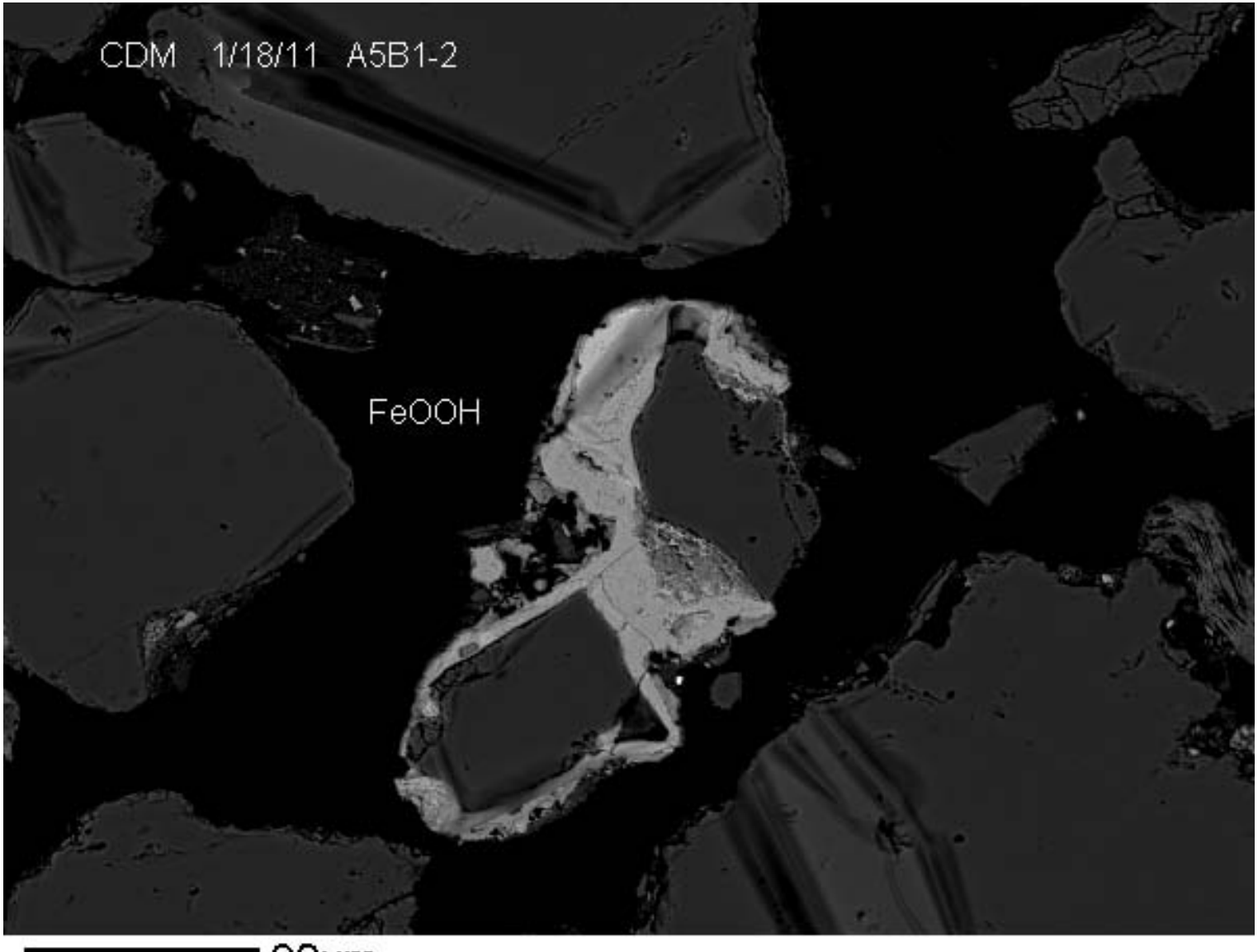
60µm

BEI

R2-0006230


University of Colorado LEGS_S001.pgt
FS: 225
Fe
Si
Al
K
OFe
5
10
15
20

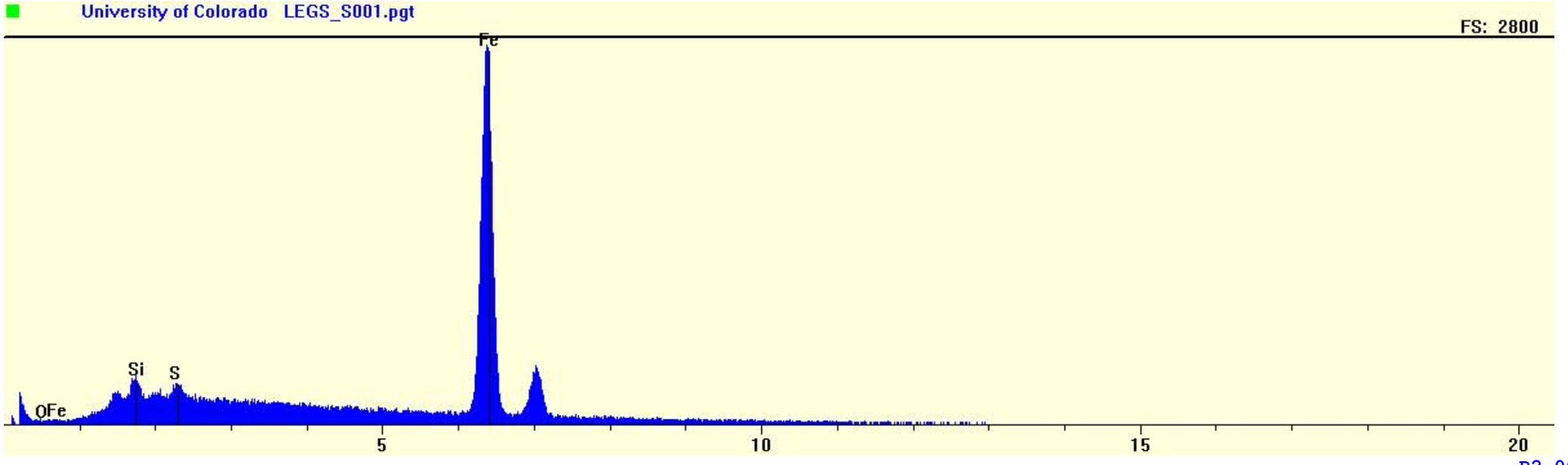
R2-0006231



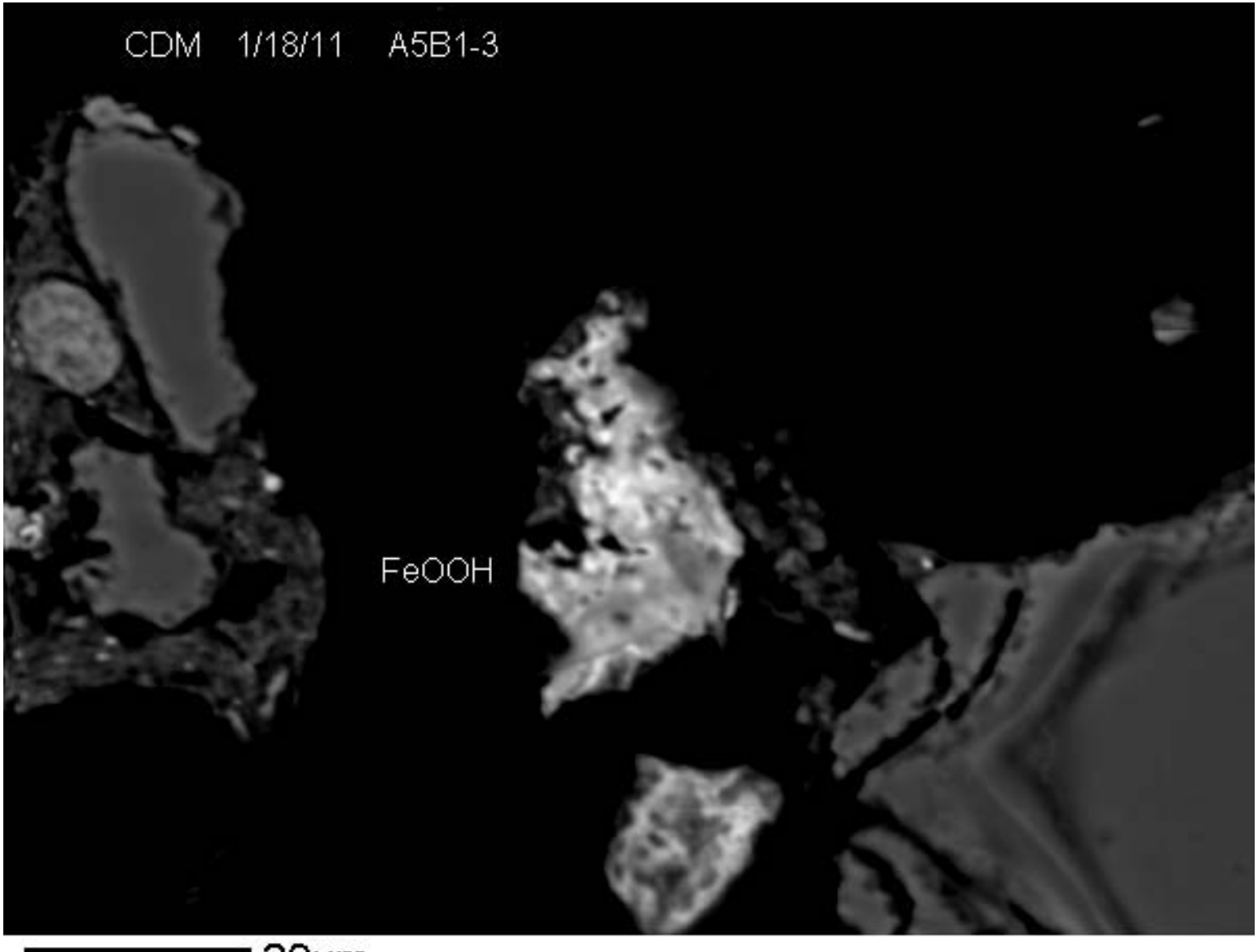
90µm

BEI

R2-0006232


University of Colorado LEGS_S001.pgt
FS: 2800
Fe
Si
S
OFe
5
10
15
20

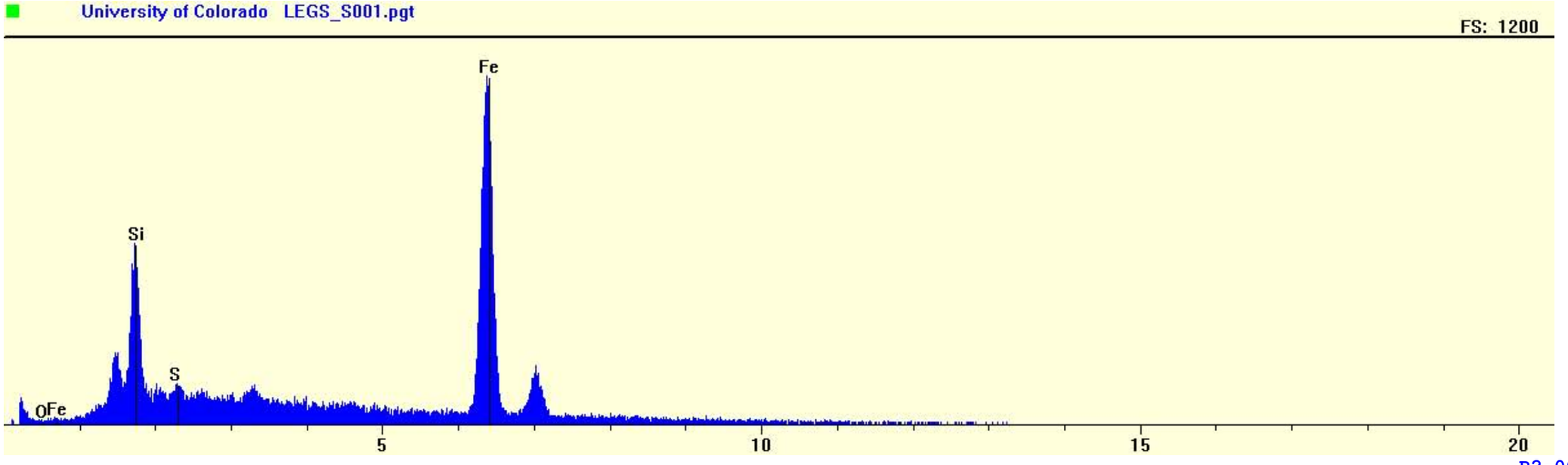
R2-0006233



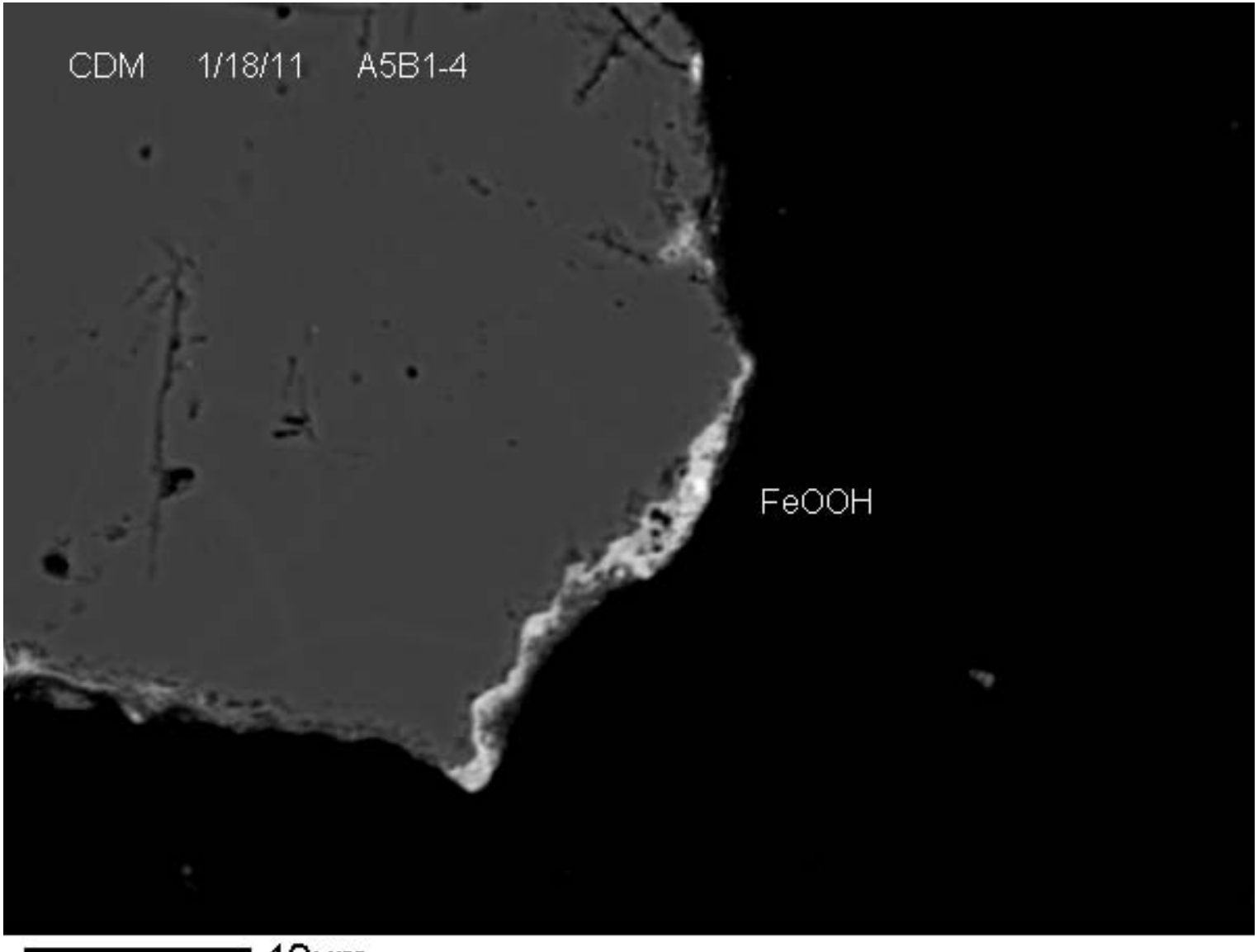
20µm

BEI

R2-0006234


University of Colorado LEGS_S001.pgt
FS: 1200
Fe
Si
S
OFe
5
10
15
20

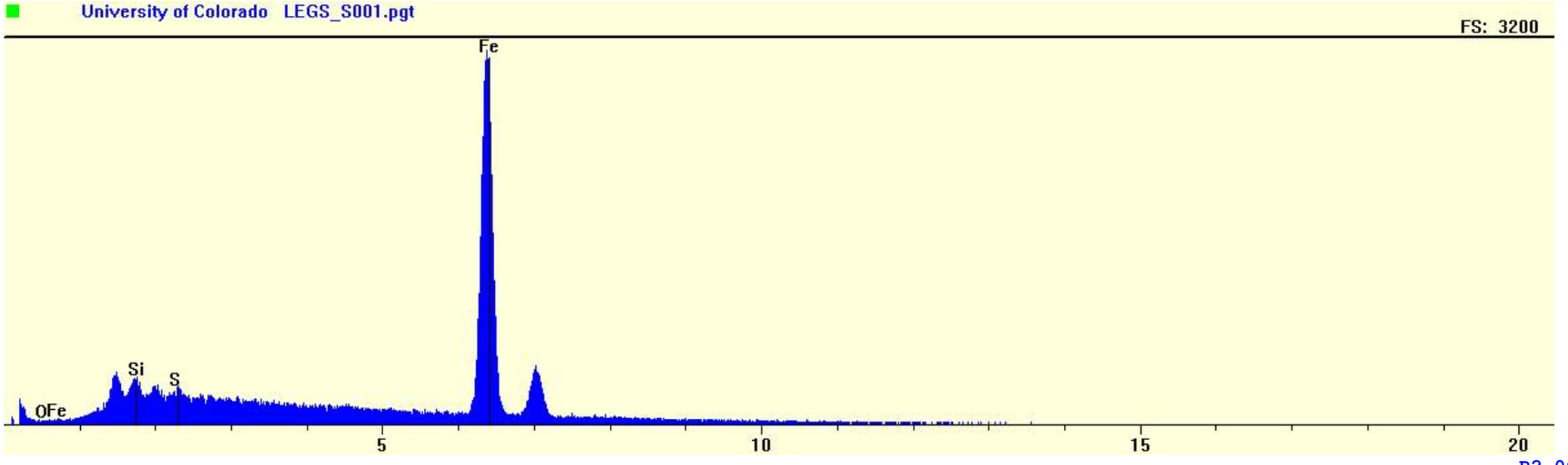
R2-0006235



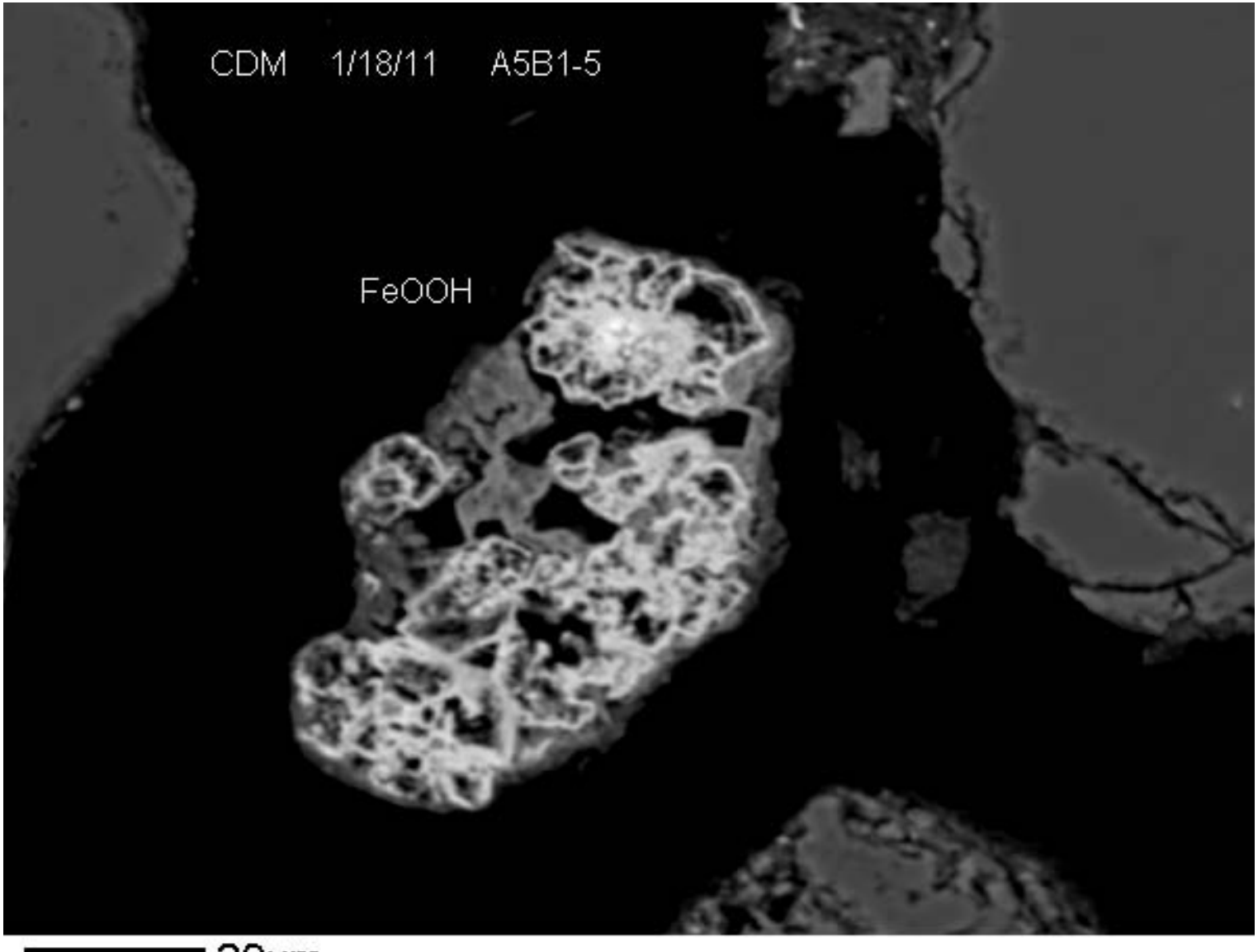
40µm

BEI

R2-0006236


University of Colorado LEGS_S001.pgt
FS: 3200
Fe
Si
S
OFe
5
10
15
20

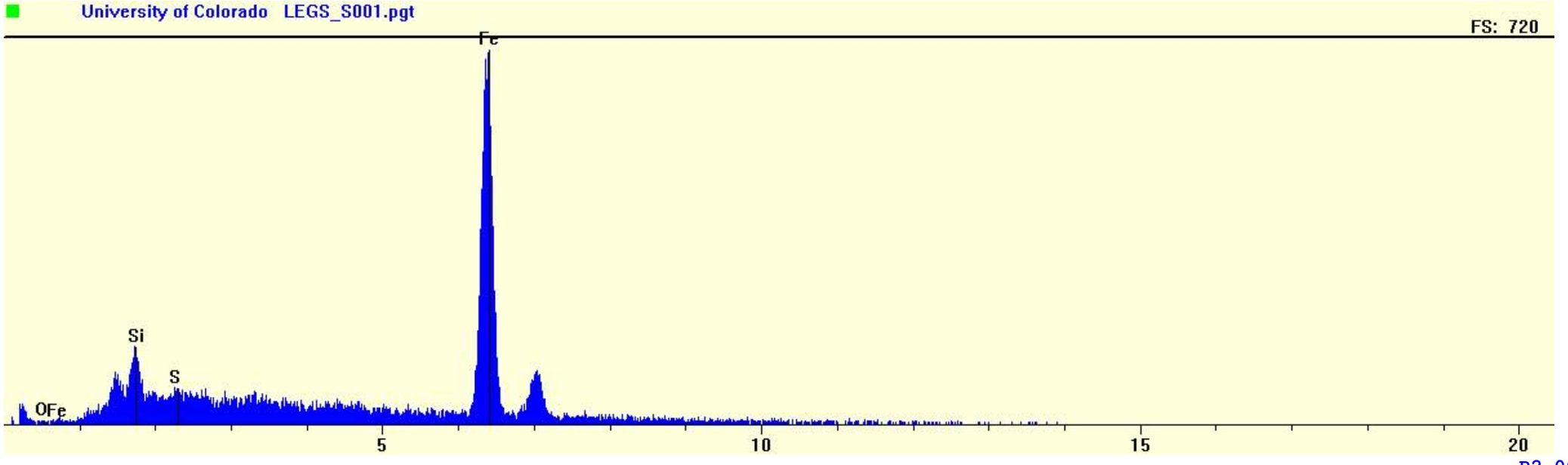
R2-0006237



20µm

BEI

R2-0006238


University of Colorado LEGS_S001.pgt
FS: 720
Fe
Si
S
OFe
5
10
15
20

R2-0006239

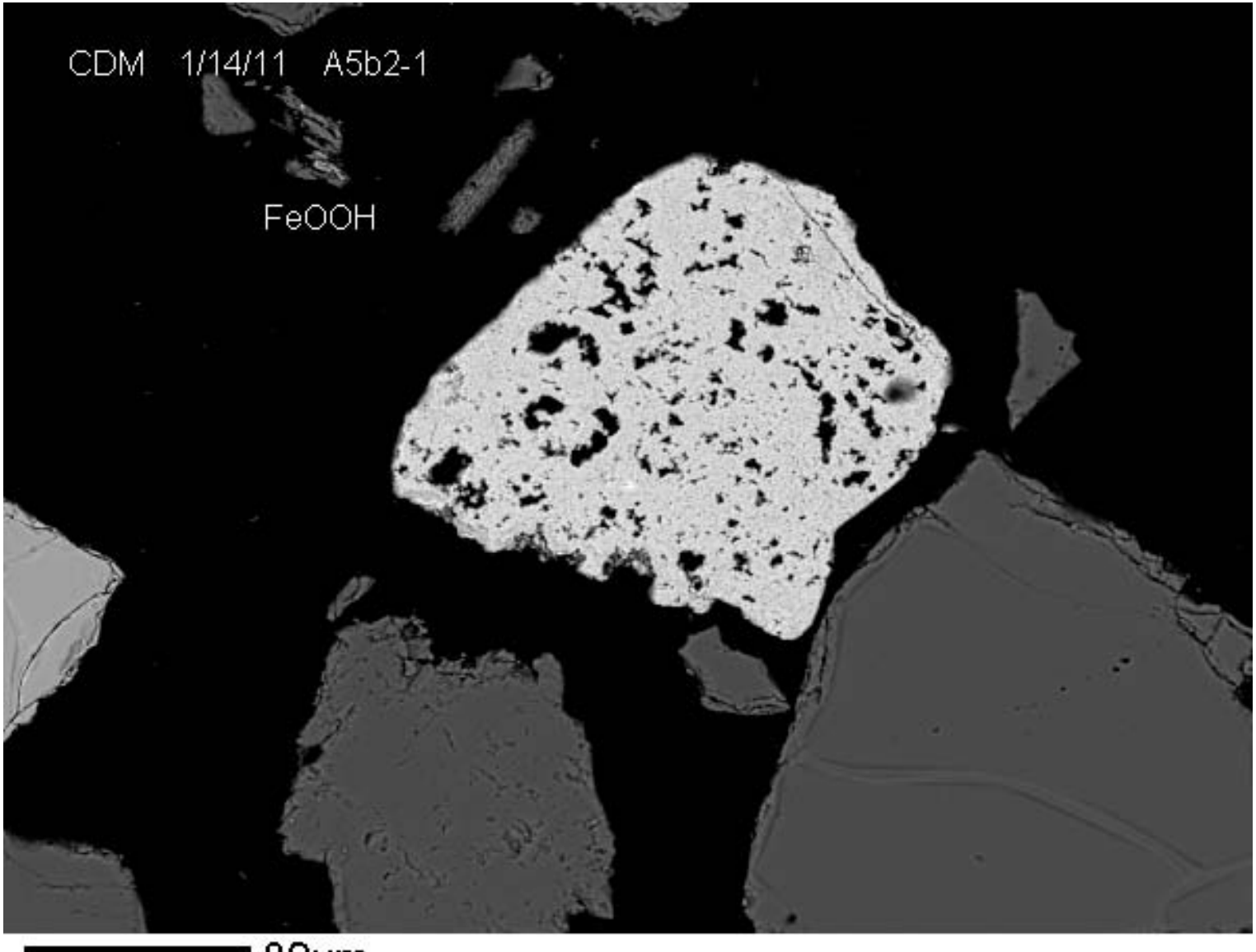
Form	Association	Size (microns)
Fe	Liberated	7
Fe	Liberated	3
Fe	Liberated	13
Fe	Rimming	92
Fe	Liberated	50
Fe	Rimming	100
Fe	Liberated	20
Fe	Liberated	20
Fe	Liberated	20
Fe	Liberated	7
Fe	Rimming	55
Fe	Liberated	60
Fe	Liberated	15
Fe	Rimming	25
Fe	Liberated	150
Fe	Liberated	5
Fe	Cemented	48
Fe	Rimming	47
Fe	Liberated	12
Fe	Liberated	26
Fe	Rimming	13
Fe	Rimming	33
Fe	Rimming	25
Fe	Liberated	14
Fe	Liberated	12
Fe	Liberated	7
Fe	Liberated	40
Fe	Liberated	80
Fe	Liberated	15
Fe	Liberated	14
Fe	Cemented	13
Fe	Rimming	17
Fe	Cemented	128
Fe	Liberated	8
Fe	Liberated	16
Fe	Liberated	32
Fe	Liberated	20
Fe	Liberated	40
Fe	Liberated	75
Fe	Liberated	22
Fe	Liberated	11
Fe	Cemented	31
Fe	Liberated	80
Fe	Cemented	36
Fe	Rimming	50
Fe	Cemented	9
Fe	Cemented	128
Fe	Rimming	4
Fe	Liberated	7
Fe	Liberated	48
Fe	Rimming	12
Fe	Rimming	24
Fe	Liberated	12
Fe	Cemented	78
Fe	Liberated	85
Fe	Liberated	27
Fe	Rimming	26
Fe	Rimming	29
Fe	Rimming	42
Fe	Cemented	3
Fe	Rimming	15
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	20
Fe	Liberated	115
Fe	Liberated	95
Fe	Cemented	78
Fe	Cemented	46
Fe	Liberated	29
Fe	Liberated	65
Fe	Rimming	90
Fe	Liberated	20
Fe	Liberated	7
Fe	Liberated	9
Fe	Rimming	3
Fe	Cemented	5
Fe	Liberated	12
Fe	Liberated	23
Fe	Liberated	35
Fe	Cemented	110
Fe	Cemented	16
Fe	Liberated	19
Fe	Liberated	43
Fe	Cemented	120
Fe	Rimming	65

Form	Number	Mean	Std-Dev	Range low	Range high
total	106	39.26	36.79	3	150
FeOOH	106	39.26	36.79	3	150

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	100	100	100	100	100	100	0

Fe	Rimming	35
Fe	Liberated	18
Fe	Liberated	4
Fe	Rimming	55
Fe	Liberated	29
Fe	Rimming	32
Fe	Rimming	25
Fe	Liberated	9
Fe	Cemented	135
Fe	Liberated	13
Fe	Liberated	8
Fe	Liberated	145
Fe	Liberated	14
Fe	Rimming	13
Fe	Liberated	9
Fe	Liberated	42
Fe	Liberated	88
Fe	Liberated	40
Fe	Liberated	95
Fe	Cemented	120
Fe	Rimming	12

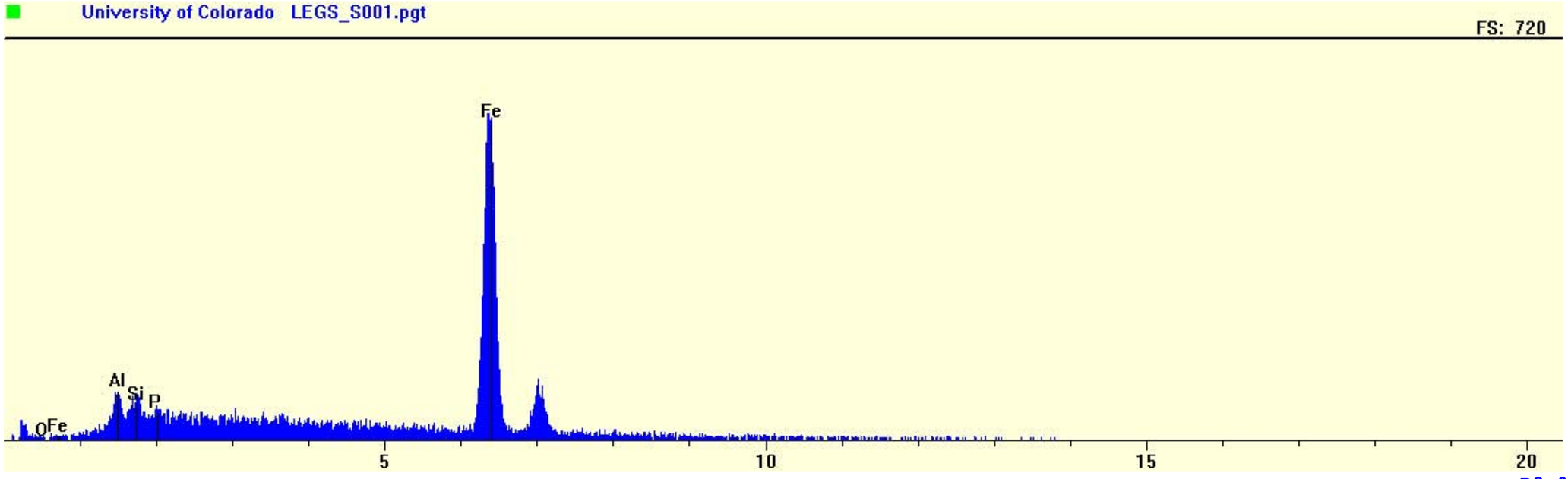
A5B2



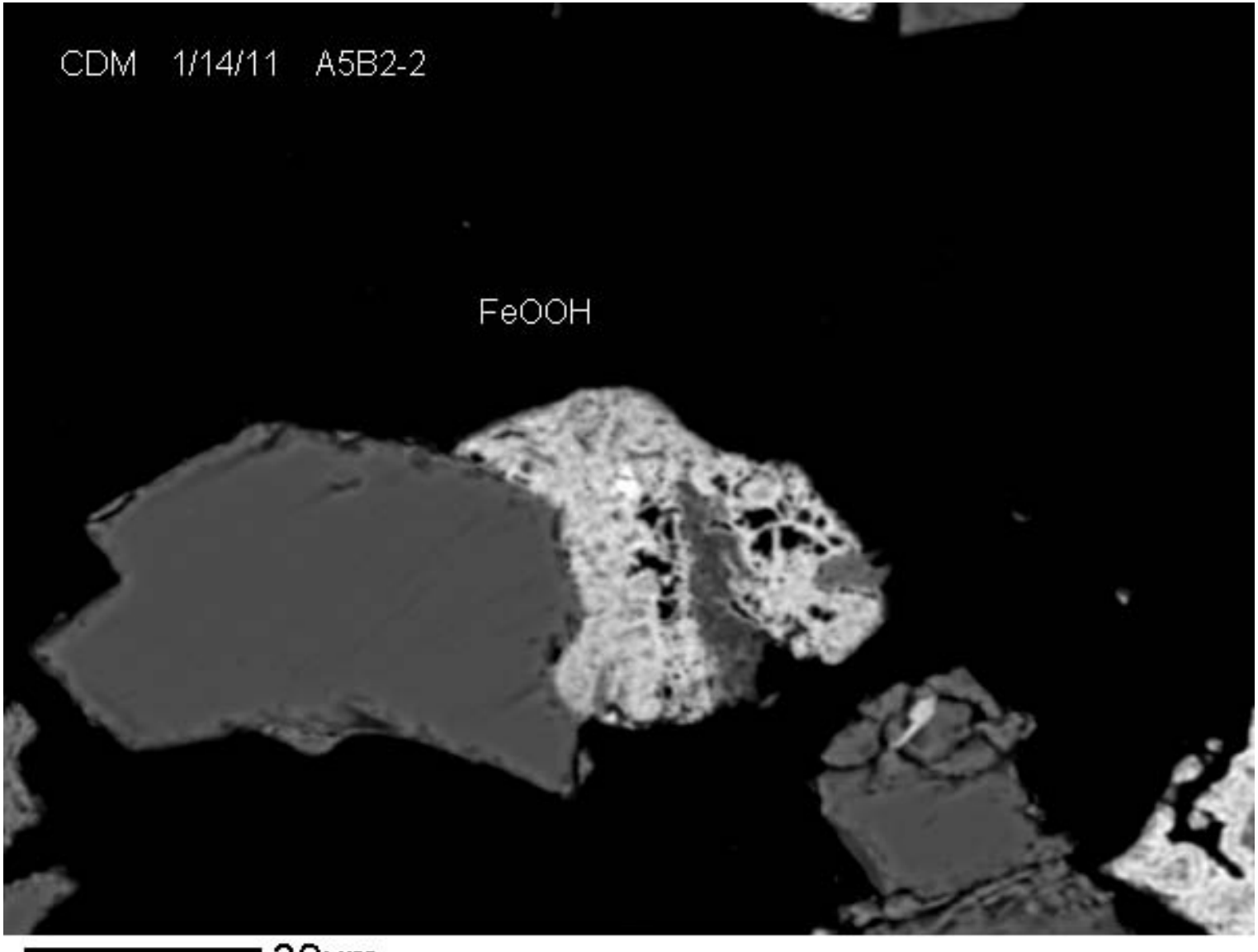
80µm

BEI

R2-0006243


University of Colorado LEGS_S001.pgt
FS: 720
Fe
Al
Si
P
O
Fe
5
10
15
20

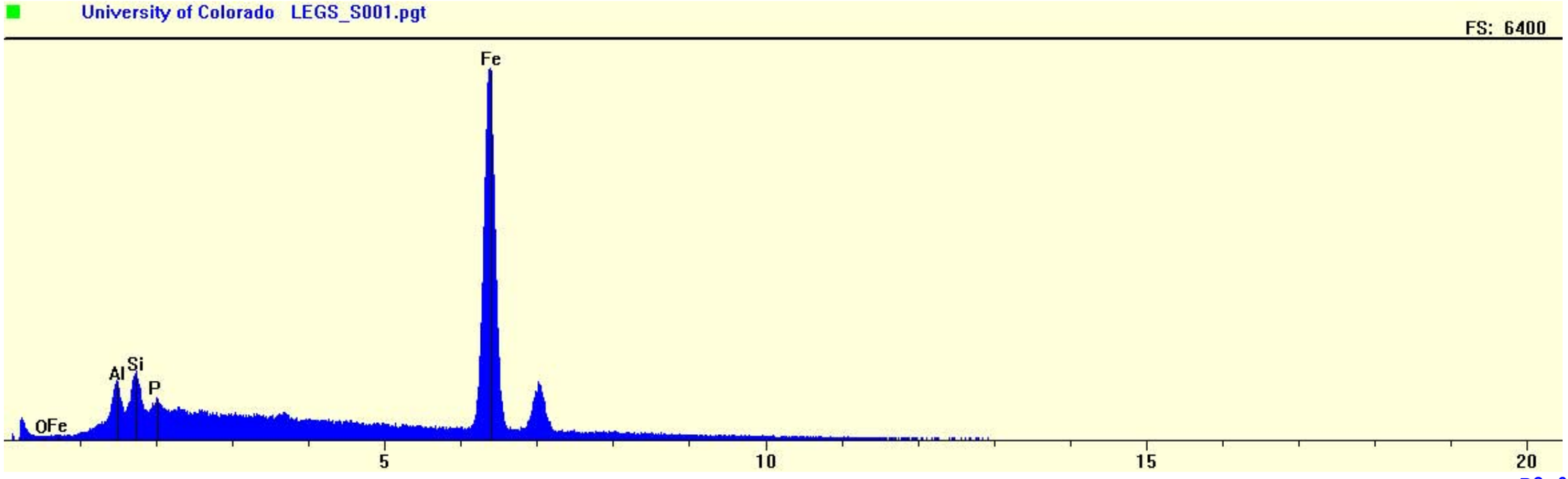
R2-0006244



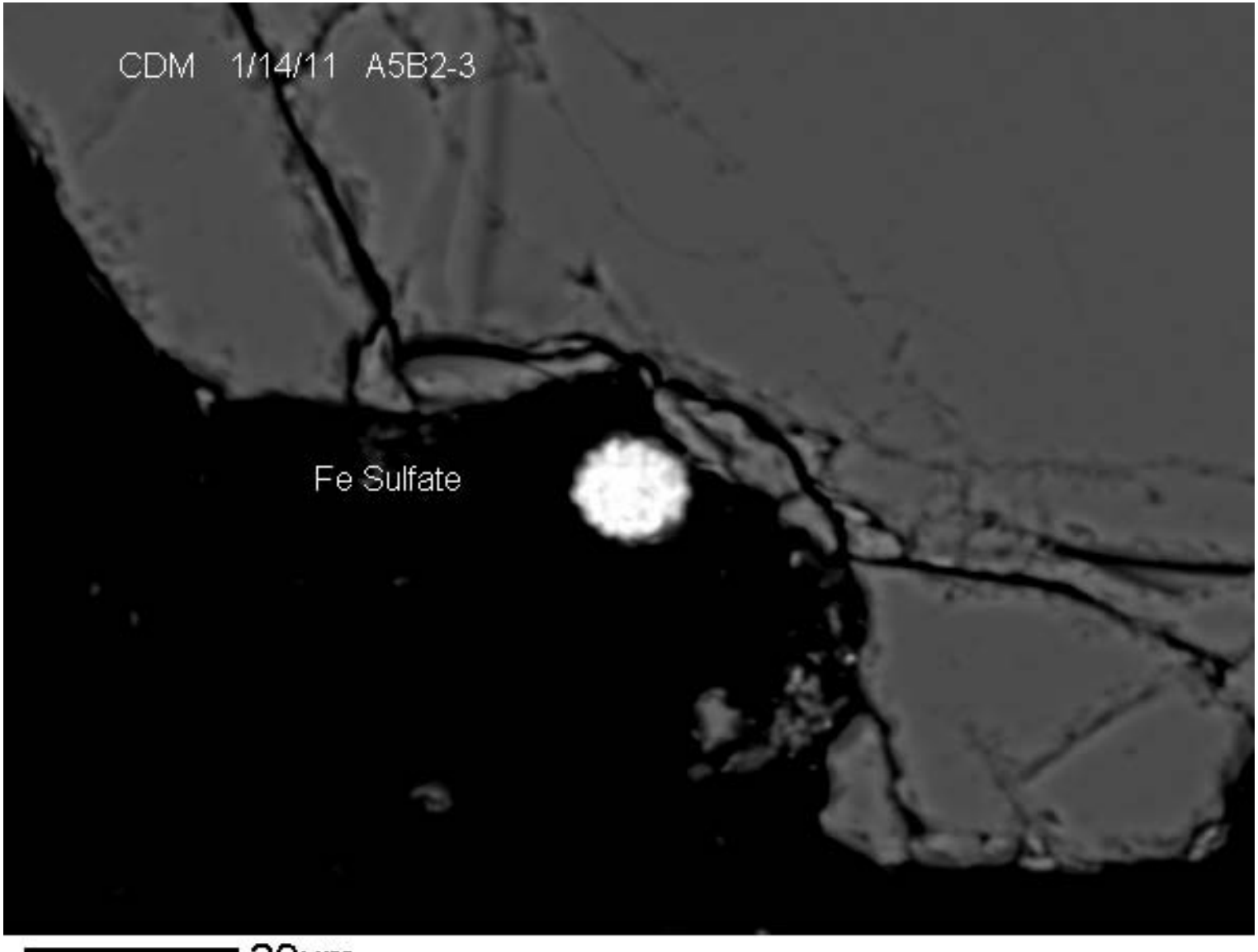
30µm

BEI

R2-0006245


University of Colorado LEGS_S001.pgt
FS: 6400
Fe
Al
Si
P
OFe
5
10
15
20

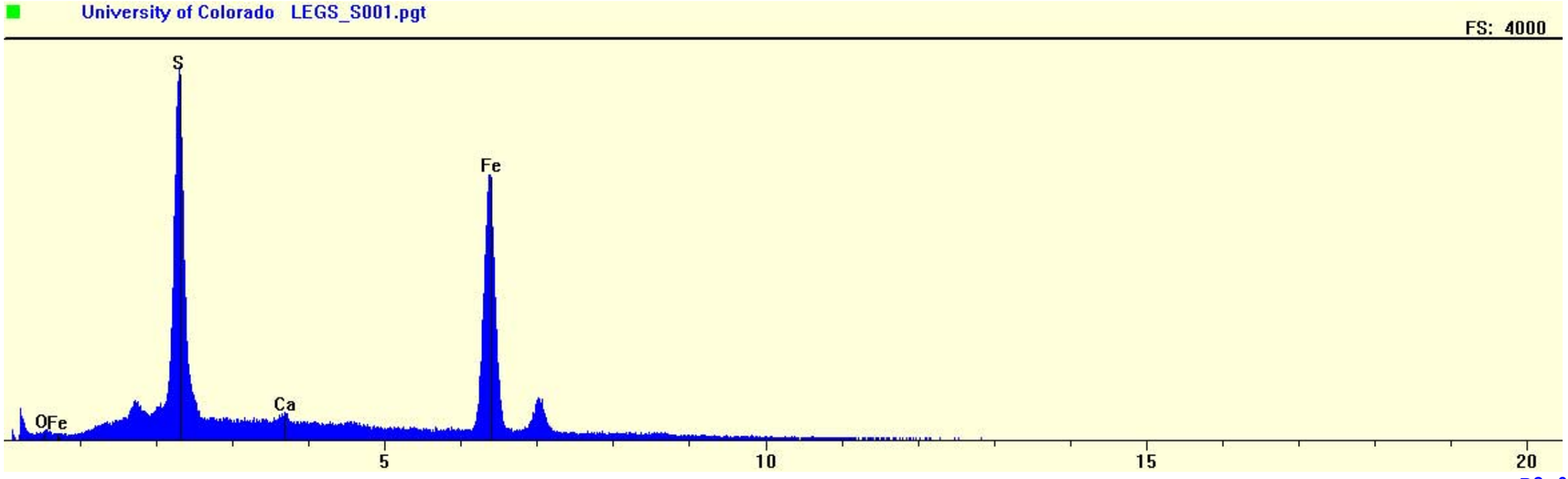
R2-0006246



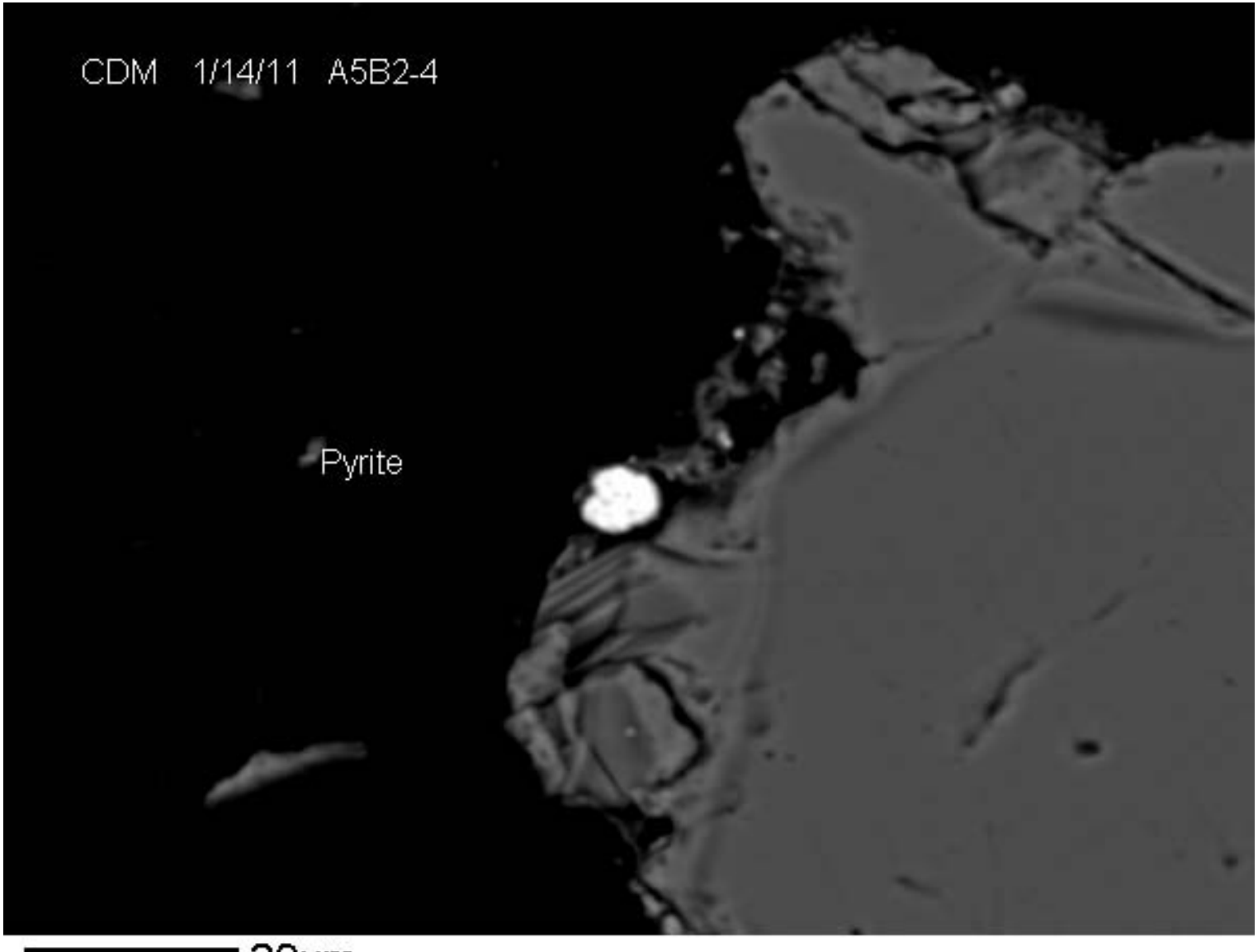
20µm

BEI

R2-0006247


University of Colorado LEGS_S001.pgt
FS: 4000
S
Fe
Ca
OFe
5
10
15
20

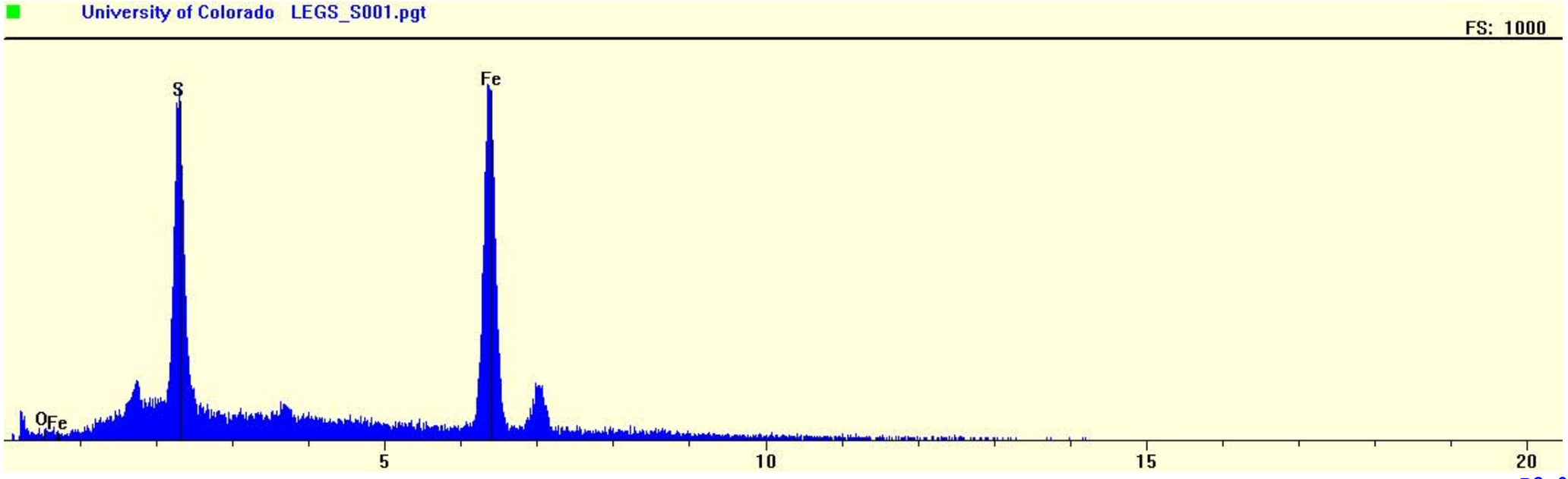
R2-0006248



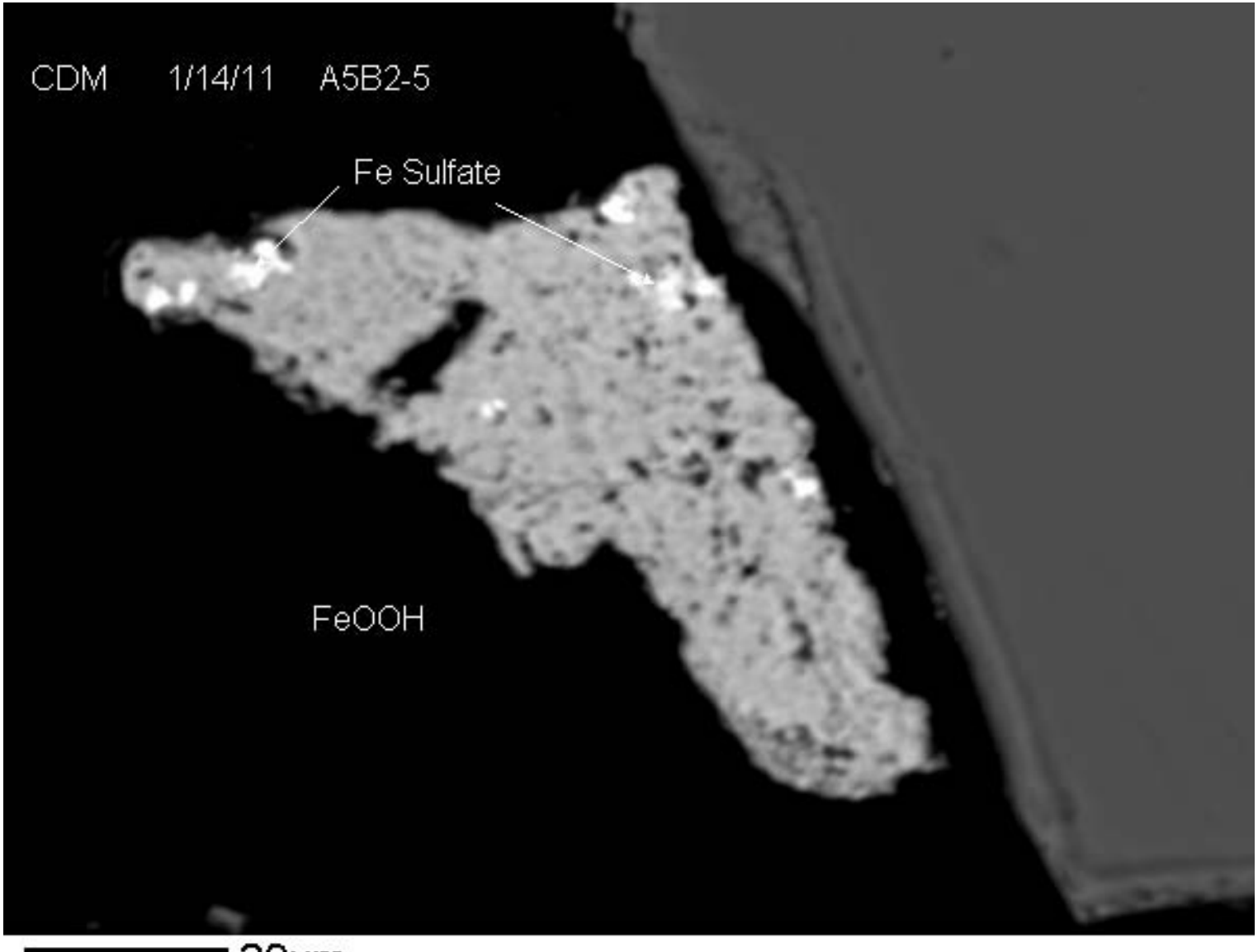
20µm

BEI

R2-0006249


University of Colorado LEGS_S001.pgt
FS: 1000
S
Fe
O
Fe
5
10
15
20

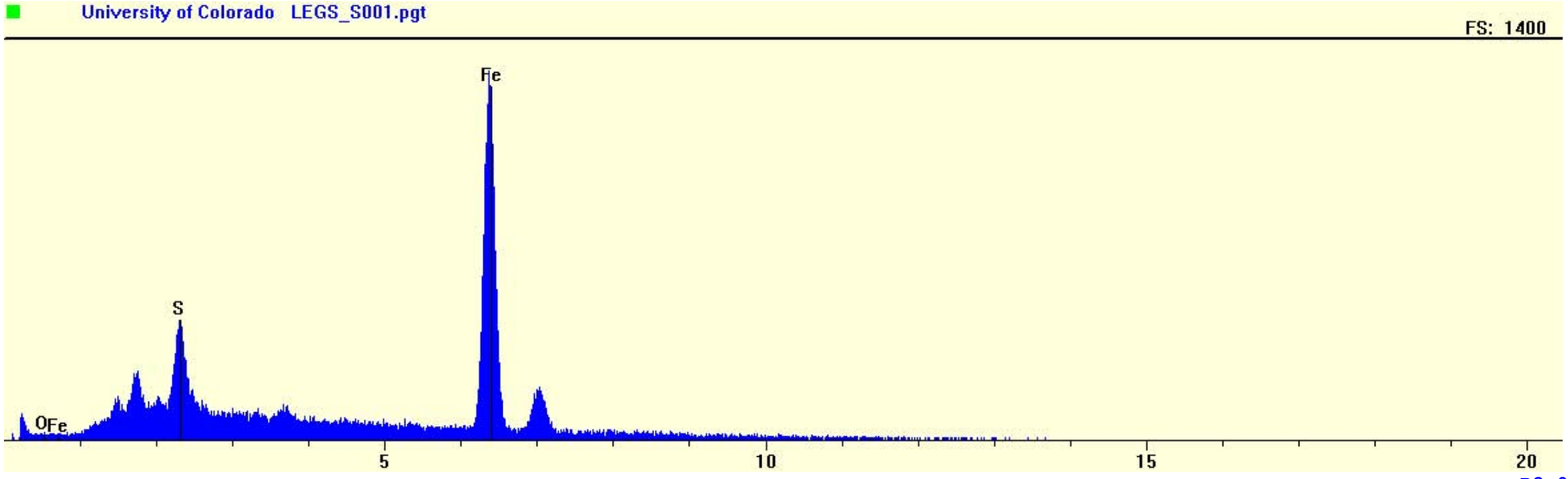
R2-0006250



20µm

BEI

R2-0006251

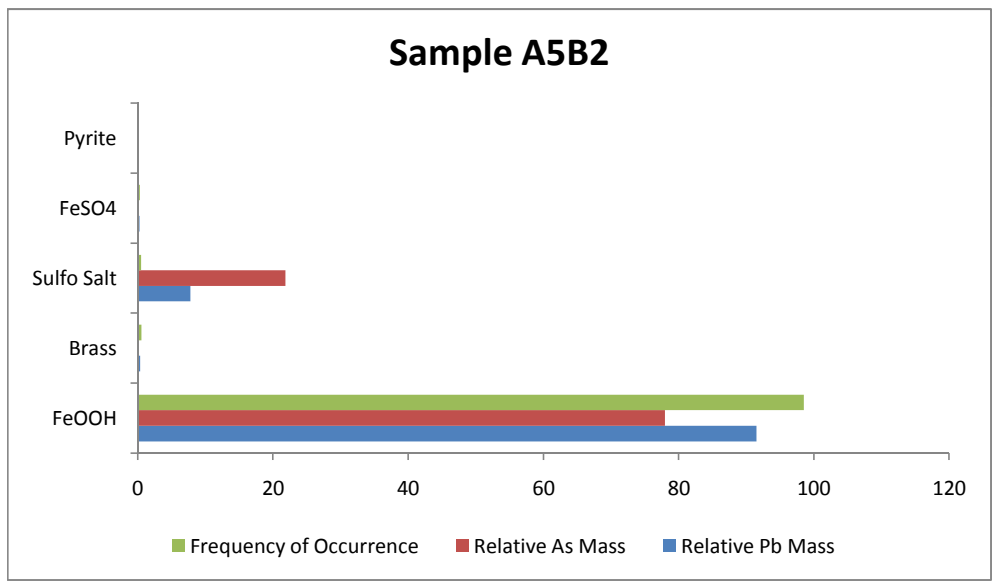

University of Colorado LEGS_S001.pgt
FS: 1400
Fe
S
OFe
5
10
15
20

R2-0006252

Form	Association	Size (microns)
Fe	Rimming	60
Fe	Liberated	5
Fe	Liberated	40
Fe	Liberated	10
Fe	Rimming	8
Fe	Rimming	25
Fe	Rimming	5
Fe	Liberated	90
Fe	Liberated	4
Fe	Liberated	50
Fe	Liberated	110
Fe	Liberated	4
Fe	Liberated	25
Fe	Liberated	20
Fe	Liberated	21
brass	Liberated	30
Fe	Cemented	135
Fe	Cemented	30
ss	Liberated	4
Fe	Cemented	120
Fe	Liberated	55
Fe	Rimming	40
Fe	Liberated	140
Fe	Liberated	145
Fe	Liberated	4
Fe	Cemented	45
Fe	Liberated	110
Fe	Liberated	70
Fe	Liberated	14
Fe	Liberated	35
Fe	Liberated	15
Fe	Cemented	105
Fe	Rimming	40
Fe	Rimming	30
Fe	Rimming	30
Fe	Rimming	30
Fe	Liberated	85
Fe	Liberated	42
Fe	Rimming	22
Fe	Rimming	30
Fe	Rimming	31
Fe	Liberated	90
Fe	Liberated	80
Fe	Liberated	1
Fe	Liberated	120
Sulf	Liberated	8
Fe	Rimming	5
Fe	Liberated	35
py	Liberated	5
Fe	Liberated	48
Fe	Liberated	105
Fe	Liberated	10
Fe	Rimming	25
Fe	Rimming	32
Fe	Liberated	100
Fe	Liberated	28
Fe	Liberated	12
Fe	Liberated	40
Fe	Rimming	100
Fe	Rimming	25
Fe	Rimming	1
Fe	Rimming	3
Fe	Liberated	85
Fe	Liberated	60
Fe	Liberated	55
Fe	Liberated	55
Sulf	Cemented	2
Sulf	Cemented	2
Sulf	Cemented	2
Sulf	Cemented	2
Sulf	Cemented	1
Fe	Rimming	190
Fe	Liberated	11
Fe	Liberated	1
Fe	Liberated	45
Fe	Liberated	12
Fe	Liberated	75
Fe	Liberated	105
Fe	Liberated	8
Fe	Rimming	20
Fe	Rimming	75
ss	Liberated	14
Fe	Rimming	185
Fe	Rimming	80
Fe	Rimming	90
Fe	Liberated	110
Fe	Liberated	80
Fe	Liberated	45
Fe	Liberated	35
Fe	Liberated	3
Fe	Liberated	22

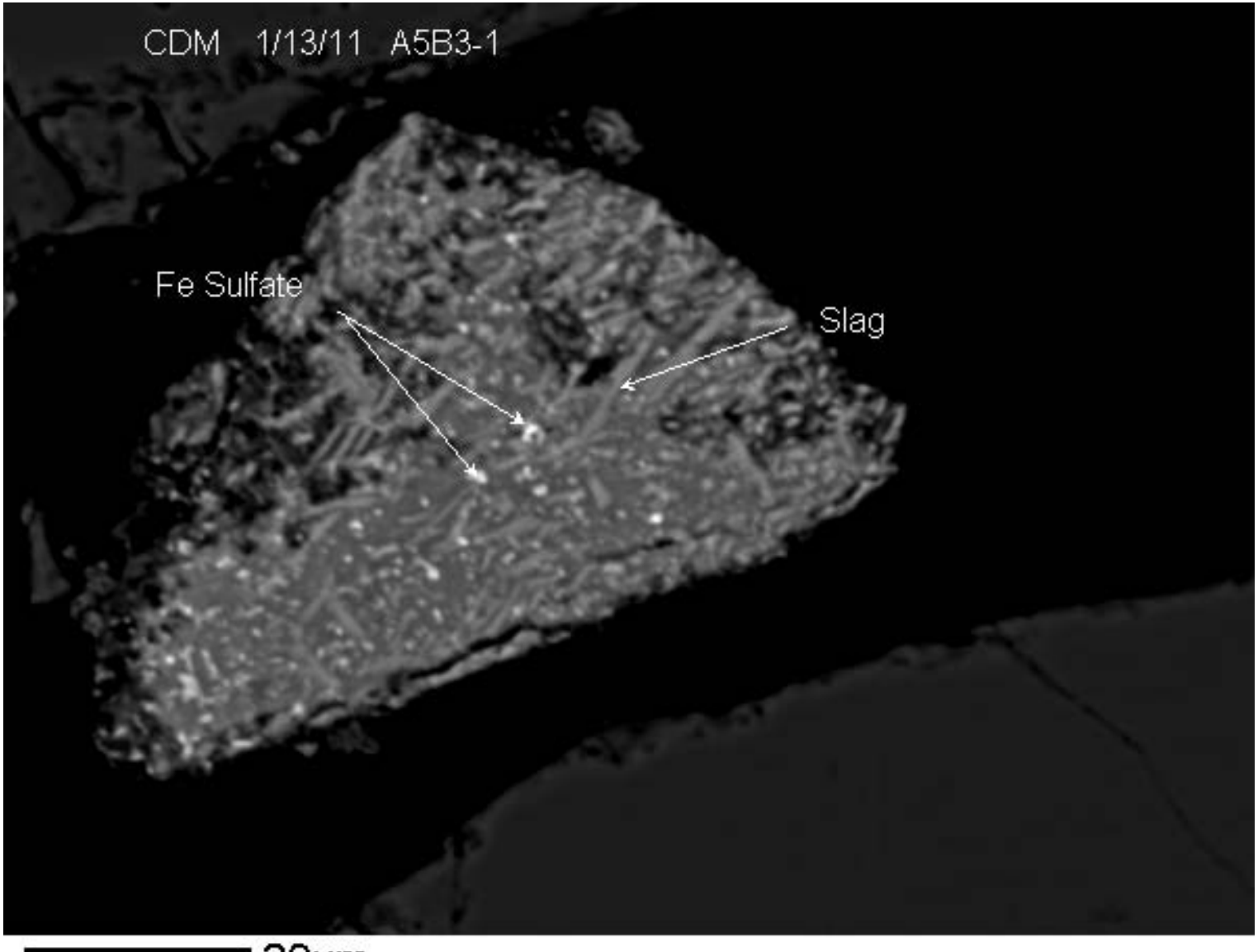
Form	Number	Mean	Std-Dev	Range low	Range high
total	108	49.93	45.78	1	190
FeOOH	97	54.76	45.79	1	190
Brass	1	30	ND	30	30
Sulfo Salt	3	9.33	5.03	4	14
FeSO4	6	2.83	2.56	1	8
Pyrite	1	5	ND	5	5

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	98.52	98.52	91.54	91.54	78	78	2.28
Brass	0.56	0.56	0.36	0.36	0	0	1.4
Sulfo Salt	0.52	0.52	7.82	7.82	21.84	21.84	1.36
FeSO4	0.32	0.32	0.27	0.27	0.08	0.08	1.06
Pyrite	0.09	0.09	0.01	0.01	0.08	0.08	0.57



Fe	Cemented	145
Fe	Cemented	30
Fe	Liberated	80
Fe	Liberated	85
Fe	Liberated	78
Fe	Liberated	47
Fe	Liberated	10
Fe	Liberated	8
Fe	Cemented	65
Fe	Rimming	7
Fe	Cemented	155
Fe	Liberated	145
ss	Liberated	10
Fe	Liberated	85
Fe	Liberated	15
Fe	Liberated	125
Fe	Rimming	45

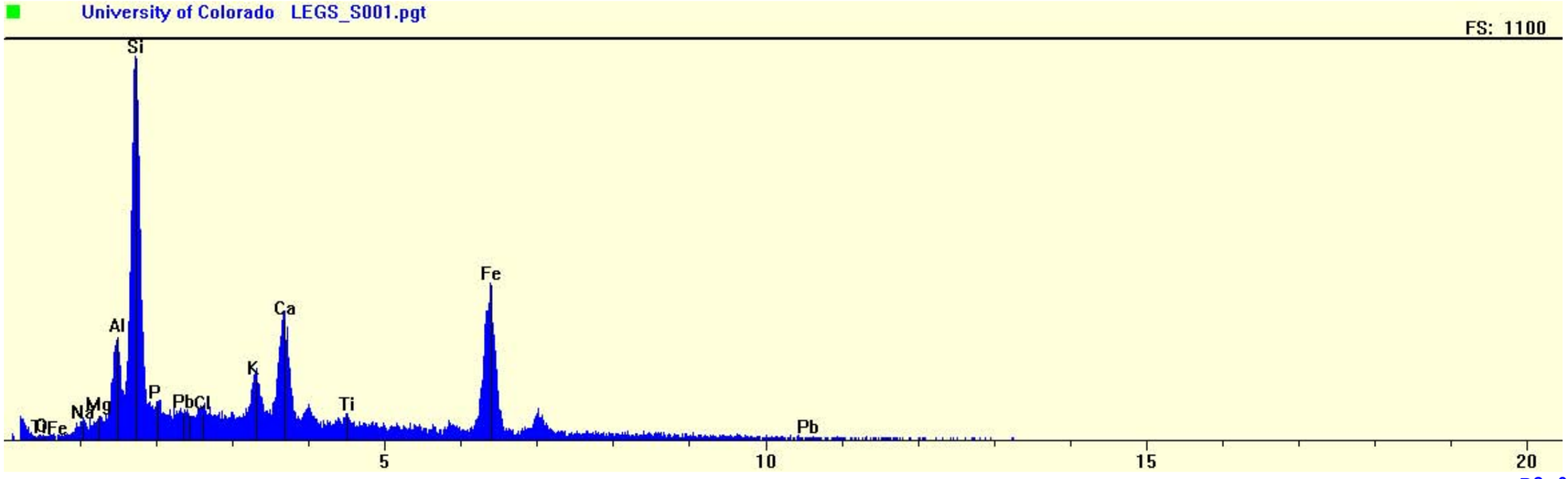
A5B3



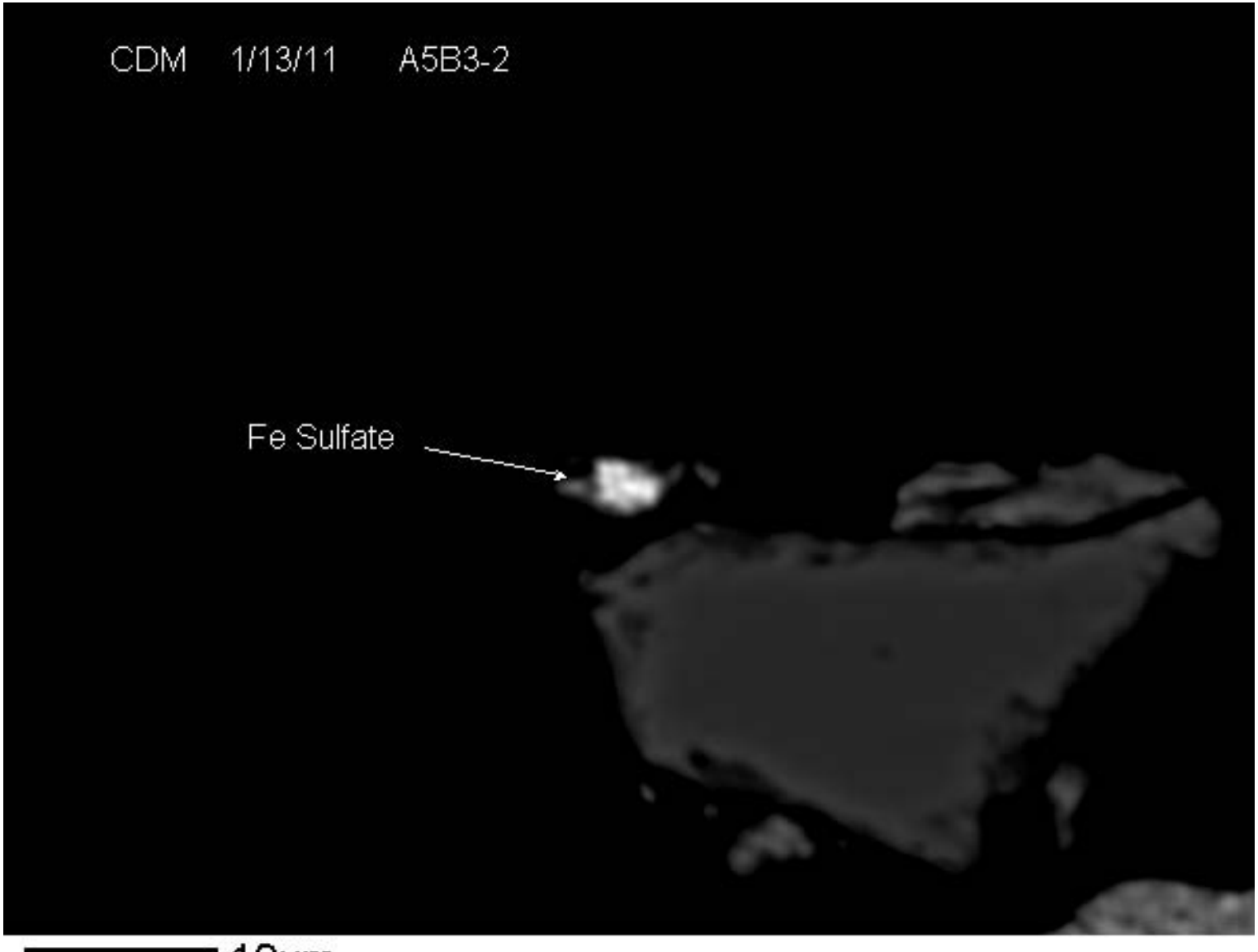
20µm

BEI

R2-0006256


University of Colorado LEGS_S001.pgt
FS: 1100
Si
Fe
Ca
Al
K
P
PbCl
Mg
Na
Ti
Pb
5
10
15
20

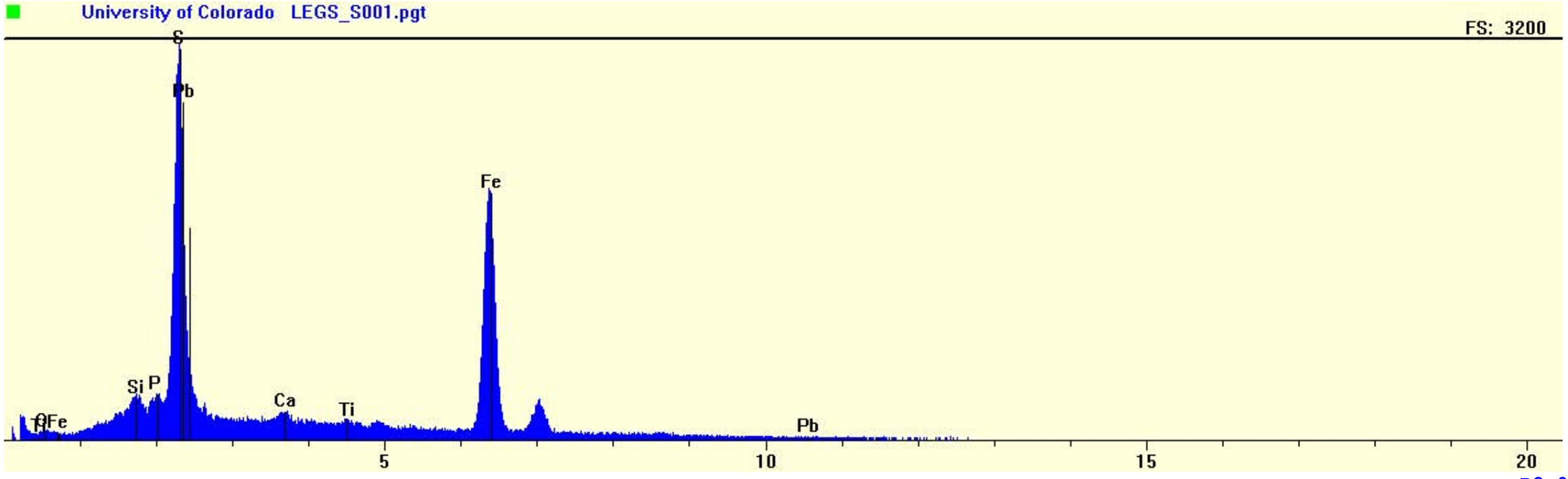
R2-0006257



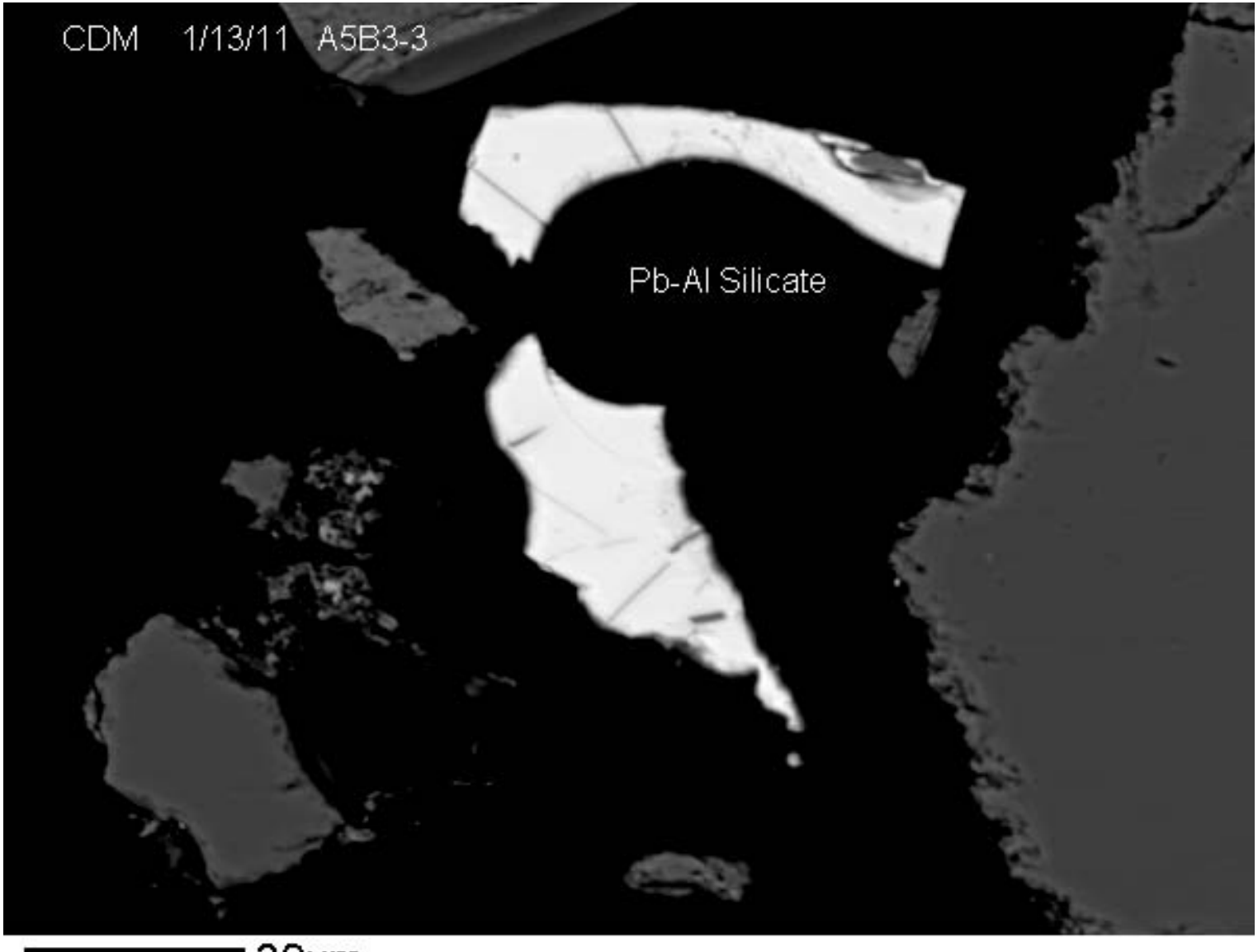
10µm

BEI

R2-0006258


University of Colorado LEGS_S001.pgt
FS: 3200
S
Pb
Fe
Si
P
Ca
Ti
Fe
Pb
5
10
15
20

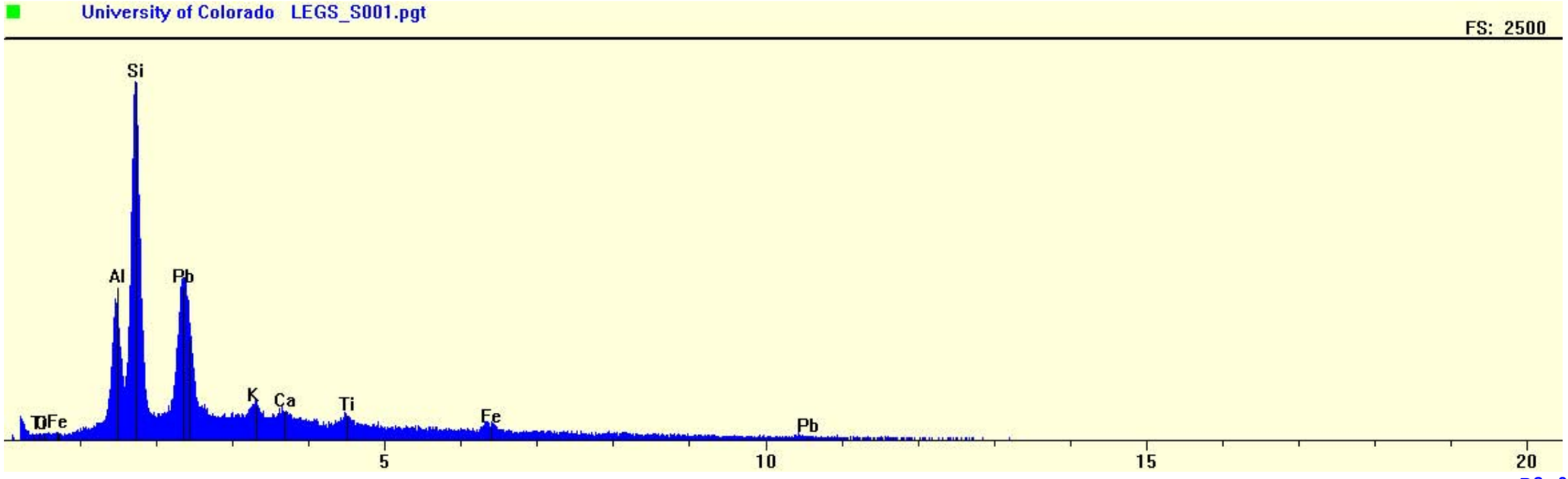
R2-0006259



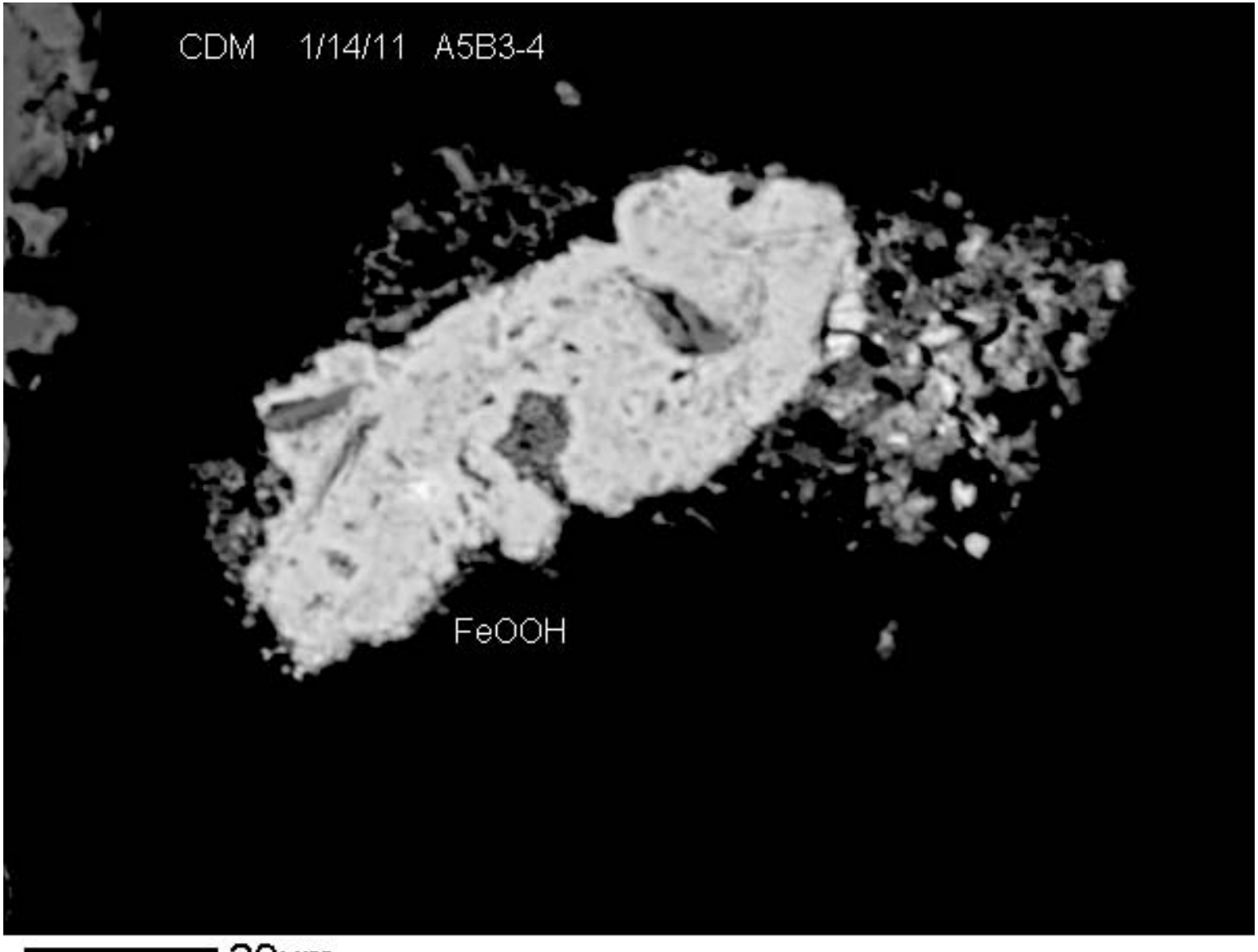
30µm

BEI

R2-0006260


University of Colorado LEGS_S001.pgt
FS: 2500
Si
Al
Pb
K
Ca
Ti
Fe
Fe
Pb
5
10
15
20

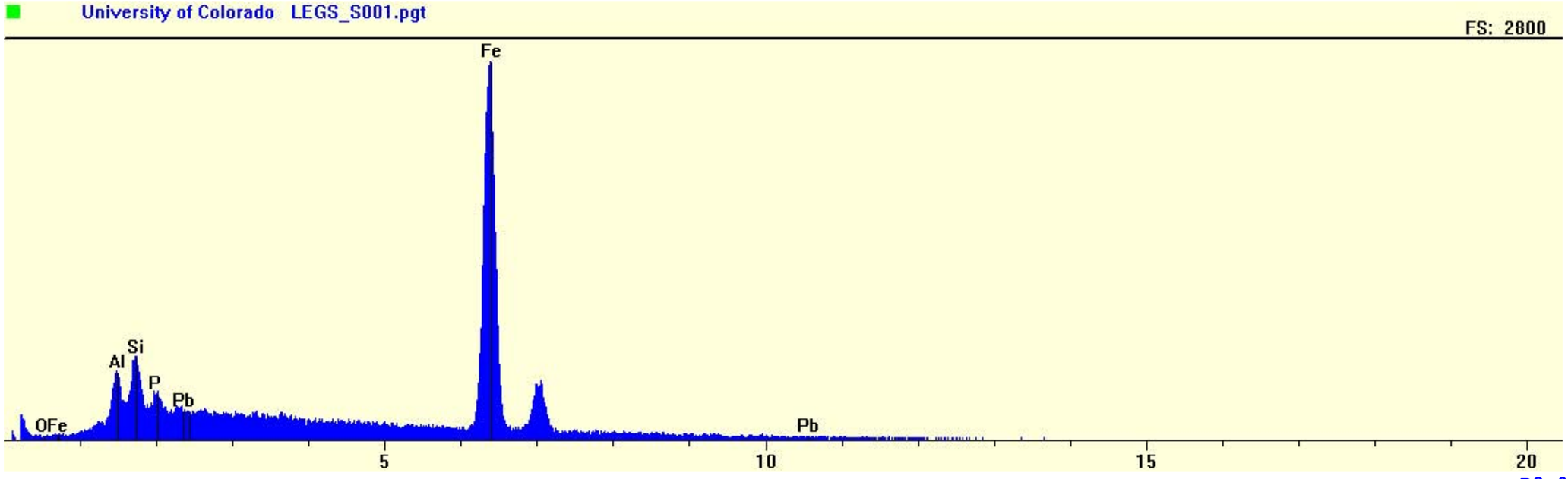
R2-0006261



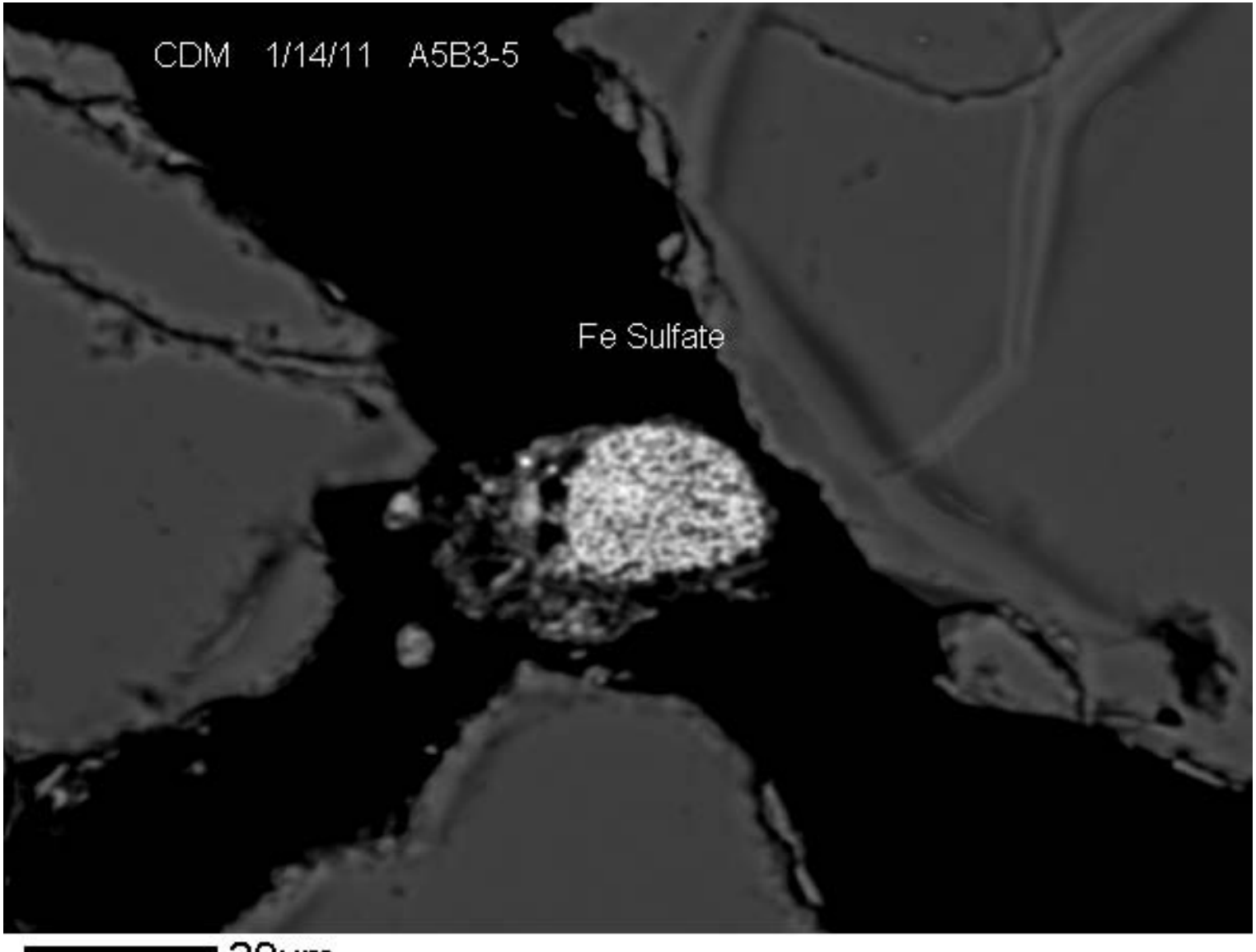
20µm

BEI

R2-0006262


University of Colorado LEGS_S001.pgt
FS: 2800
Fe
Si
Al
P
Pb
OFe
Pb
5
10
15
20

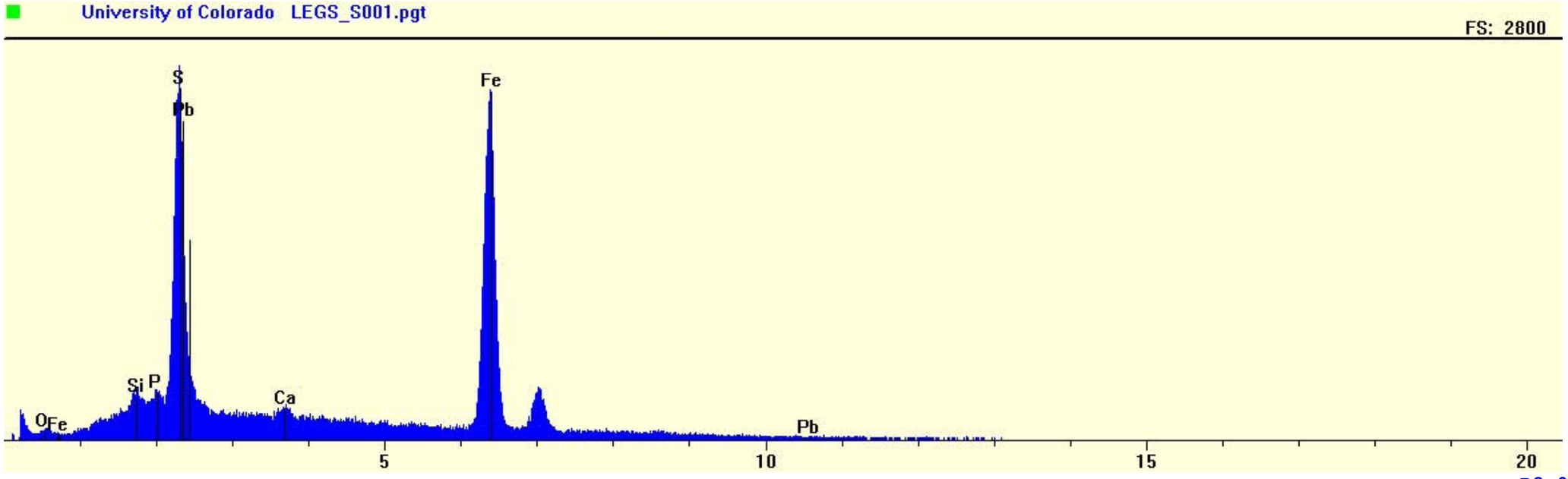
R2-0006263



20µm

BEI

R2-0006264

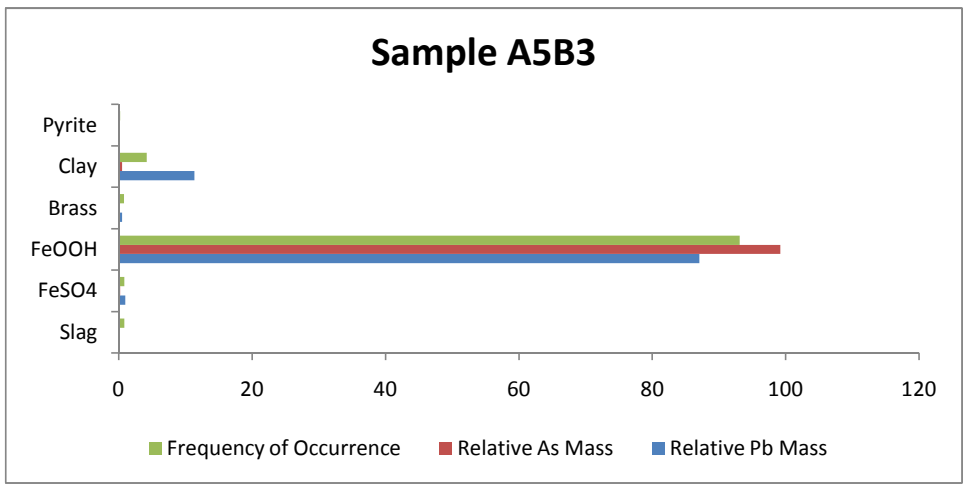

University of Colorado LEGS_S001.pgt
FS: 2800
S
Pb
Fe
Si
P
Ca
O
Fe
Pb
5
10
15
20

R2-0006265

Form	Association	Size(microns)
Slag	Liberated	43
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Inclusion	1
Sulf	Liberated	3
Fe	Liberated	105
Fe	Rimming	40
Fe	Liberated	60
brass	Liberated	40
Fe	Liberated	90
Fe	Liberated	28
Fe	Rimming	7
Fe	Liberated	128
Fe	Liberated	3
AlSi	Liberated	45
AlSi	Liberated	42
Fe	Liberated	8
Fe	Liberated	80
py	Liberated	3
Fe	Rimming	11
Fe	Rimming	14
Fe	Liberated	75
Fe	Cemented	155
Fe	Cemented	100
Fe	Liberated	48
Fe	Liberated	40
Fe	Liberated	5
Fe	Liberated	85
Fe	Cemented	115
Fe	Liberated	35
Fe	Liberated	20
Fe	Rimming	45
Fe	Liberated	90
py	Inclusion	4
Fe	Rimming	14
Fe	Liberated	50
Fe	Liberated	60
Fe	Liberated	15
Sulf	Liberated	3
Fe	Liberated	10
Fe	Rimming	3
Fe	Rimming	26
Fe	Rimming	65
Fe	Liberated	100
Fe	Liberated	190
Fe	Liberated	5
Fe	Liberated	7
Fe	Liberated	44
Fe	Liberated	5
Fe	Liberated	7
Fe	Liberated	85
Fe	Liberated	145
Fe	Cemented	9
Fe	Liberated	12
Fe	Liberated	16
Fe	Liberated	11
Fe	Liberated	1
Fe	Liberated	29
py	Liberated	4
Fe	Liberated	55
Fe	Liberated	95
Fe	Liberated	128
Fe	Liberated	48
Sulf	Liberated	12
Fe	Cemented	135
Sulf	Liberated	12
Fe	Liberated	110
Fe	Liberated	11
Fe	Rimming	95
Fe	Liberated	55
Fe	Liberated	150
Fe	Cemented	135
Fe	Liberated	128
Fe	Liberated	4
Fe	Liberated	70
Fe	Liberated	3
Fe	Liberated	128
Fe	Cemented	120
Fe	Liberated	80
Fe	Rimming	130
Fe	Cemented	35

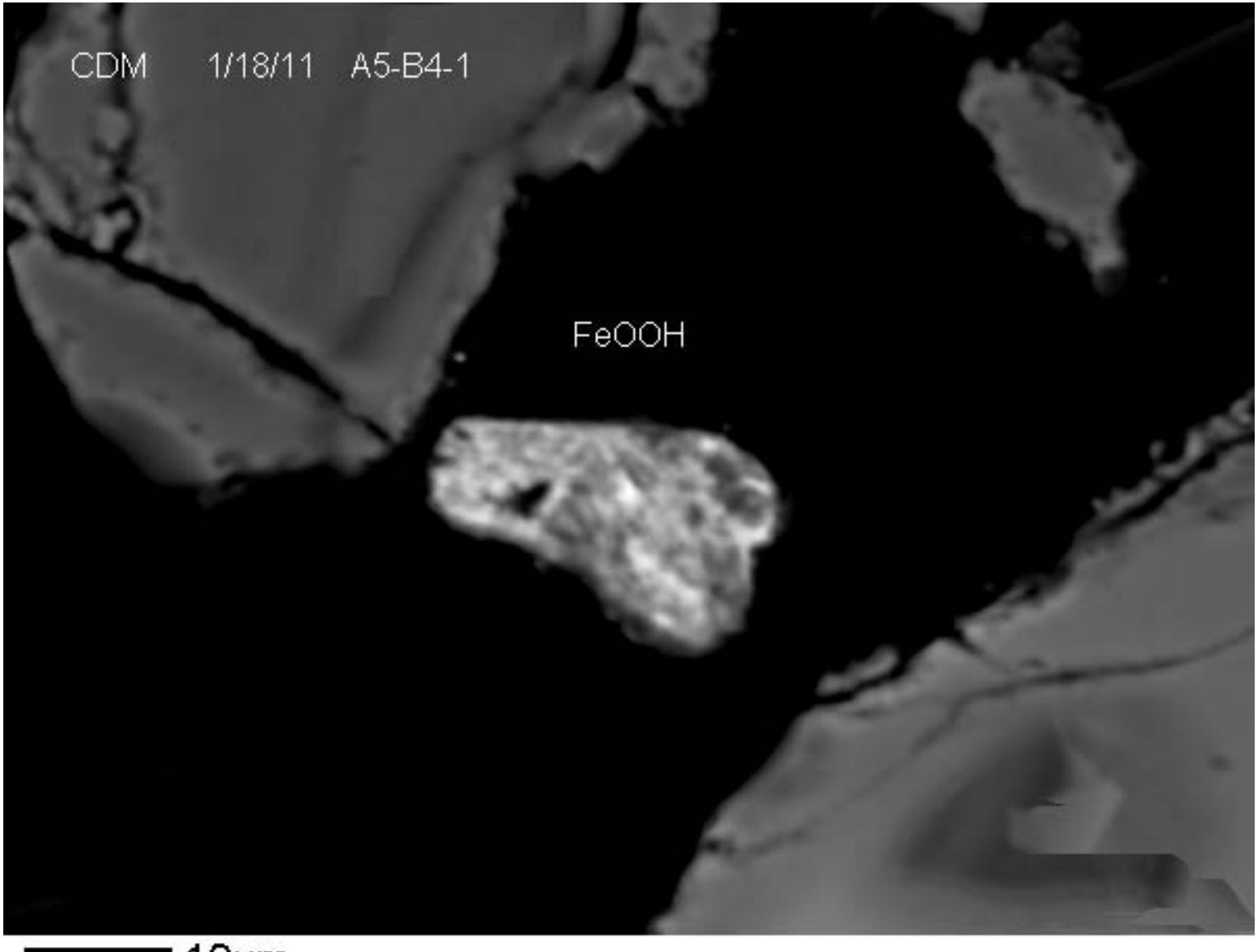
Form	Number	Mean	Std-Dev	Range low	Range high
total	101	49.73	49.49	1	190
Slag	1	43	ND	43	43
FeSO4	15	2.73	3.83	1	12
FeOOH	78	59.95	49.82	1	190
Brass	1	40	ND	40	40
Clay	3	70.67	47.08	42	125
Pyrite	3	3.67	0.58	3	4

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
Slag	0.86	0.86	0.08	0.08	0	0	1.8
FeSO4	0.82	0.6	1.01	0.58	0.22	0.14	1.75
FeOOH	93.09	93.37	87.05	87.43	99.17	99.28	4.95
Brass	0.8	0.8	0.52	0.52	0	0	1.73
Clay	4.22	4.23	11.33	11.38	0.52	0.52	3.92
Pyrite	0.22	0.14	0.01	0.01	0.09	0.06	0.91



Fe	Liberated	165
Fe	Rimming	40
Fe	Rimming	20
Fe	Rimming	48
Fe	Rimming	70
AlSi	Liberated	125
Fe	Liberated	50
Fe	Liberated	13
Fe	Liberated	11
Fe	Rimming	75
Fe	Liberated	25
Fe	Cemented	148

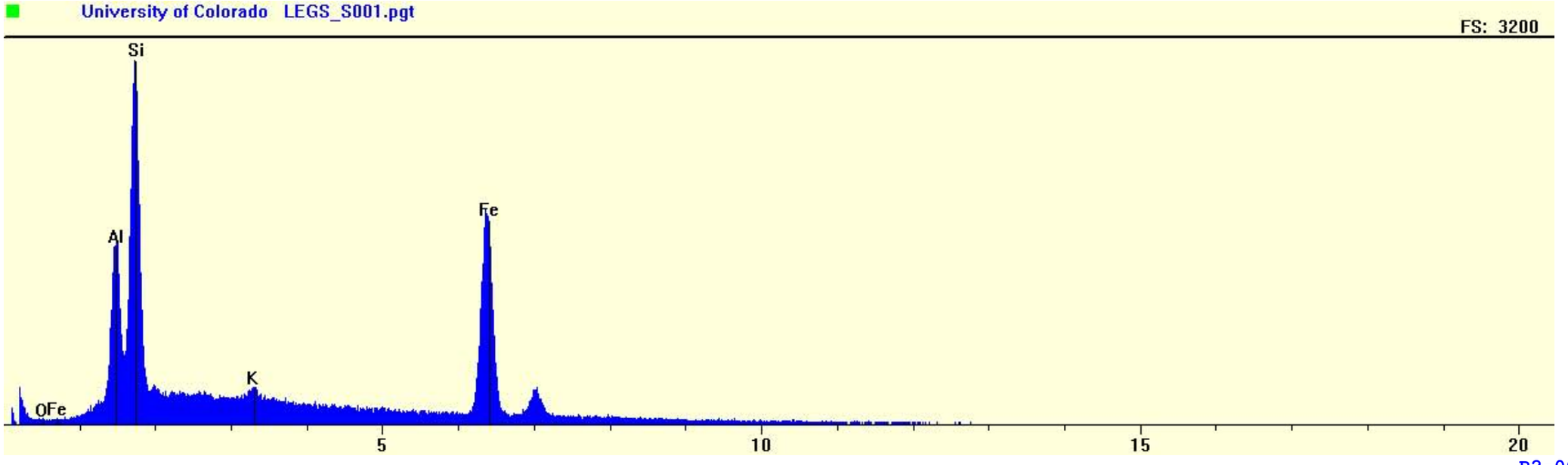
A5B4



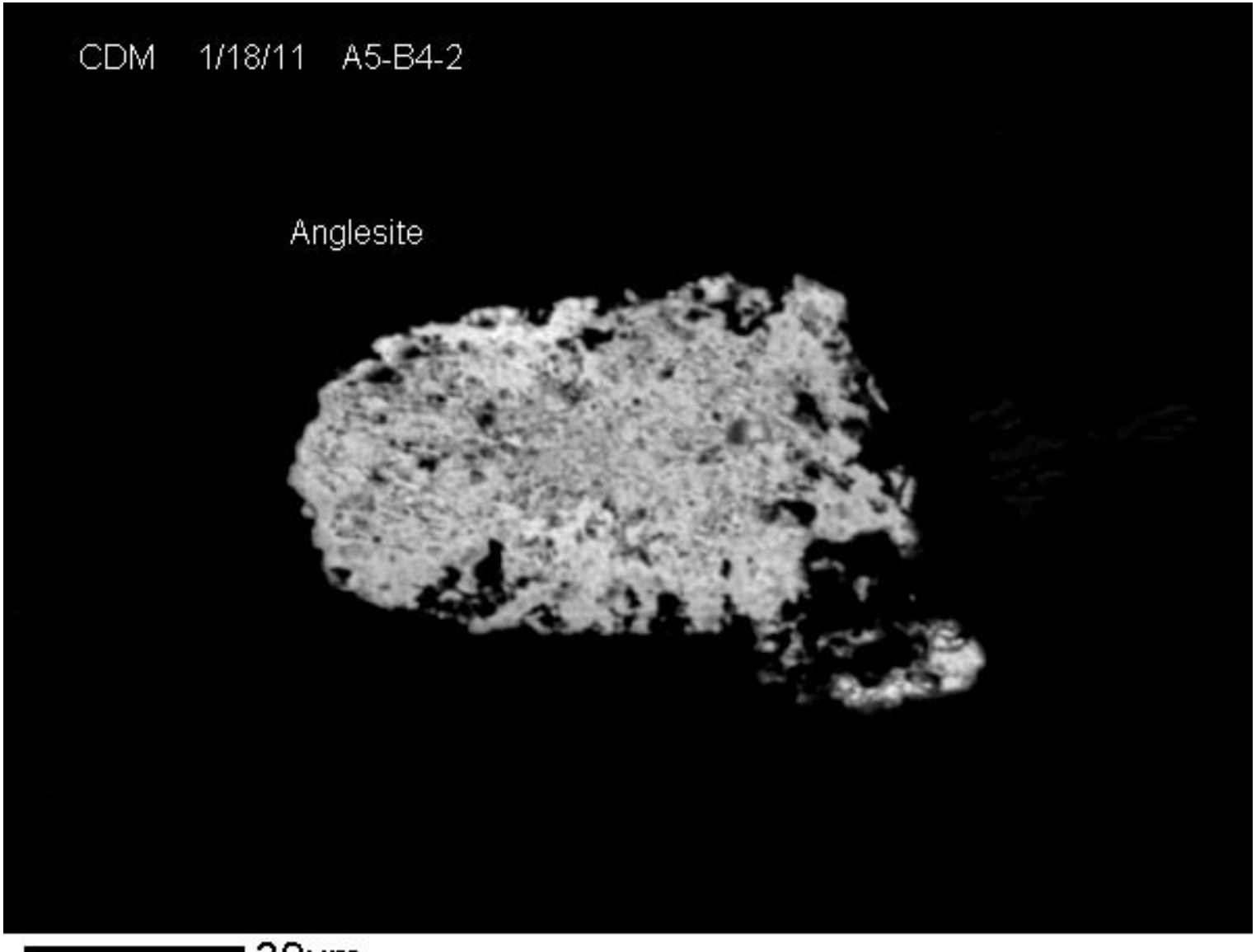
10µm

BEI

R2-0006269


University of Colorado LEGS_S001.pgt
FS: 3200
Si
Al
Fe
K
OFe
5
10
15
20

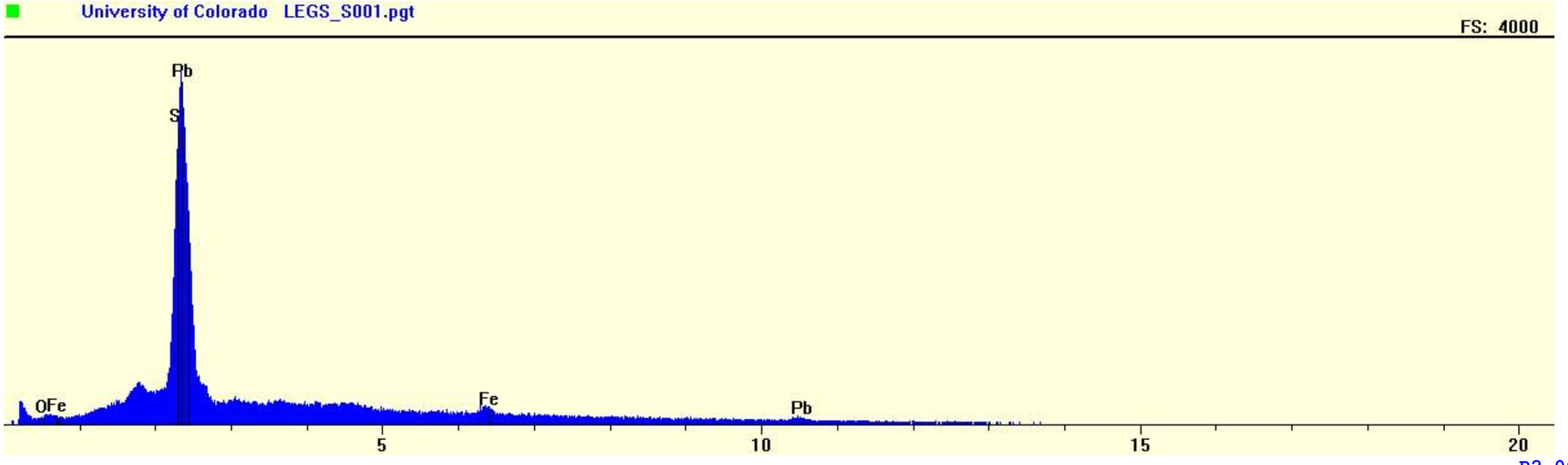
R2-0006270



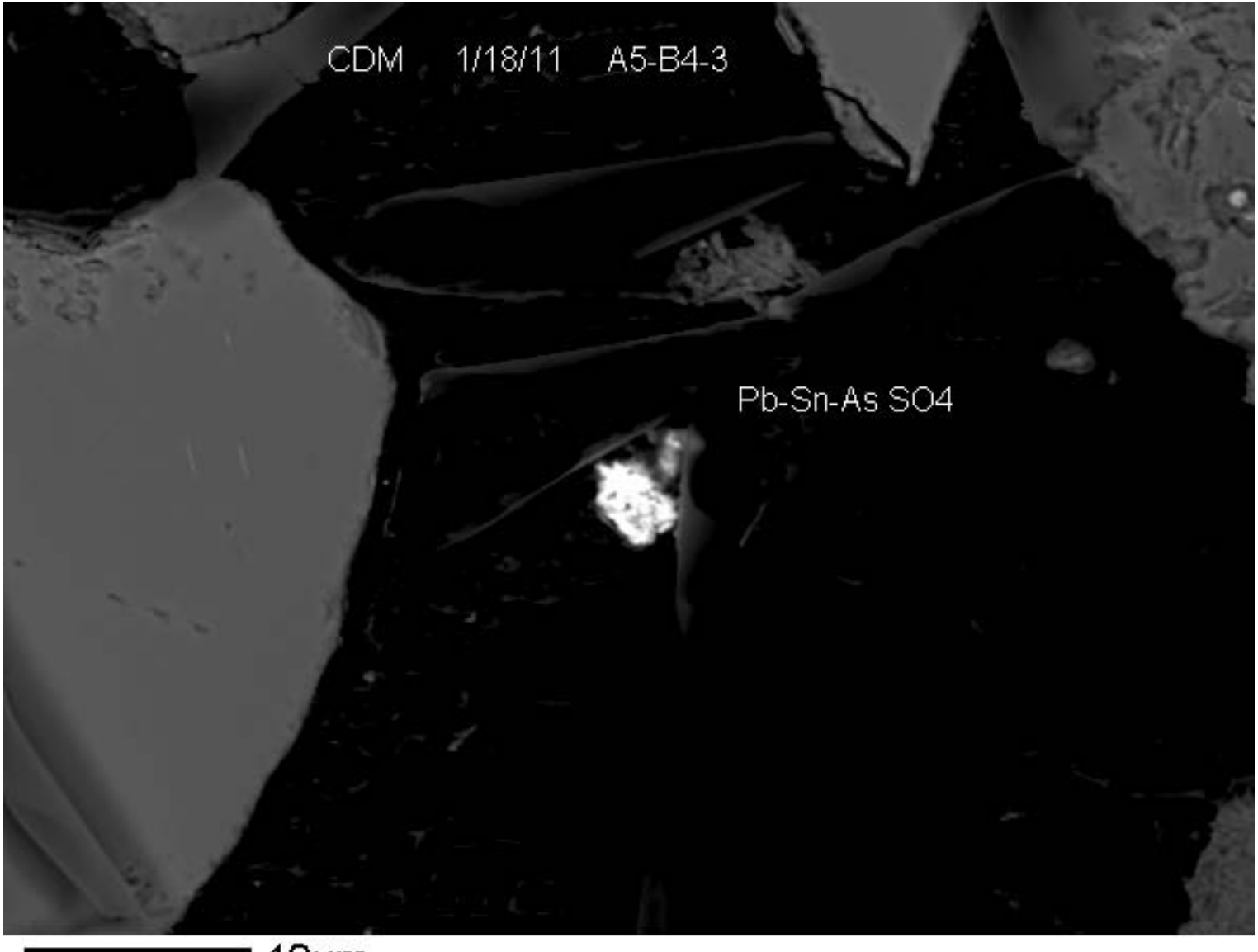
30µm

BEI

R2-0006271


University of Colorado LEGS_S001.pgt
FS: 4000
Pb
S
OFe
Fe
Pb
5
10
15
20

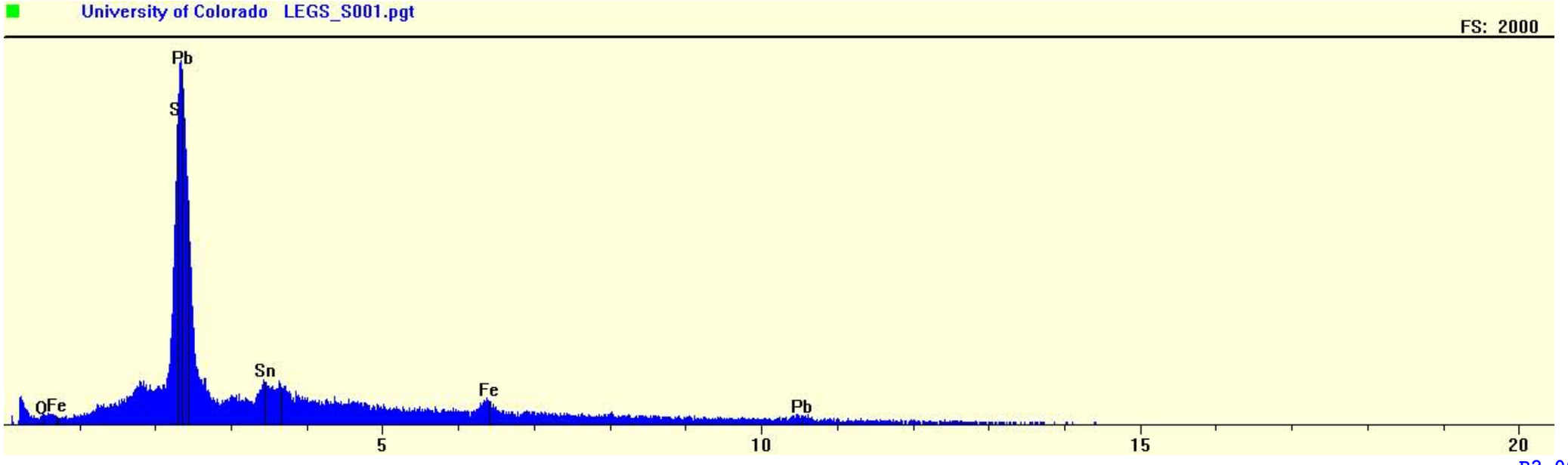
R2-0006272



40µm

BEI

R2-0006273

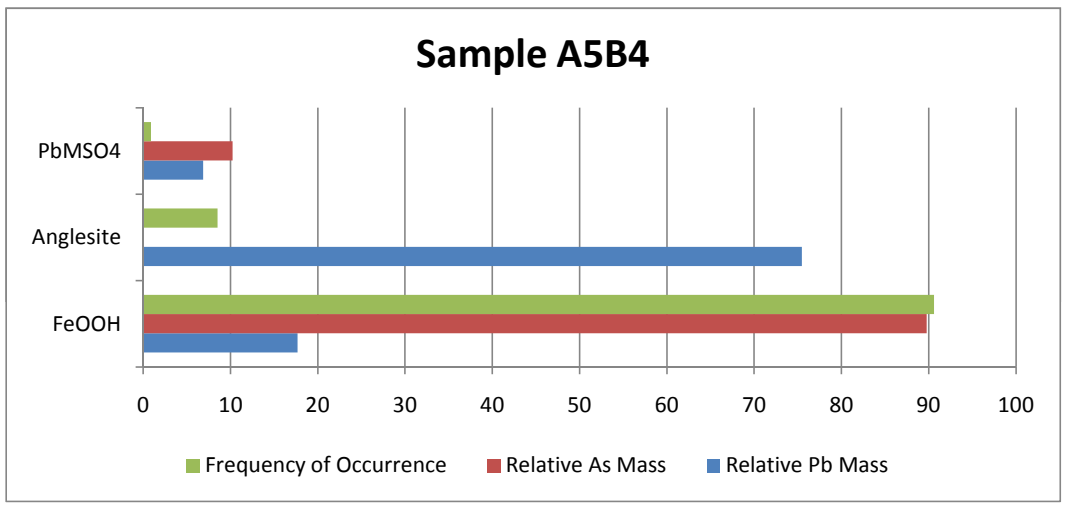

University of Colorado LEGS_S001.pgt
FS: 2000
Pb
S
Sn
Fe
Pb
QFe
5
10
15
20

R2-0006274

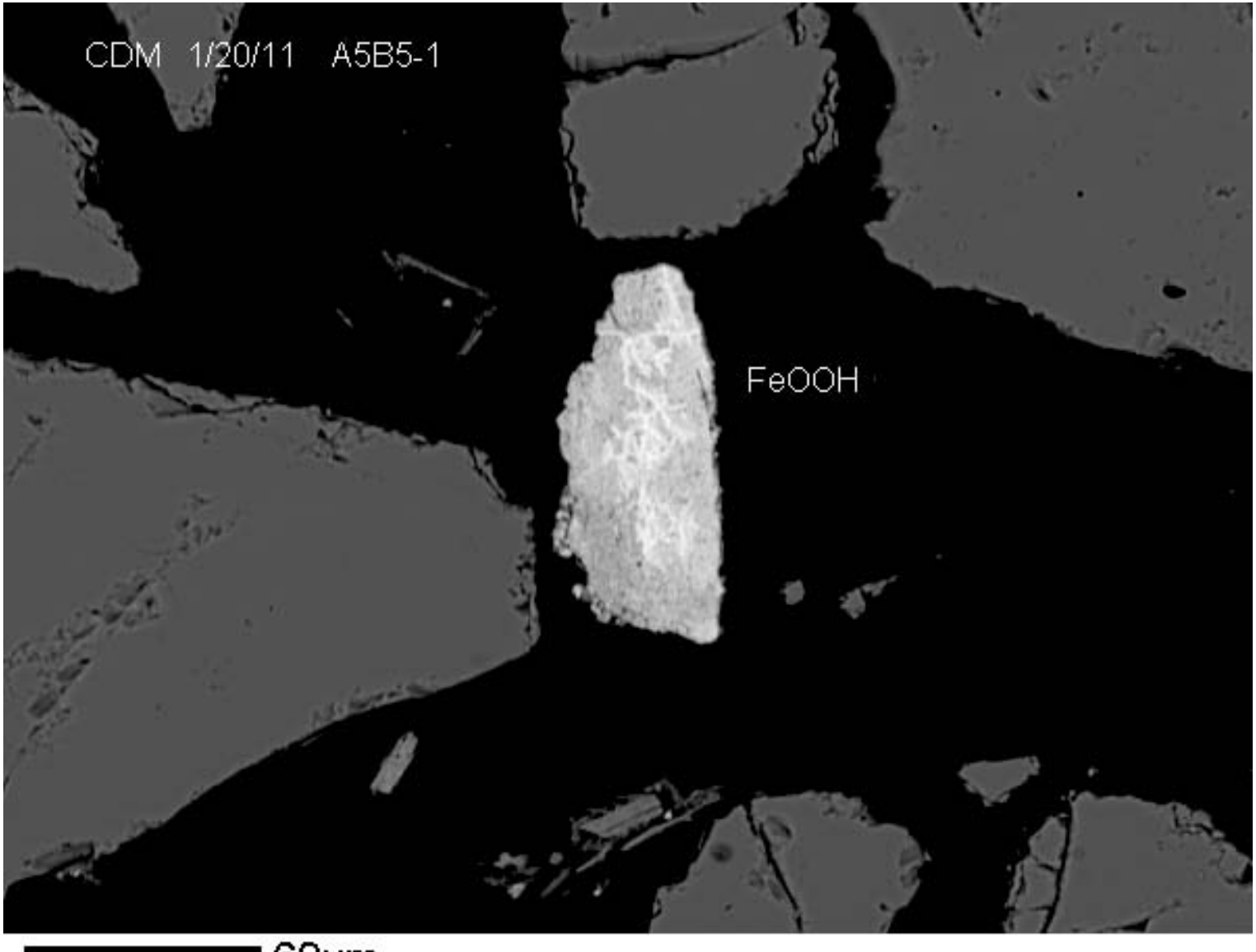
Form	Association	Size (microns)
Fe	Liberated	185
Fe	Liberated	43
Fe	Liberated	8
Fe	Liberated	60
Fe	Liberated	12
Fe	Liberated	15
Fe	Liberated	32
Fe	Liberated	58
Fe	Liberated	47
Fe	Liberated	96
Fe	Liberated	110
Fe	Liberated	130
Fe	Liberated	40
Ang	Liberated	12
Ang	Liberated	62
Fe	Rimming	40
Fe	Rimming	55
Fe	Liberated	85
pbmso4	Liberated	10
Fe	Liberated	7
Fe	Liberated	21
Ang	Liberated	24

Form	Number	Mean	Std-Dev	Range low	Range high
total	22	52.36	45.36	7	185
FeOOH	18	58	47.47	7	185
Anglesite	3	32.67	26.1	12	62
PbMSO4	1	10	ND	10	10

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	90.63	90.63	17.67	17.67	89.77	89.77	12.18
Anglesite	8.51	8.51	75.46	75.46	0	0	11.66
PbMSO4	0.87	0.87	6.87	6.87	10.23	10.23	3.88



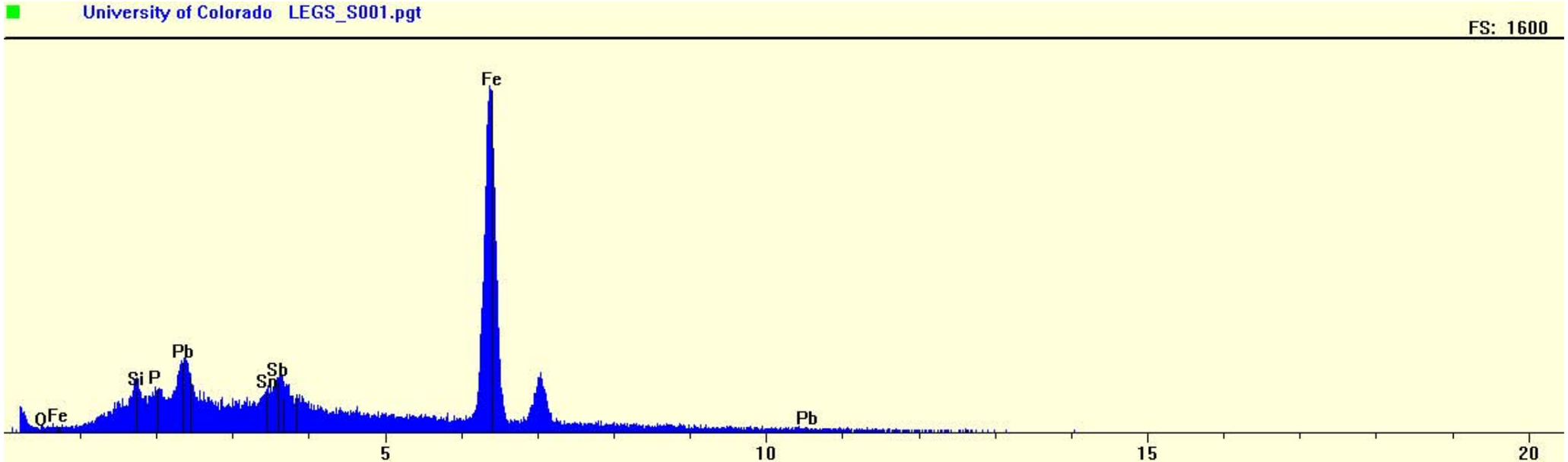
A5B5



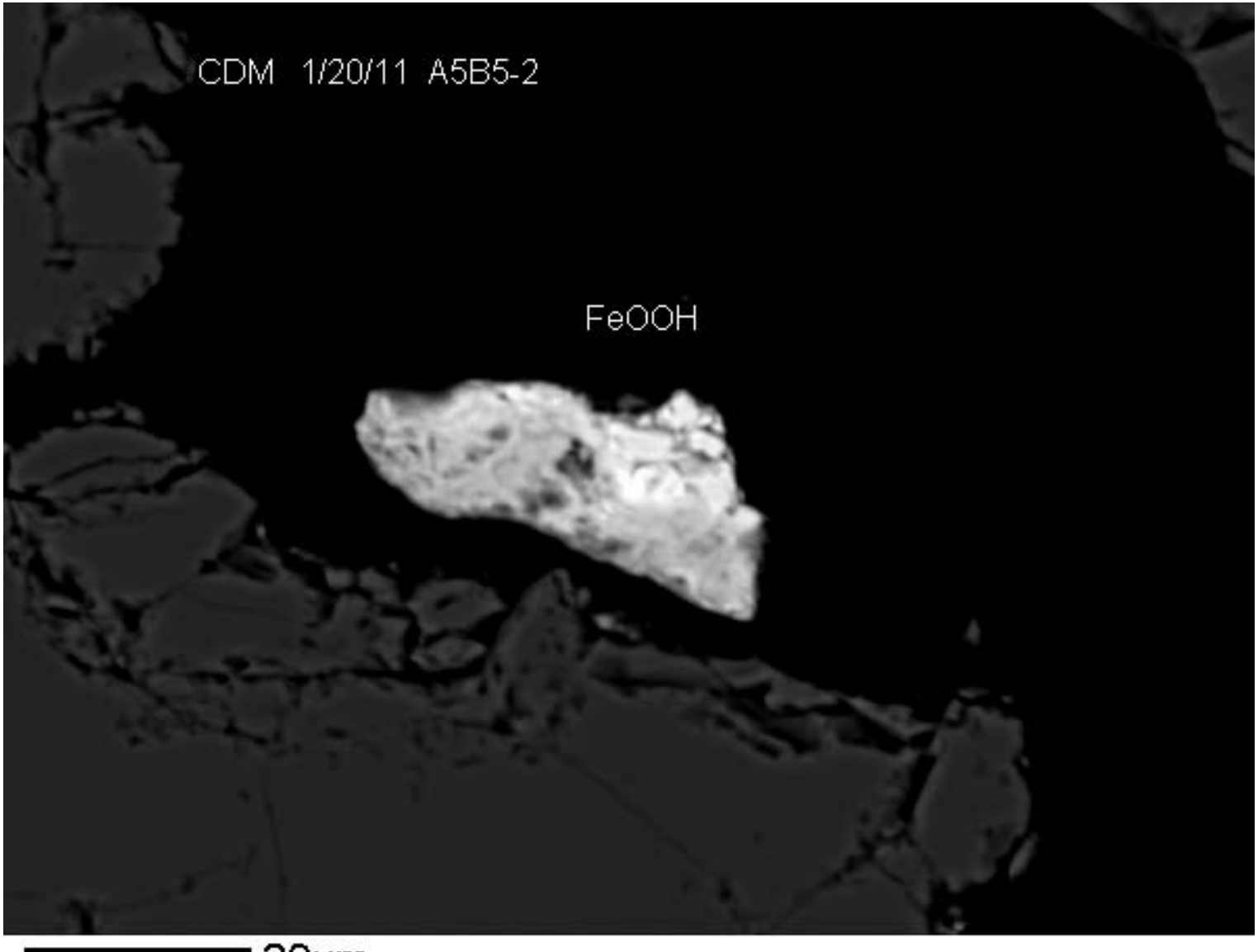
60µm

BEI

R2-0006277


University of Colorado LEGS_S001.pgt
FS: 1600
Fe
Pb
Si P
Sb
Sn
QFe
Pb
5
10
15
20

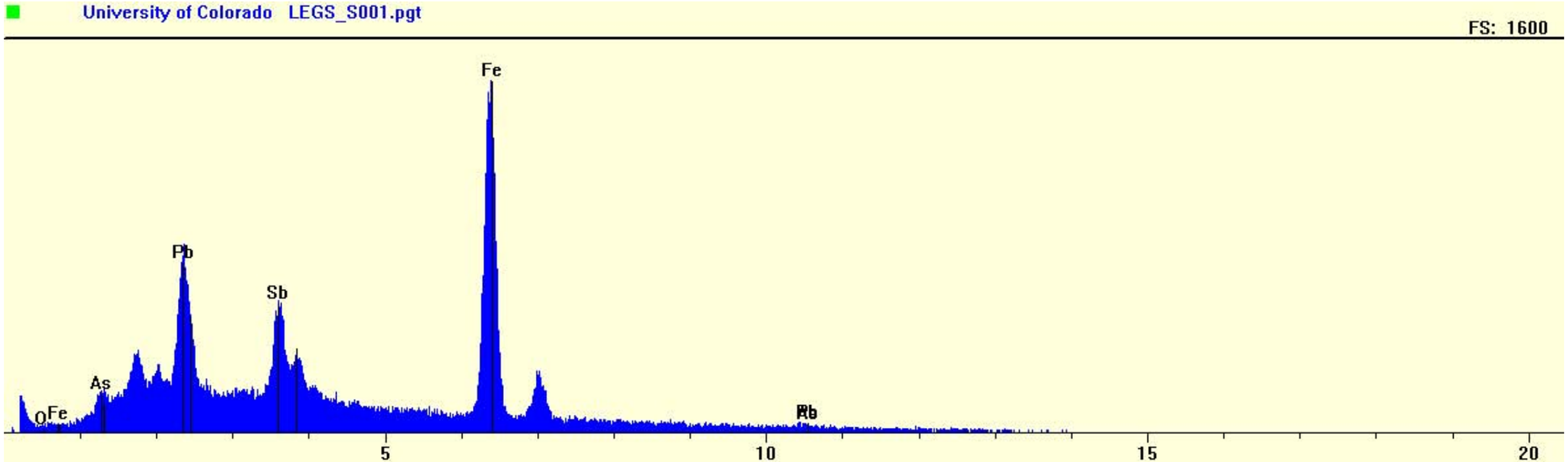
R2-0006278



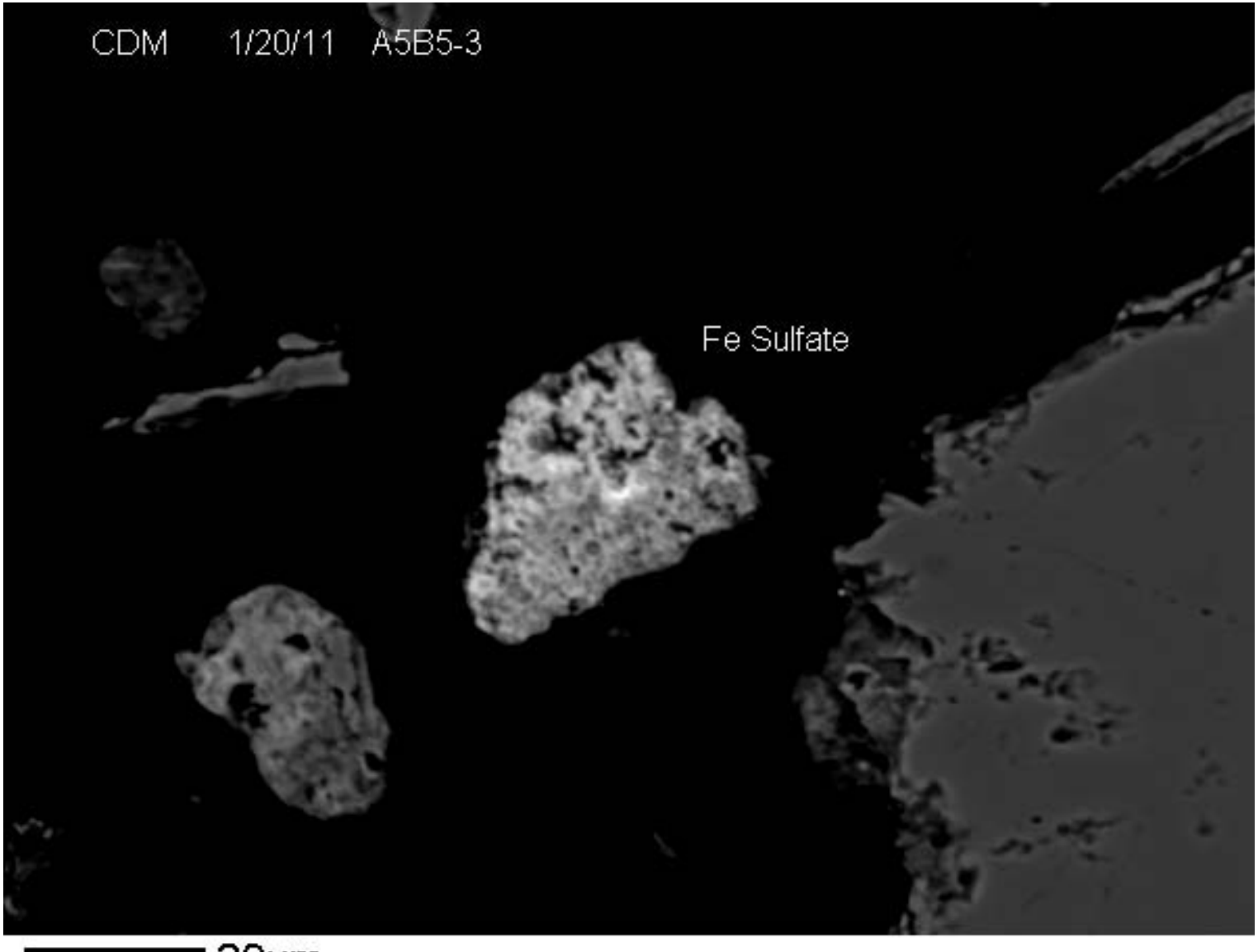
20µm

BEI

R2-0006279


University of Colorado LEGS_S001.pgt
FS: 1600
Fe
Pb
Sb
As
O
Fe
Rb
5
10
15
20

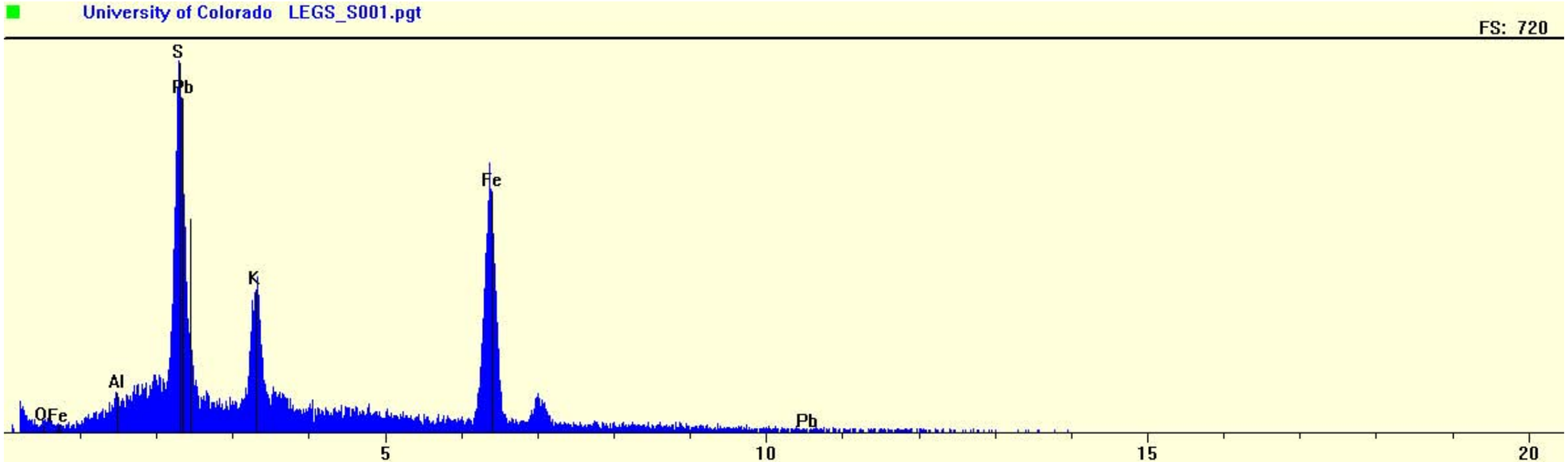
R2-0006280



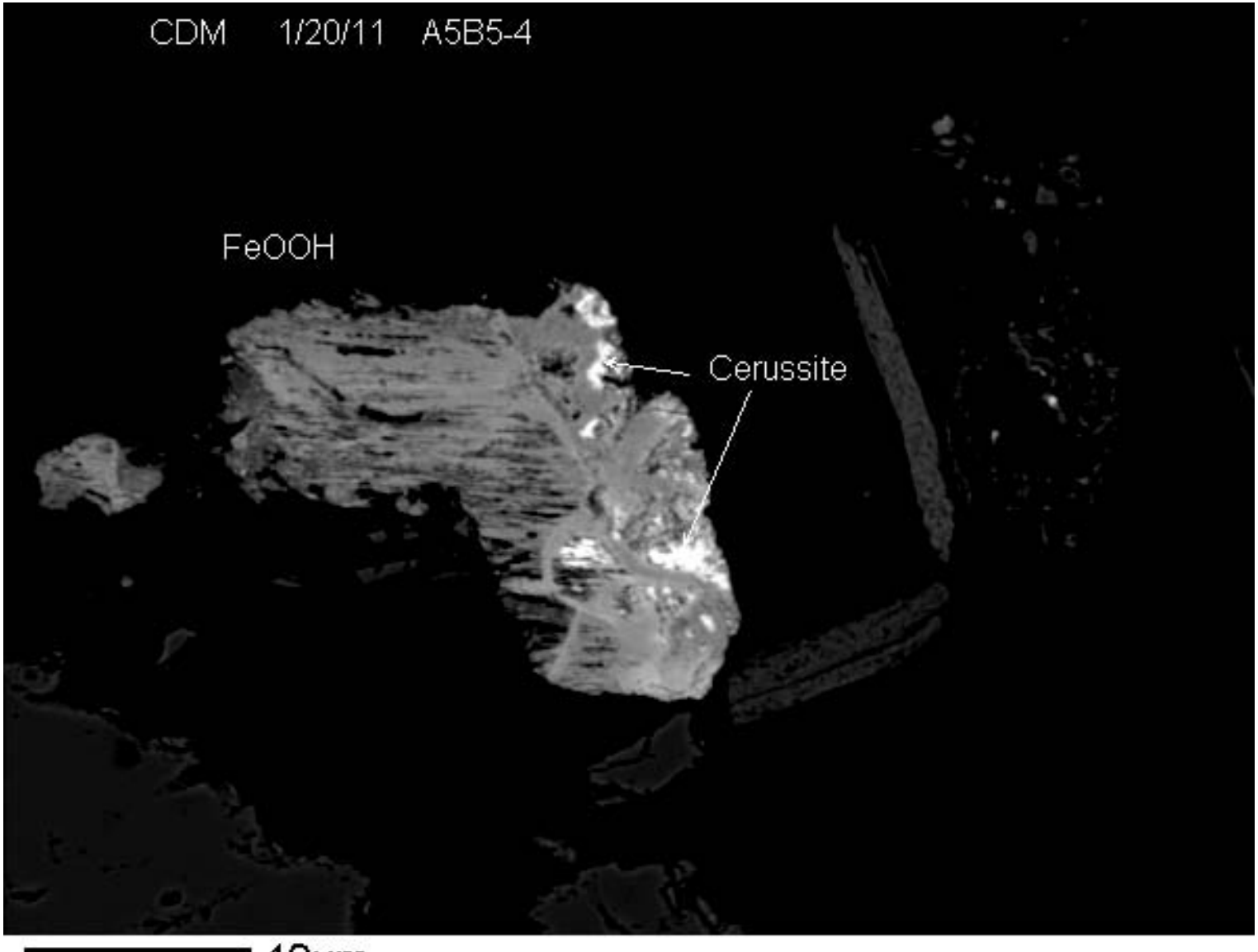
20µm

BEI

R2-0006281


University of Colorado LEGS_S001.pgt
FS: 720
S
Pb
Fe
K
Al
OFe
Pb
5
10
15
20

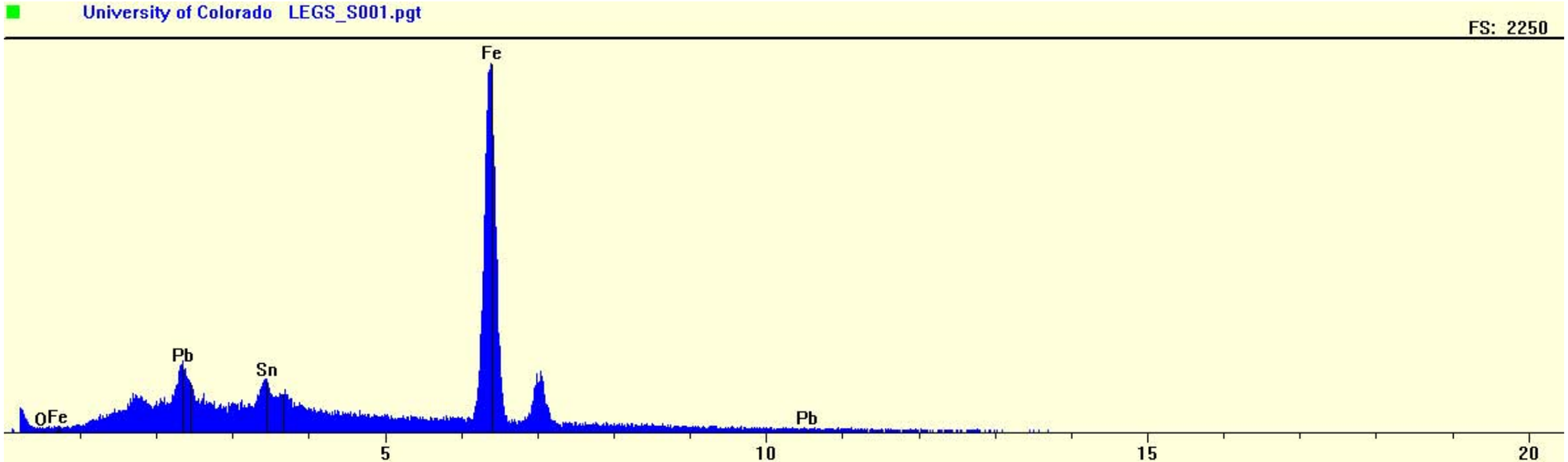
R2-0006282



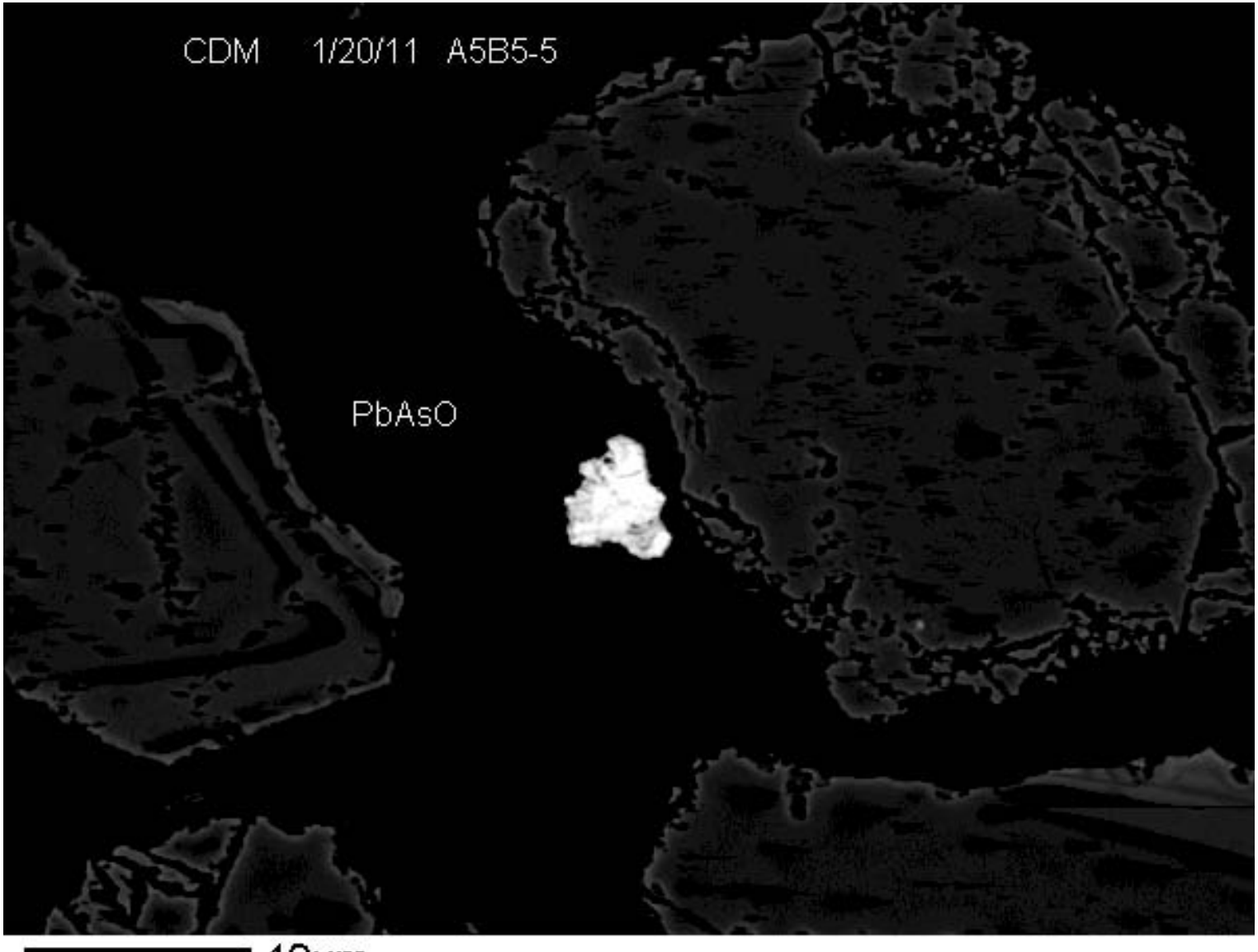
40µm

BEI

R2-0006283


University of Colorado LEGS_S001.pgt
FS: 2250
Fe
Pb
Sn
OFe
Pb
5
10
15
20

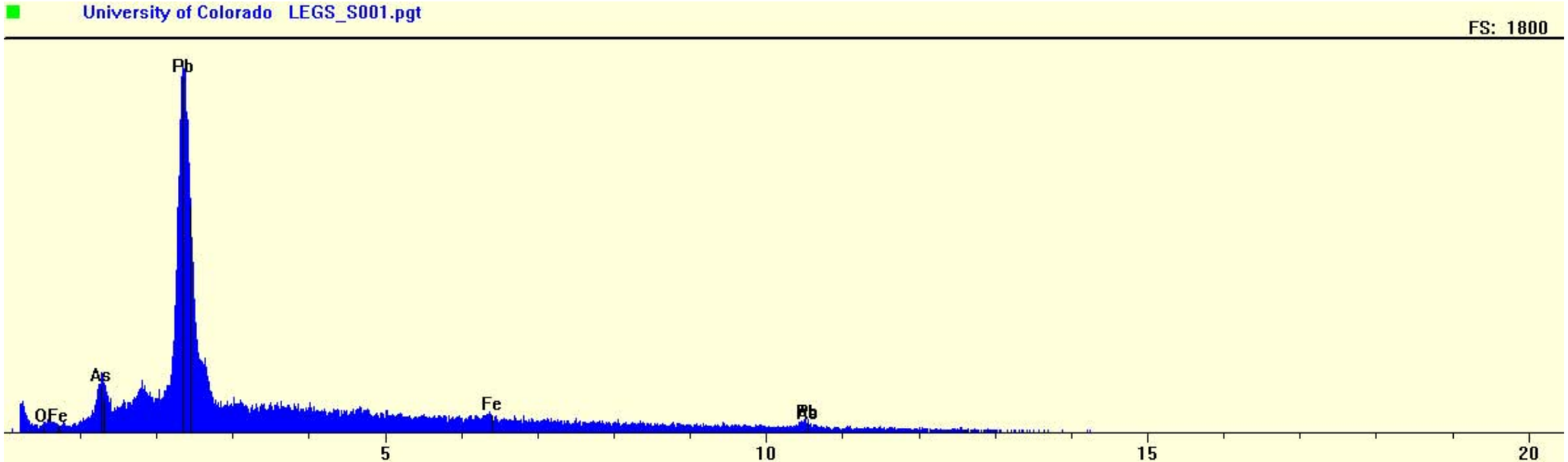
R2-0006284



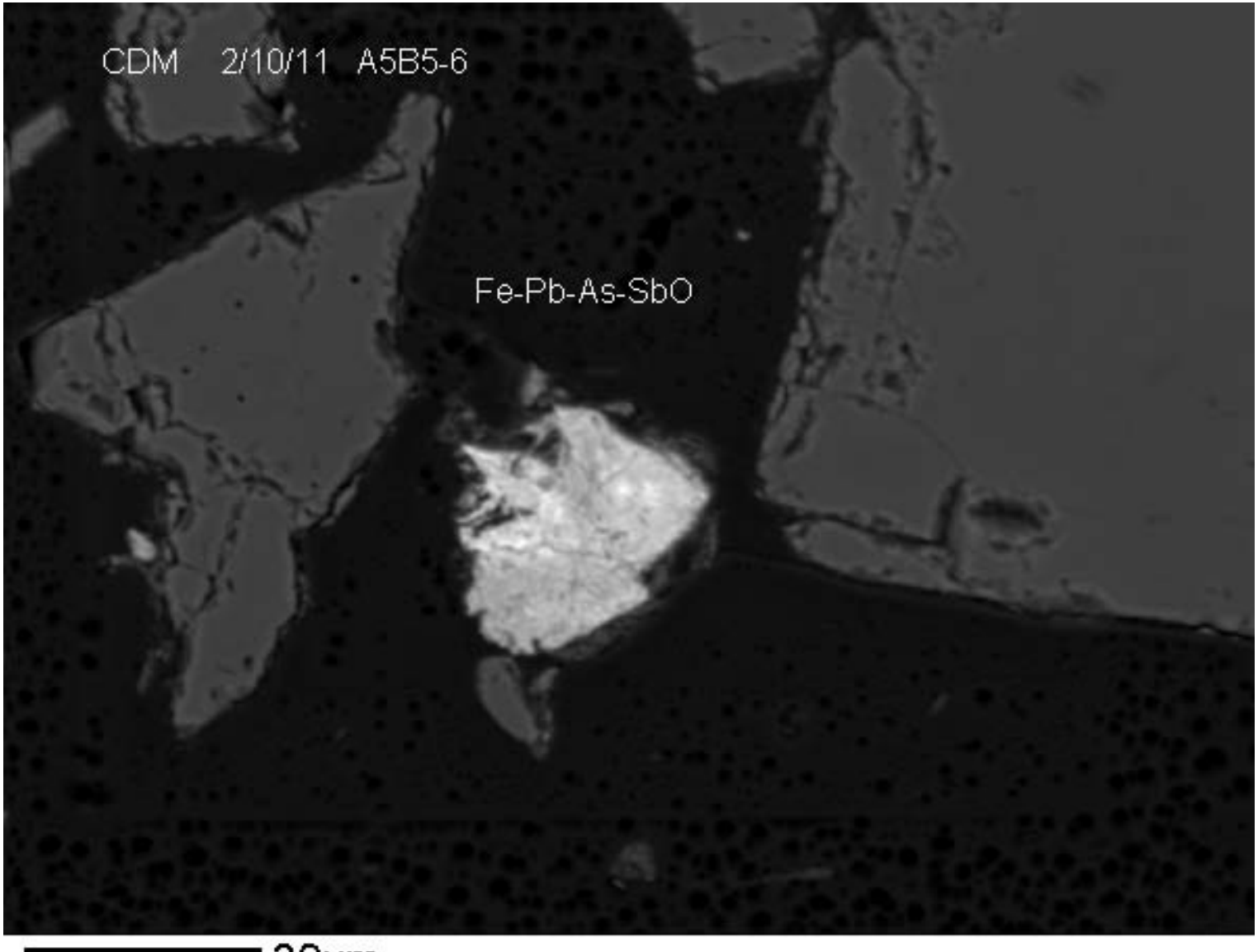
40µm

BEI

R2-0006285


University of Colorado LEGS_S001.pgt
FS: 1800
Pb
As
OFe
Fe
Pb
5
10
15
20

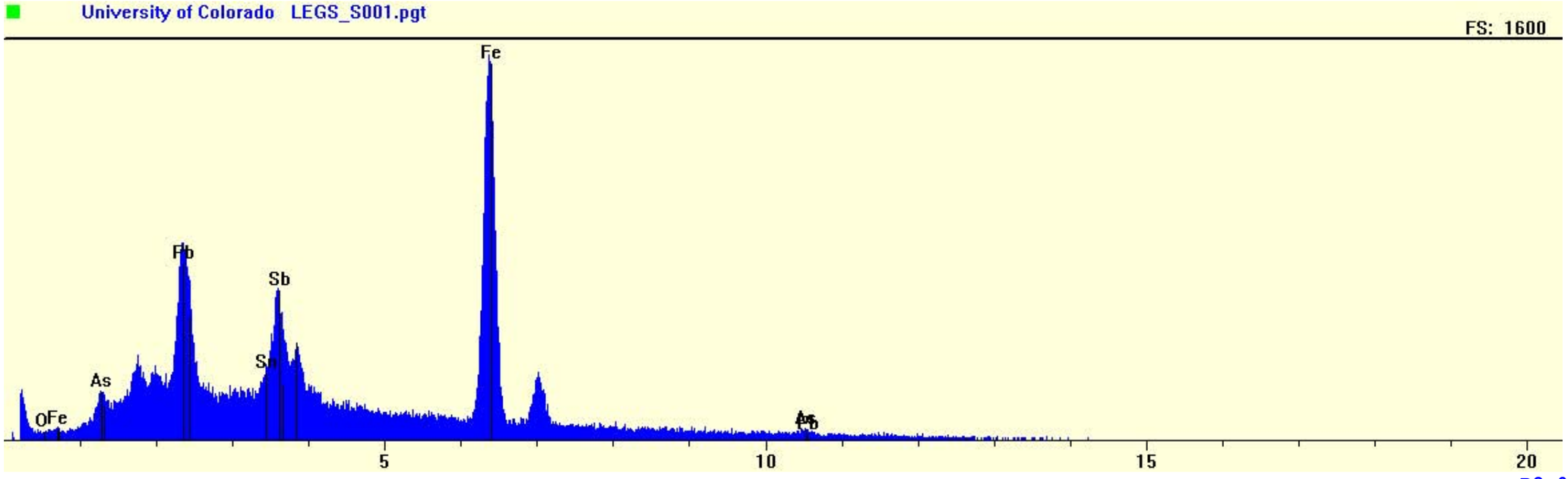
R2-0006286



30µm

BEI

R2-0006287

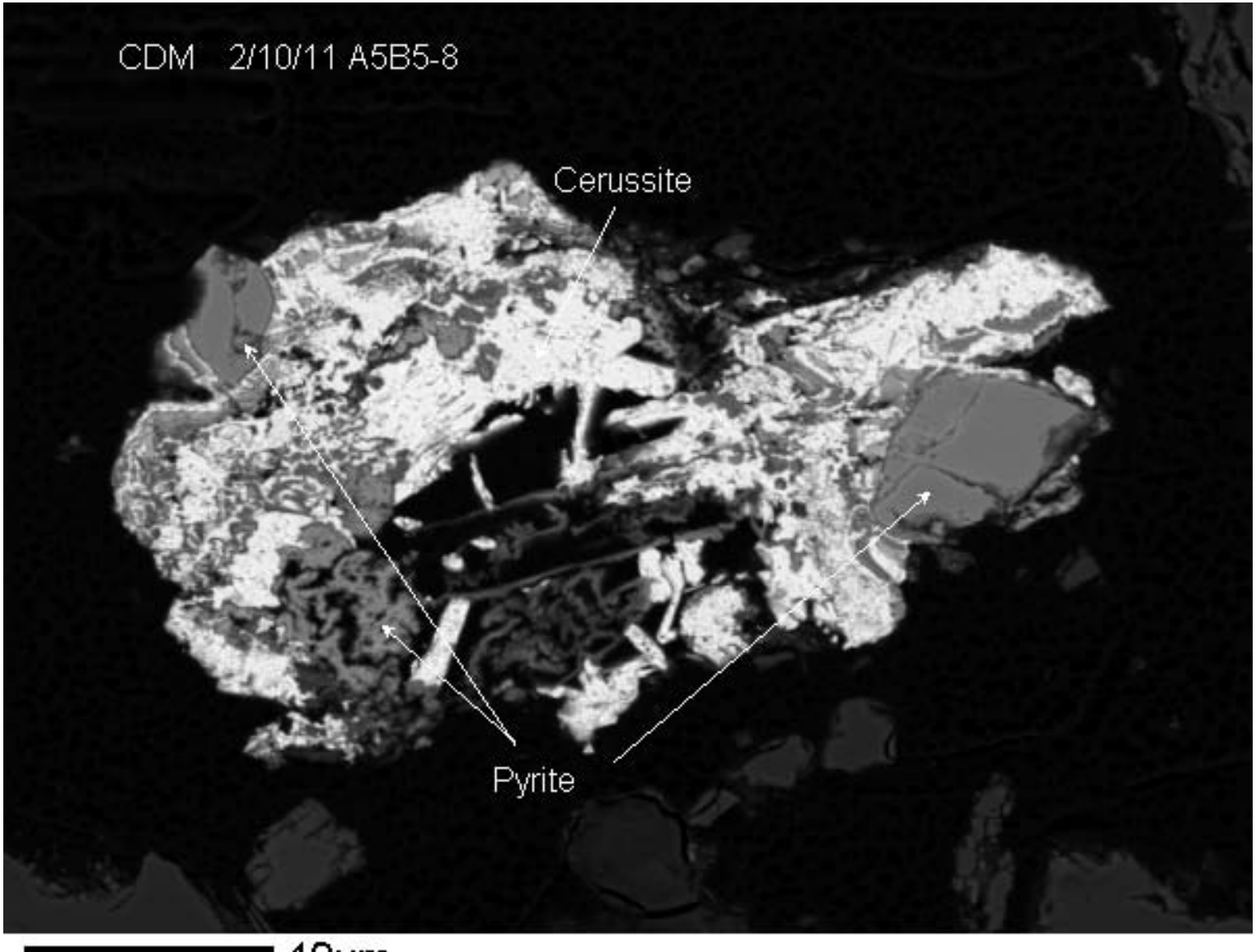

University of Colorado LEGS_S001.pgt
FS: 1600
Fe
Pb
Sb
Sb
As
OFe
As
Pb
5
10
15
20

R2-0006288

10µm

BEI

R2-0006289



40µm

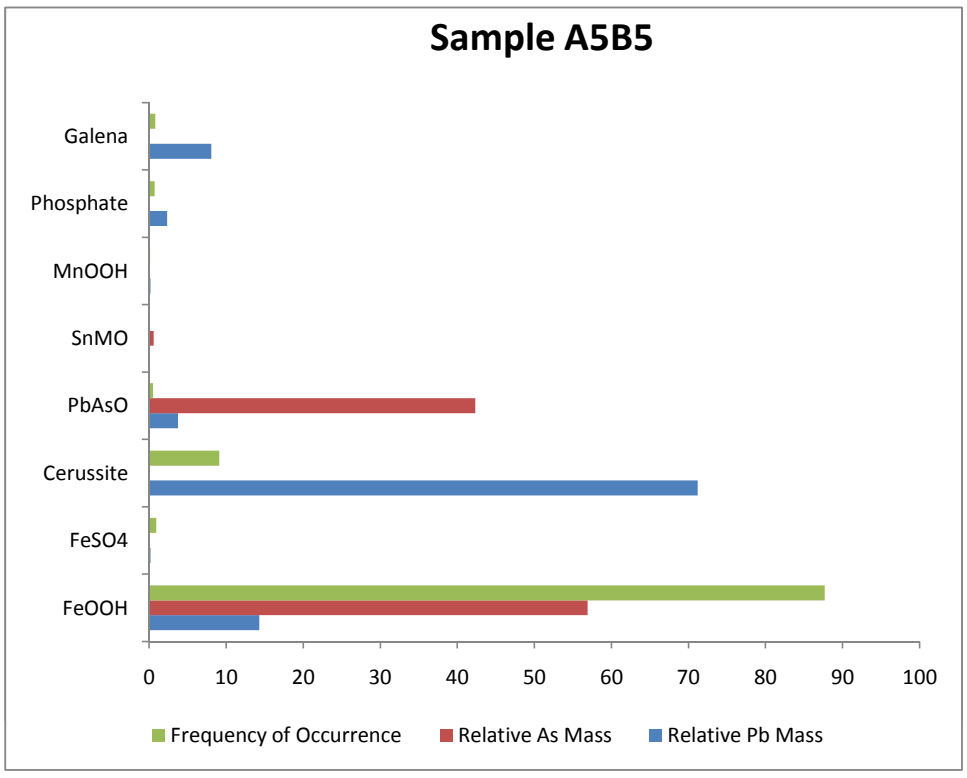
BEI

R2-0006290

Form	Association	Size (microns)
Fe	Liberated	8
Fe	Liberated	14
Fe	Liberated	80
Fe	Liberated	6
Fe	Liberated	7
Fe	Liberated	5
Fe	Liberated	23
Fe	Liberated	4
Fe	Liberated	125
Fe	Liberated	6
Fe	Liberated	40
Fe	Liberated	7
Fe	Liberated	8
Fe	Rimming	23
Sulf	Liberated	22
Fe	Liberated	14
Cer	Inclusion	6
Cer	Inclusion	3
Cer	Inclusion	2
Cer	Inclusion	3
Cer	Rimming	3
Fe	Liberated	55
Cer	Cemented	1
Cer	Cemented	1
Cer	Cemented	1
Fe	Liberated	135
Fe	Liberated	125
Fe	Cemented	96
Fe	Liberated	31
Fe	Liberated	10
Fe	Cemented	64
PbAsO	Liberated	12
Fe	Liberated	6
Fe	Liberated	15
Fe	Rimming	75
Fe	Rimming	35
Fe	Rimming	35
Fe	Rimming	35
Fe	Cemented	4
Fe	Rimming	80
Fe	Liberated	5
Fe	Liberated	9
snmo	Liberated	2
Fe	Liberated	5
Fe	Cemented	7
Fe	Liberated	4
Fe	Liberated	4
Mn	Liberated	3
Fe	Liberated	70
Fe	Liberated	6
Fe	Liberated	8
Fe	Liberated	7
Fe	Liberated	190
Fe	Liberated	3
Fe	Liberated	7
Fe	Liberated	12
Fe	Liberated	100
Fe	Liberated	24
Fe	Rimming	7
Fe	Liberated	5
Fe	Liberated	7
Fe	Liberated	4
Fe	Liberated	31
Fe	Cemented	10
Fe	Liberated	75
Phos	Cemented	2
Phos	Cemented	2
Phos	Cemented	2
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Phos	Cemented	1
Fe	Liberated	190
Fe	Liberated	4
Fe	Liberated	23
Fe	Liberated	40
Cer	Liberated	2
Fe	Liberated	22
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1

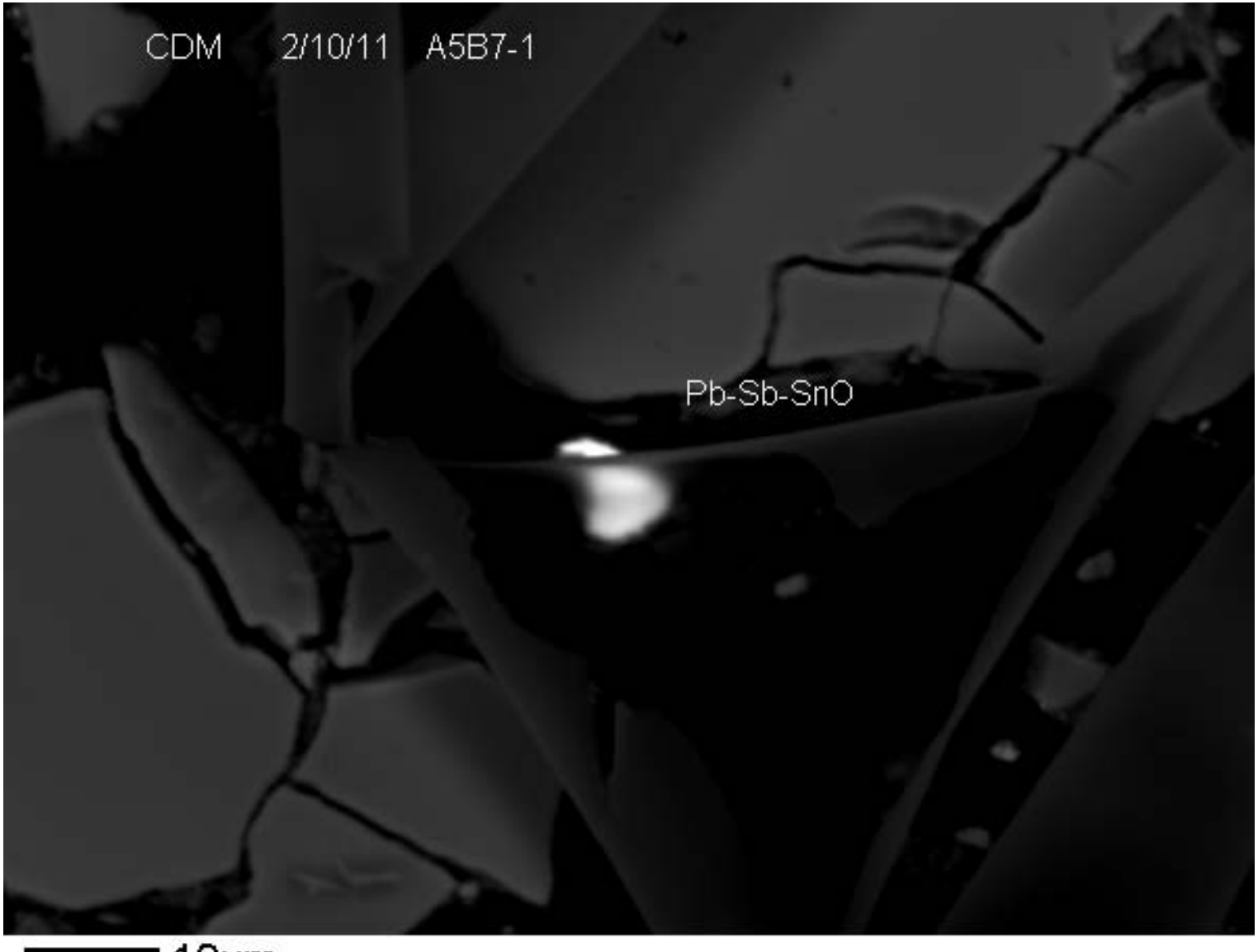
Form	Number	Mean	Std-Dev	Range low	Range high
total	111	21.06	36.87	1	190
FeOOH	58	35.34	45.48	3	190
FeSO4	1	22	ND	22	22
Cerussite	16	13.31	18.15	1	60
PbAsO	1	12	ND	12	12
SnMO	1	2	ND	2	2
MnOOH	1	3	ND	3	3
Phosphate	14	1.21	0.43	1	2
Galena	19	1	0	1	1

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	87.68	88.94	14.31	16.39	56.91	56.91	6.11
FeSO4	0.94	0.95	0.17	0.19	0.05	0.05	1.8
Cerussite	9.11	8.63	71.2	76.22	0	0	5.35
PbAsO	0.51	0.52	3.73	4.27	42.35	42.35	1.33
SnMO	0.09	0.09	0.04	0.04	0.6	0.6	0.54
MnOOH	0.13	0.13	0.18	0.21	0.02	0.02	0.67
Phosphate	0.73	0.74	2.34	2.68	0.07	0.07	1.58
Galena	0.81	0	8.05	0	0	0	1.67



Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Ga	Inclusion	1
Cer	Cemented	20
Cer	Cemented	20
Cer	Cemented	20
Cer	Cemented	20
Cer	Cemented	50
Cer	Cemented	60

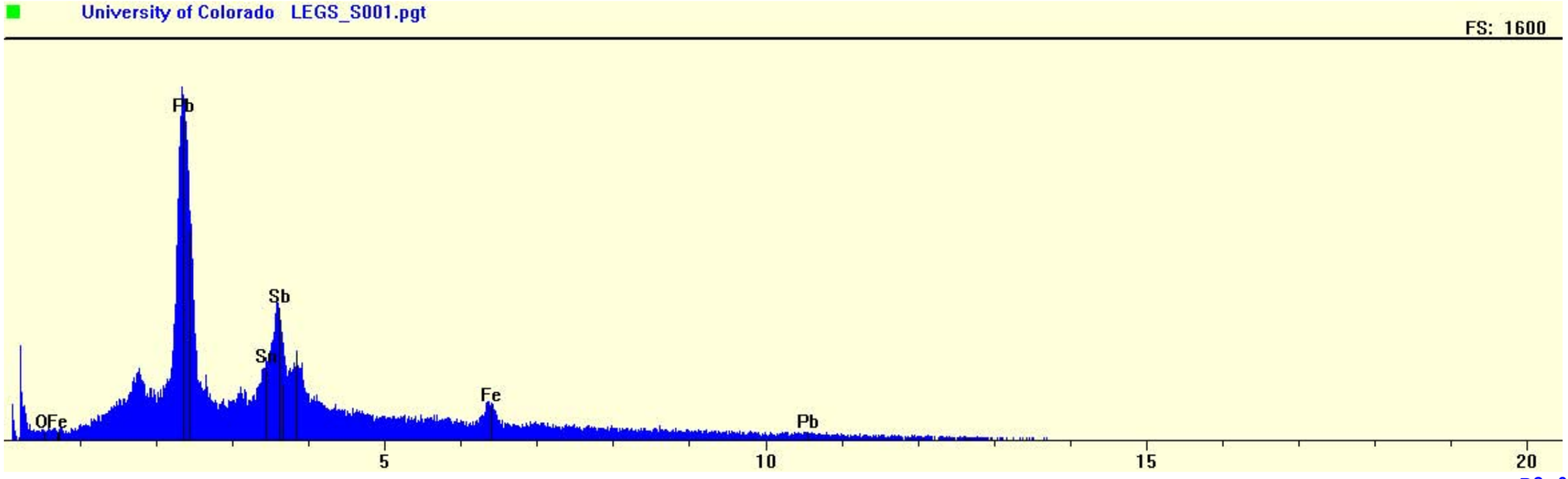
A5B7



10µm

BEI

R2-0006294

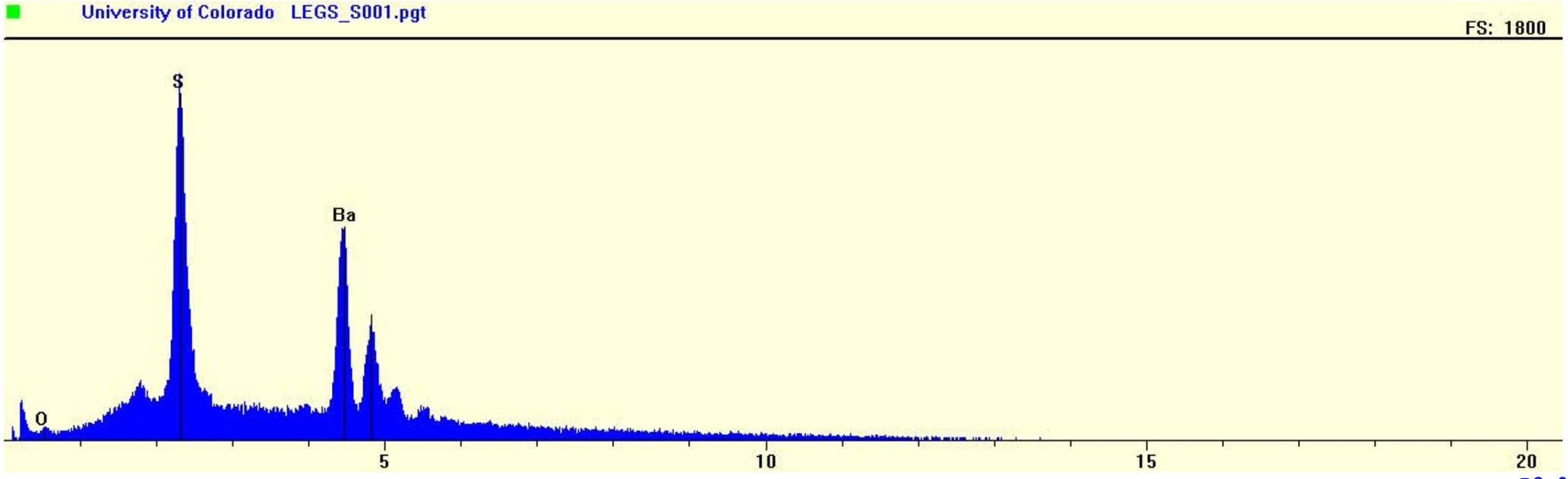

University of Colorado LEGS_S001.pgt
FS: 1600
Pb
Sb
Sn
Fe
OFe
Pb
5
10
15
20

R2-0006295

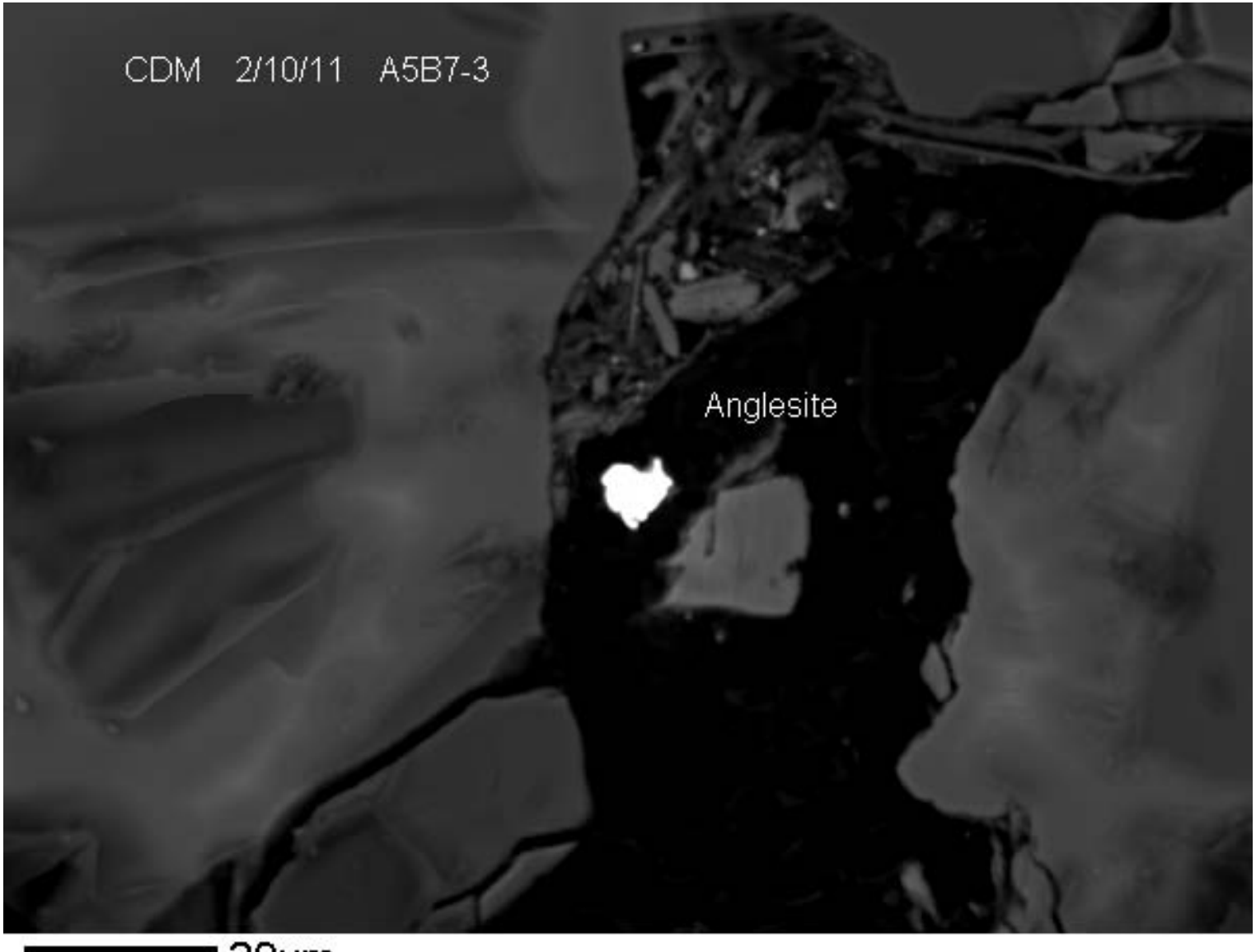
10µm

BEI

R2-0006296



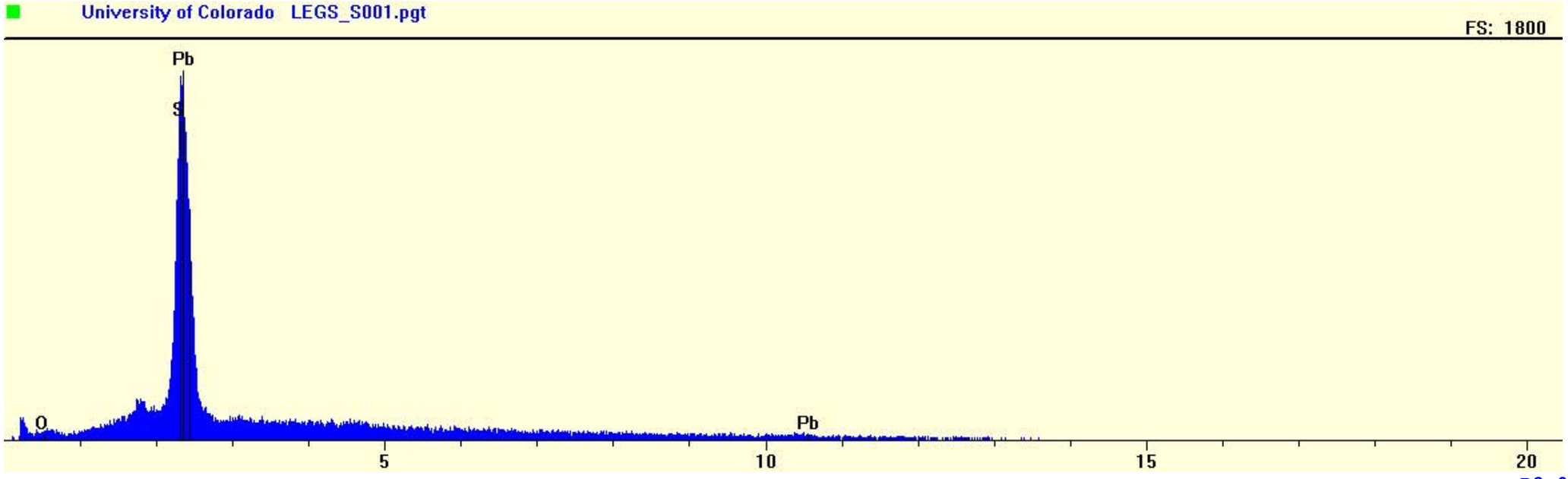
R2-0006297



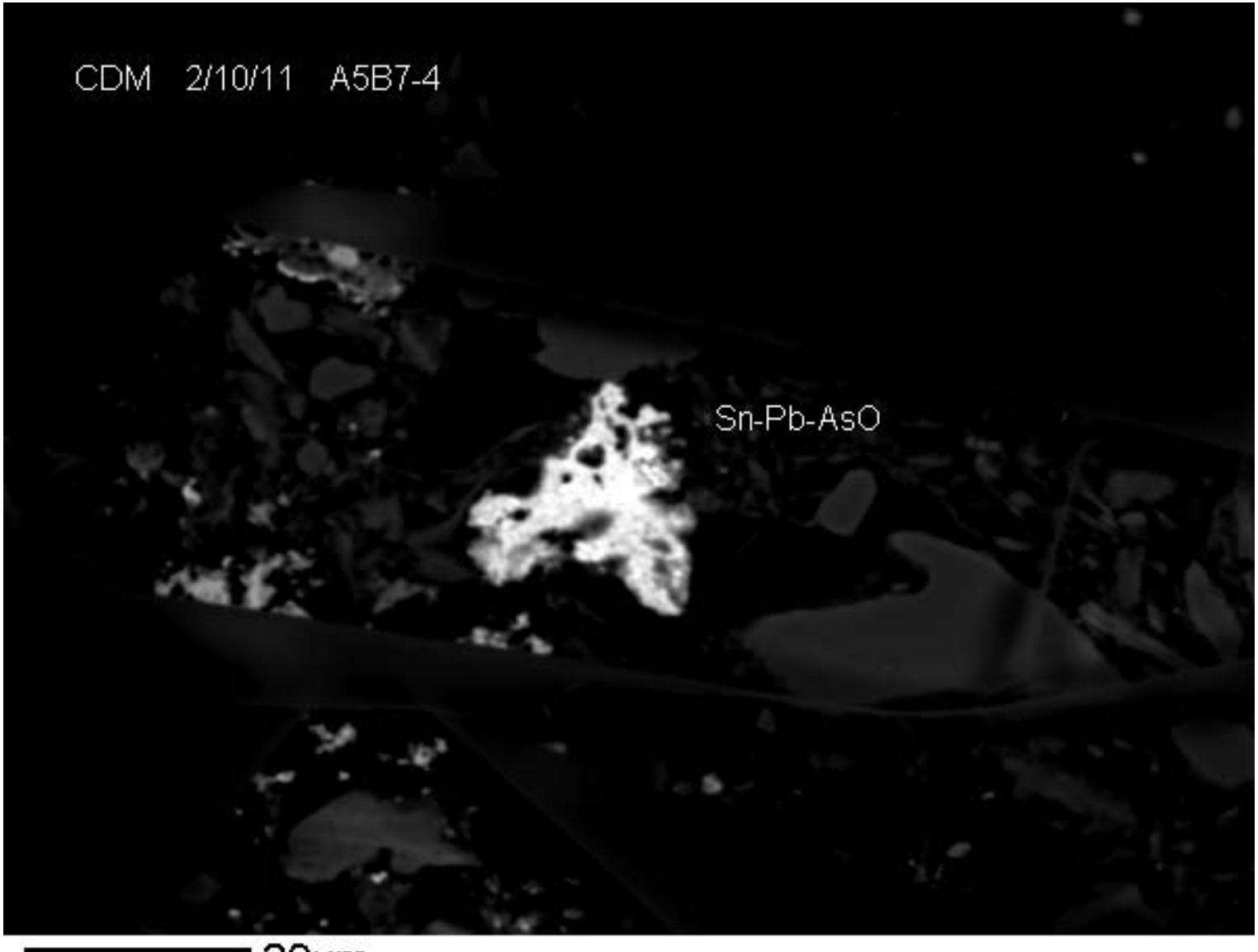
20µm

BEI

R2-0006298


University of Colorado LEGS_S001.pgt
FS: 1800
Pb
S
O
Pb
5
10
15
20

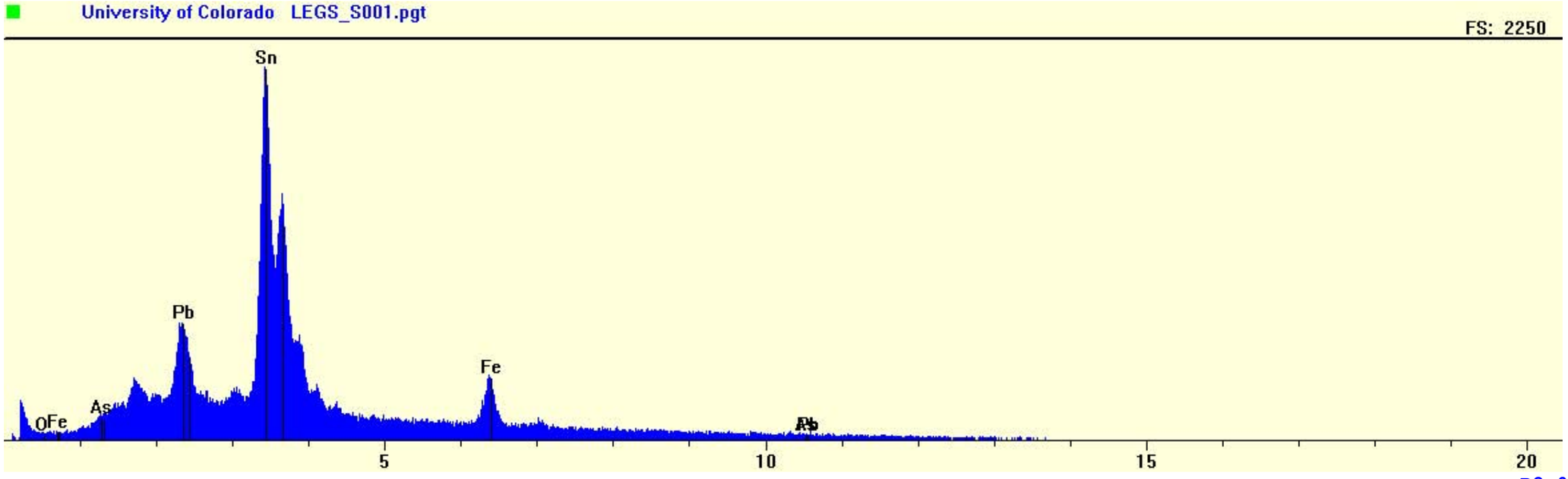
R2-0006299



20µm

BEI

R2-0006300

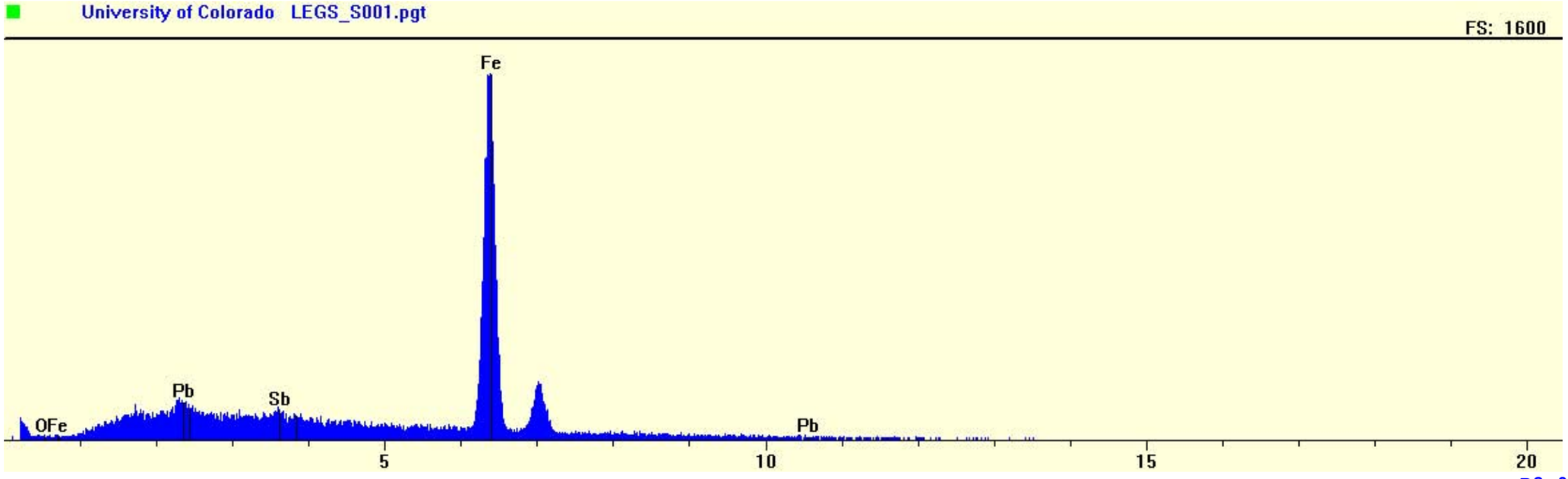

University of Colorado LEGS_S001.pgt
FS: 2250
Sn
Pb
Fe
As
OFe
Pb
5
10
15
20

R2-0006301

10µm

BEI

R2-0006302

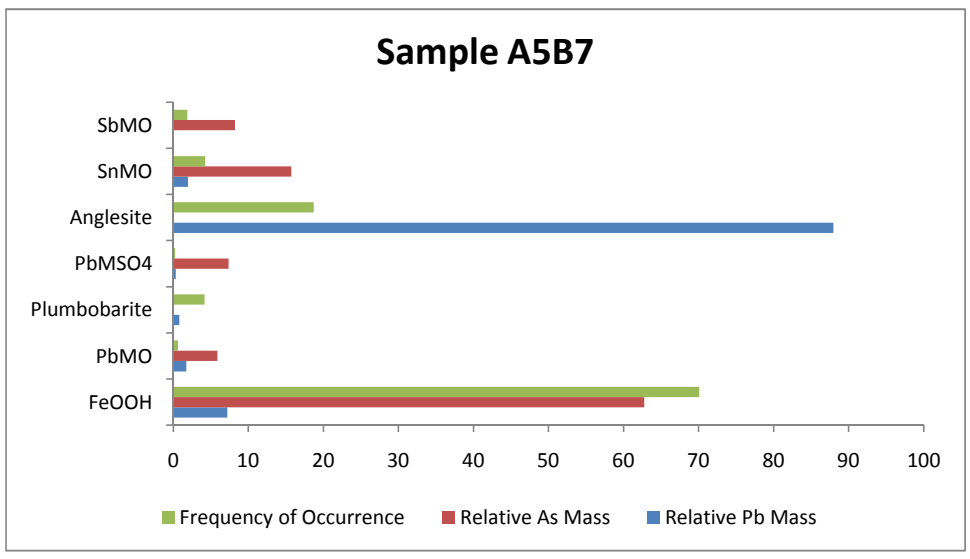

University of Colorado LEGS_S001.pgt
FS: 1600
Fe
Pb
Sb
OFe
Pb
5
10
15
20

R2-0006303

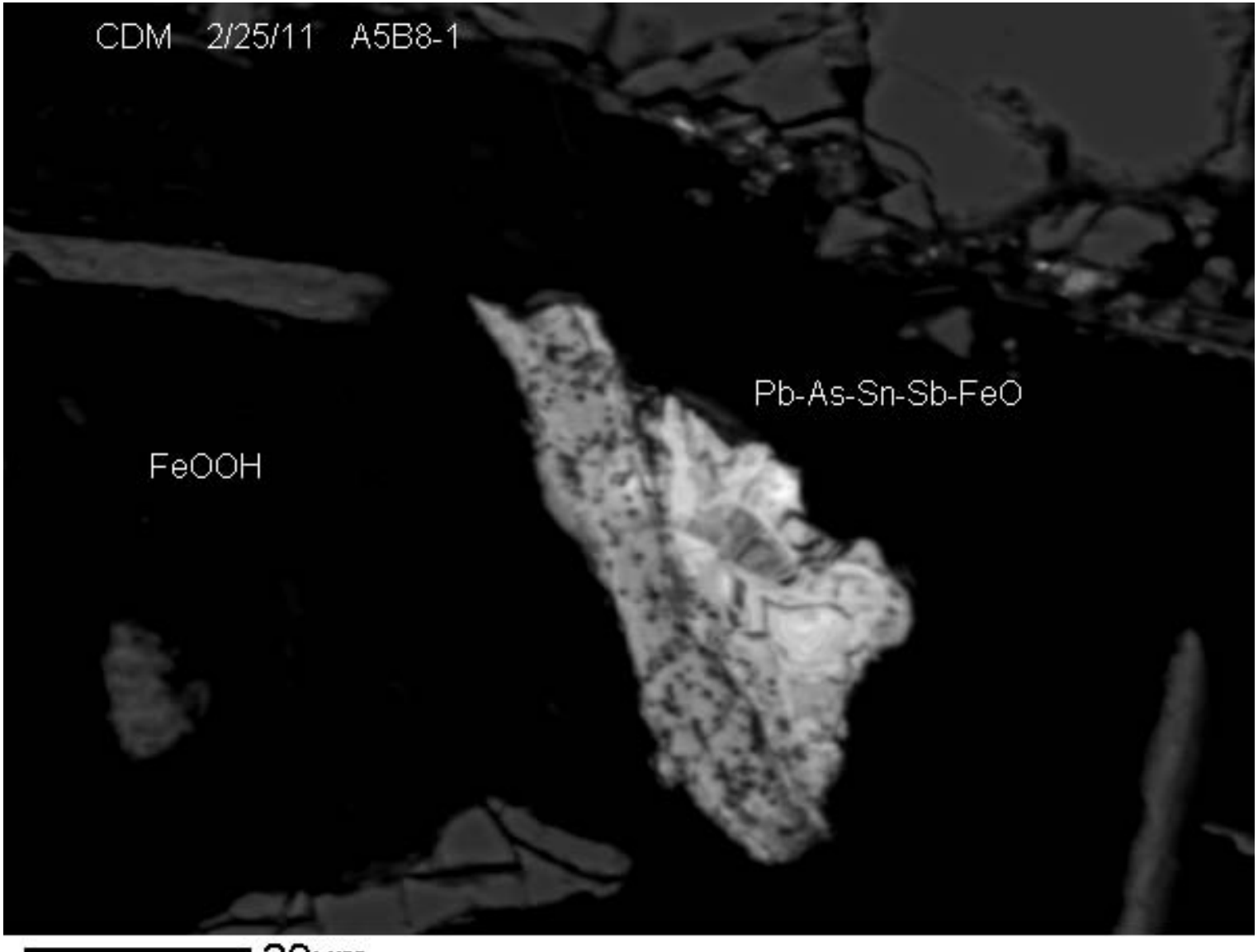
Form	Association	Size(microns)
Fe	Liberated	22
Fe	Liberated	60
Fe	Liberated	48
PbMO	Liberated	5
bar	Liberated	7
bar	Inclusion	4
pbmso4	Liberated	2
Fe	Liberated	11
Fe	Liberated	3
Fe	Liberated	3
Fe	Liberated	3
Fe	Liberated	3
Fe	Liberated	3
Fe	Liberated	27
Ang	Rimming	6
Ang	Liberated	4
Ang	Liberated	5
Ang	Liberated	25
Ang	Liberated	9
Ang	Cemented	1
Ang	Cemented	5
Ang	Liberated	3
snmo	Liberated	14
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
snmo	Liberated	2
Fe	Rimming	85
Fe	Rimming	210
Ang	Liberated	8
bar	Liberated	7
Ang	Liberated	3
Ang	Liberated	1
Ang	Liberated	1
Ang	Liberated	1
Ang	Liberated	4
Ang	Liberated	1
Ang	Liberated	12
Ang	Liberated	3
Ang	Liberated	4
Ang	Liberated	6
Ang	Liberated	44
Fe	Liberated	18
bar	Liberated	3
bar	Liberated	12
sbmo	Liberated	15
Ang	Liberated	3
Fe	Liberated	62

Form	Number	Mean	Std-Dev	Range low	Range high
total	54	14.74	32.17	1	210
FeOOH	14	39.86	55.84	3	210
PbMO	1	5	ND	5	5
Plumbobarite	5	6.6	3.51	3	12
PbMSO4	1	2	ND	2	2
Anglesite	21	7.1	10.01	1	44
SnMO	11	3.09	3.62	2	14
SbMO	1	15	ND	15	15

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	70.1	70.45	7.21	7.22	62.77	62.77	12.21
PbMO	0.63	0.63	1.75	1.76	5.89	5.89	2.11
Plumbobarite	4.15	3.66	0.81	0.72	0	0	5.32
PbMSO4	0.25	0.25	0.31	0.31	7.36	7.36	1.34
Anglesite	18.72	18.81	87.95	88.04	0	0	10.4
SnMO	4.27	4.29	1.93	1.93	15.74	15.74	5.39
SbMO	1.88	1.89	0.03	0.03	8.23	8.23	3.63



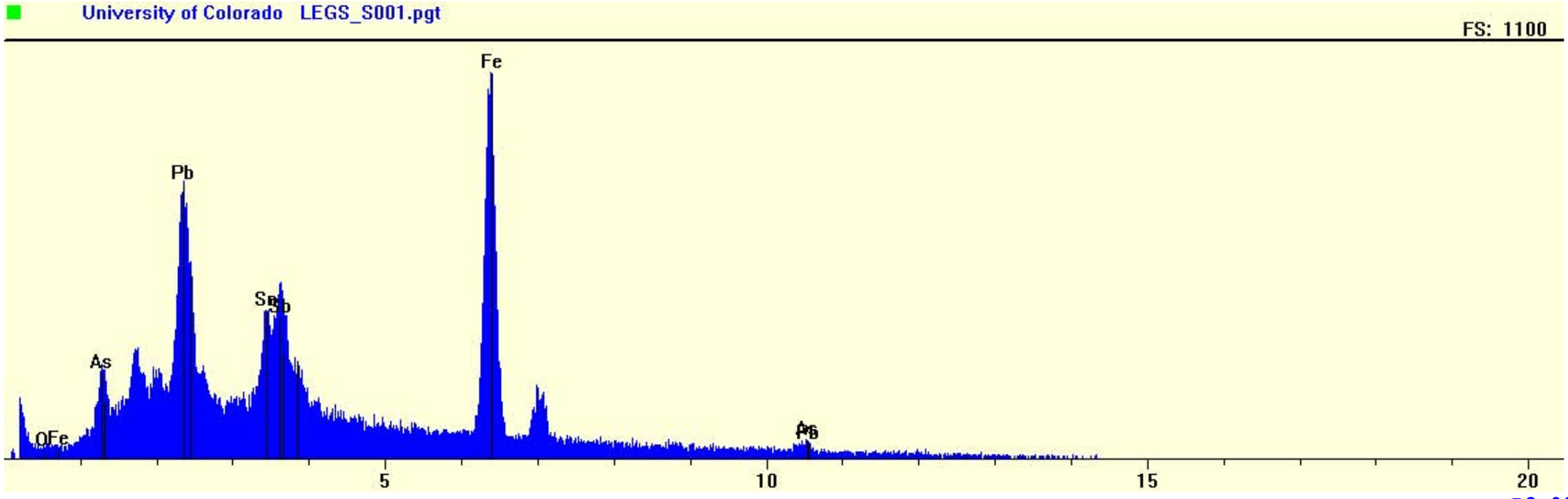
A5B8



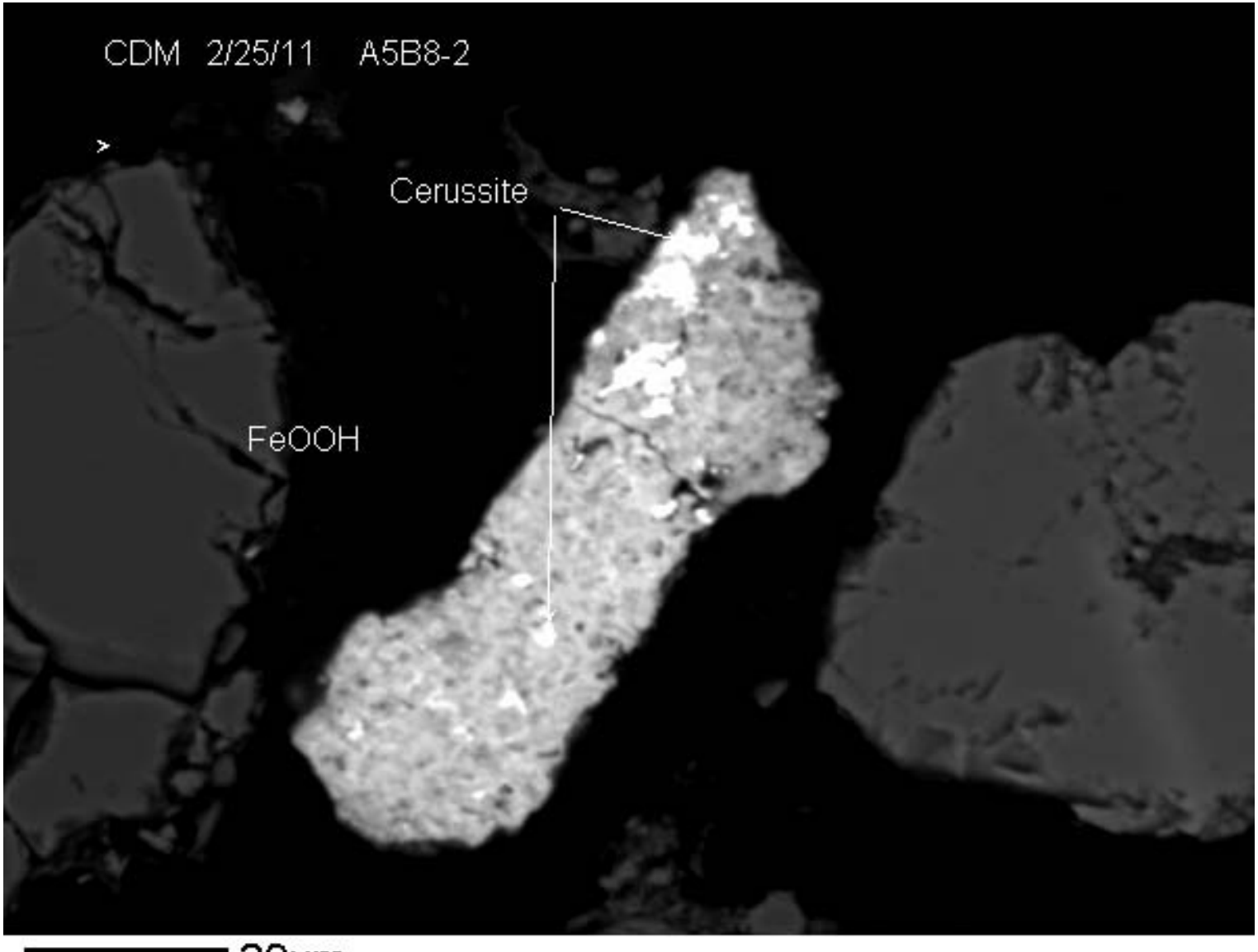
20µm

BEI

R2-0006306


University of Colorado LEGS_S001.pgt
FS: 1100
Fe
Pb
Sn
Sb
As
OFe
Pb
5
10
15
20

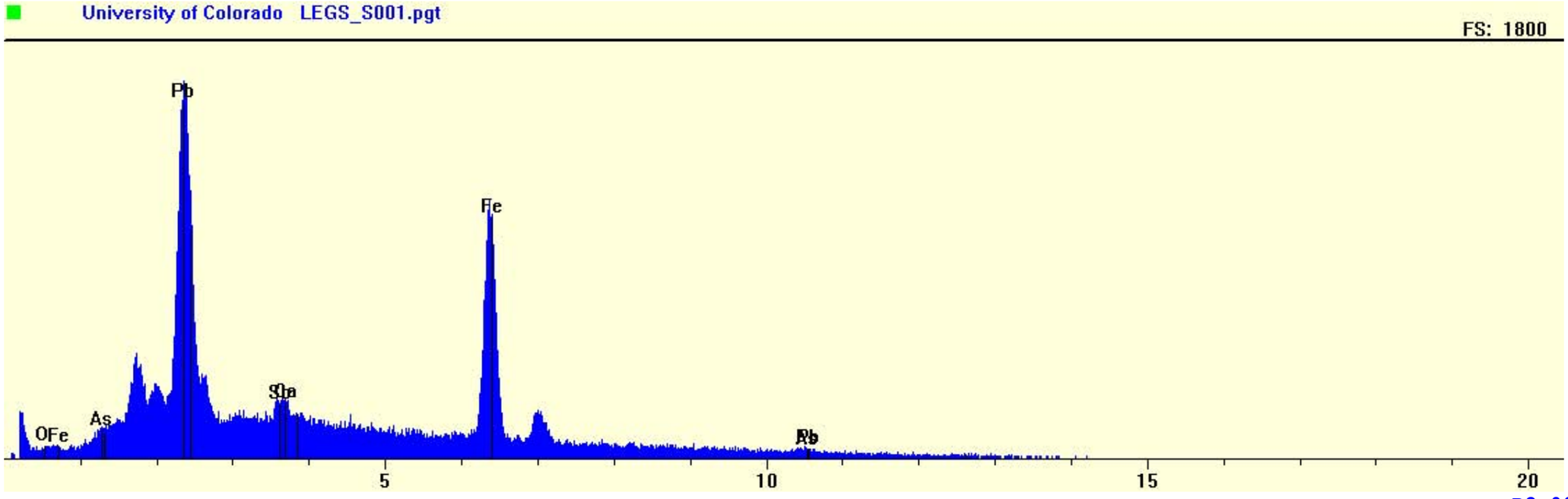
R2-0006307



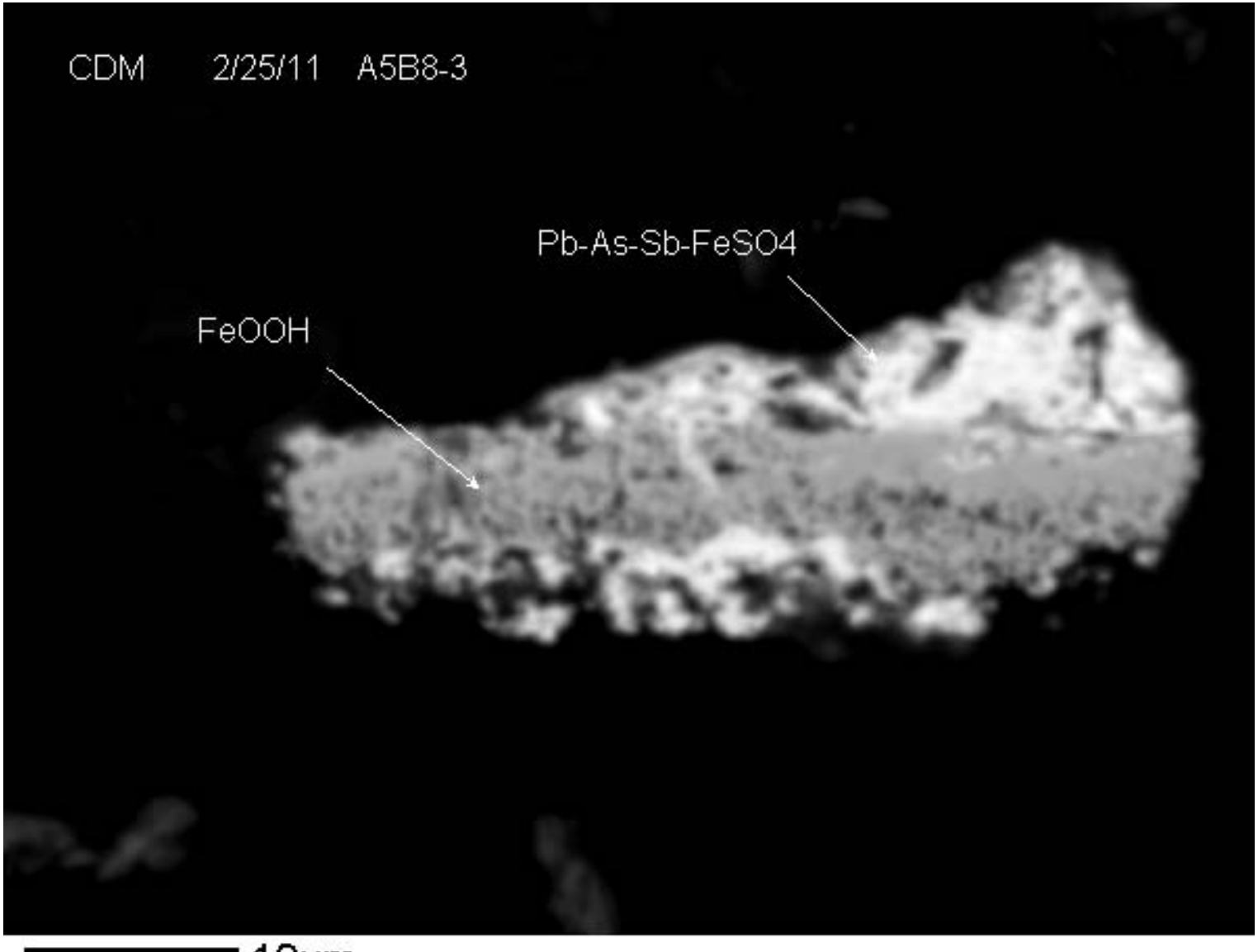
20µm

BEI

R2-0006308


University of Colorado LEGS_S001.pgt
FS: 1800
Pb
Fe
Sb
OFe
As
Pb
5
10
15
20

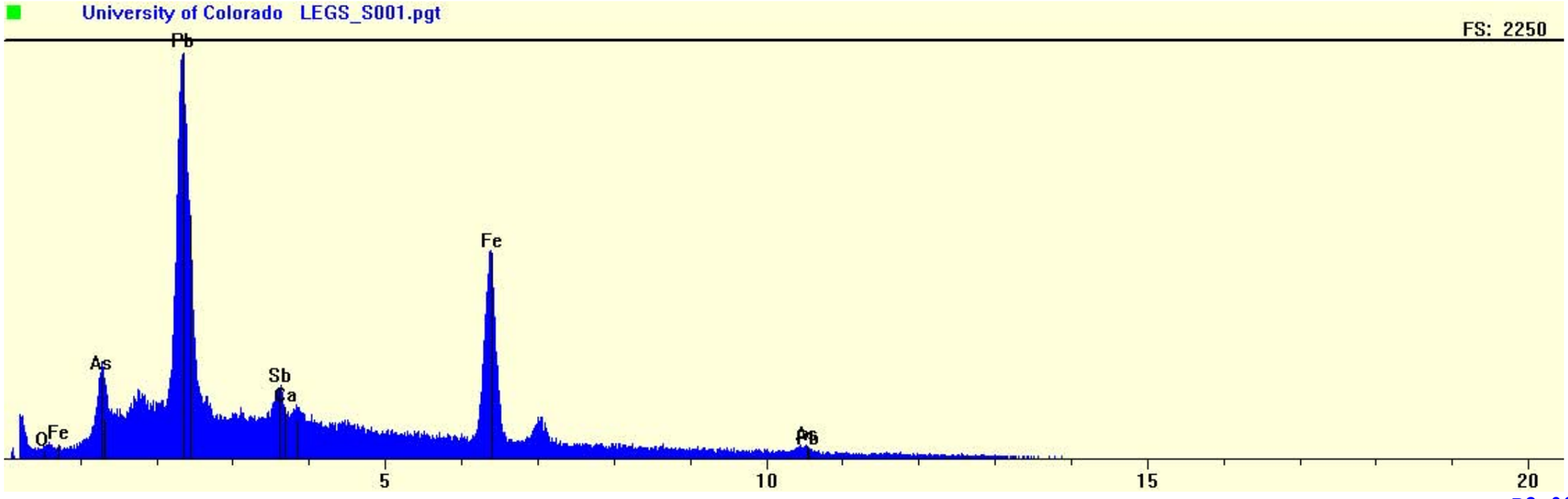
R2-0006309



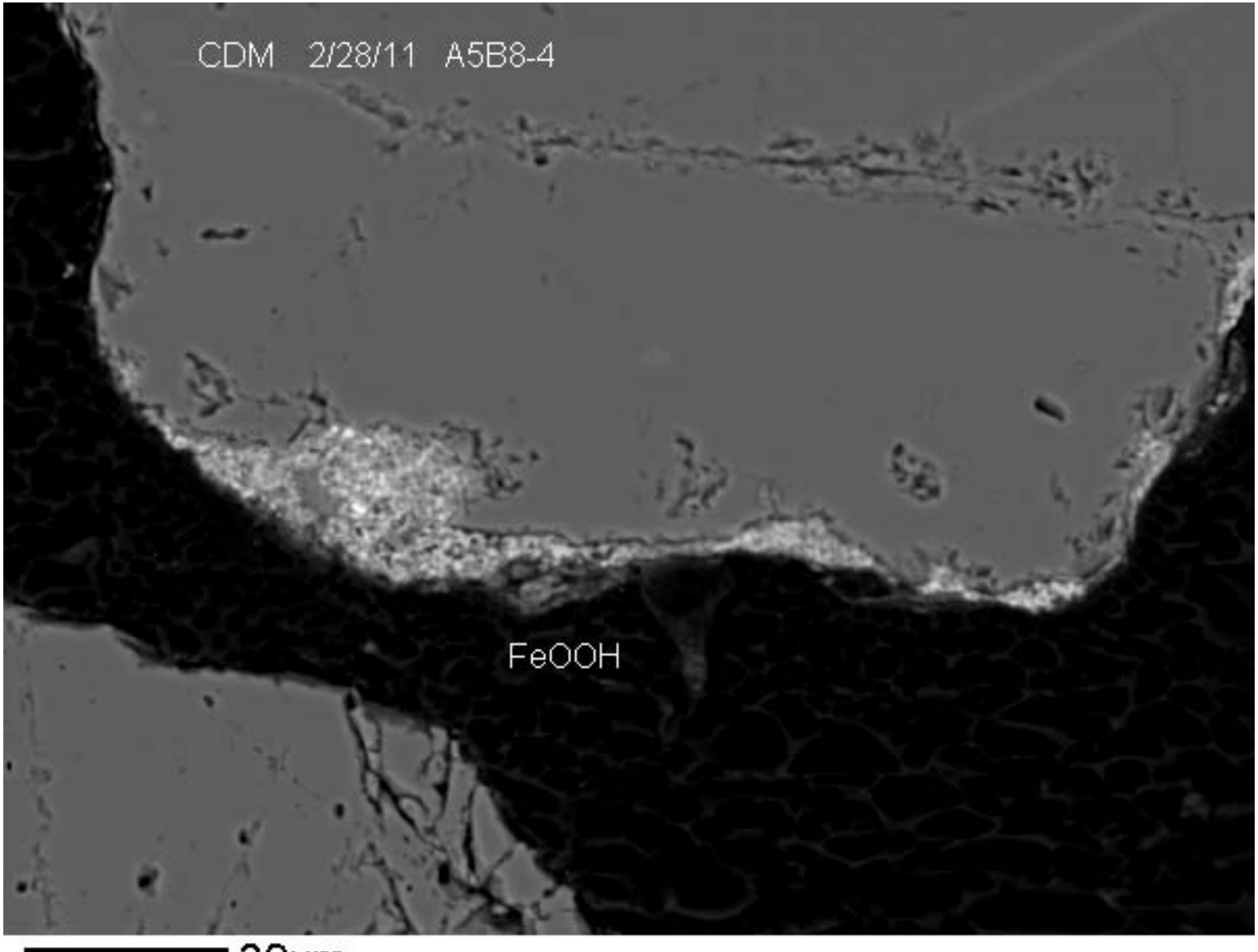
10µm

BEI

R2-0006310


University of Colorado LEGS_S001.pgt
FS: 2250
Pb
Fe
As
Sb
Ca
O
Fe
Pb
5
10
15
20

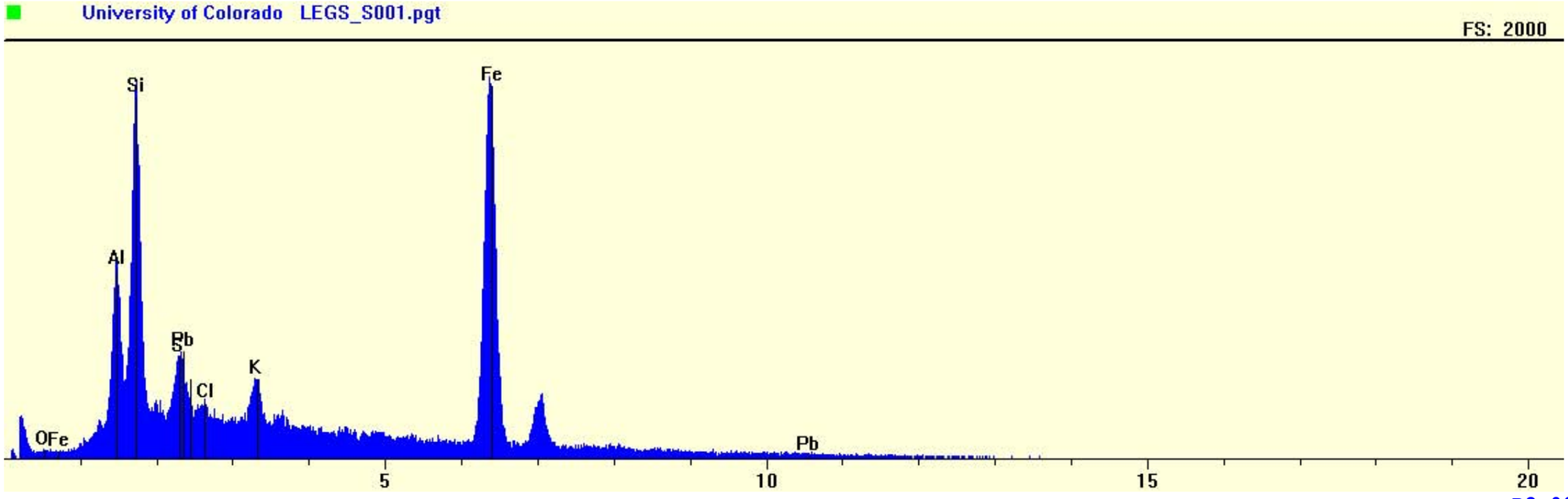
R2-0006311



30µm

BEI

R2-0006312

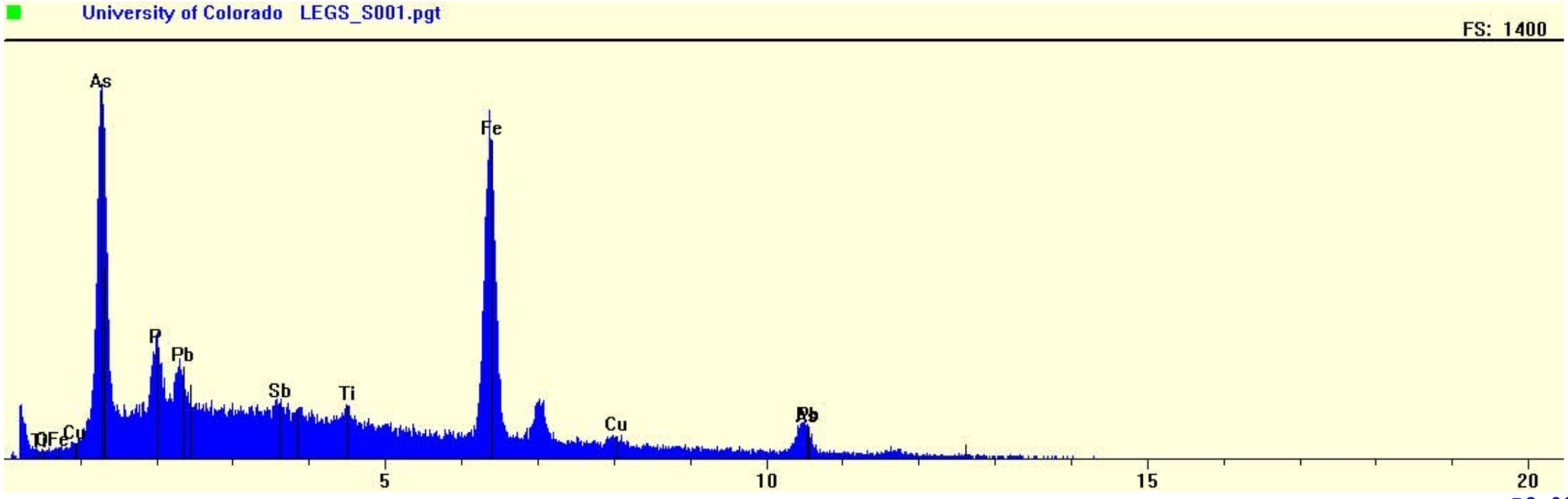

University of Colorado LEGS_S001.pgt
FS: 2000
Si
Fe
Al
Rb
S
K
Cl
OFe
Pb
5
10
15
20

R2-0006313

20µm

BEI

R2-0006314

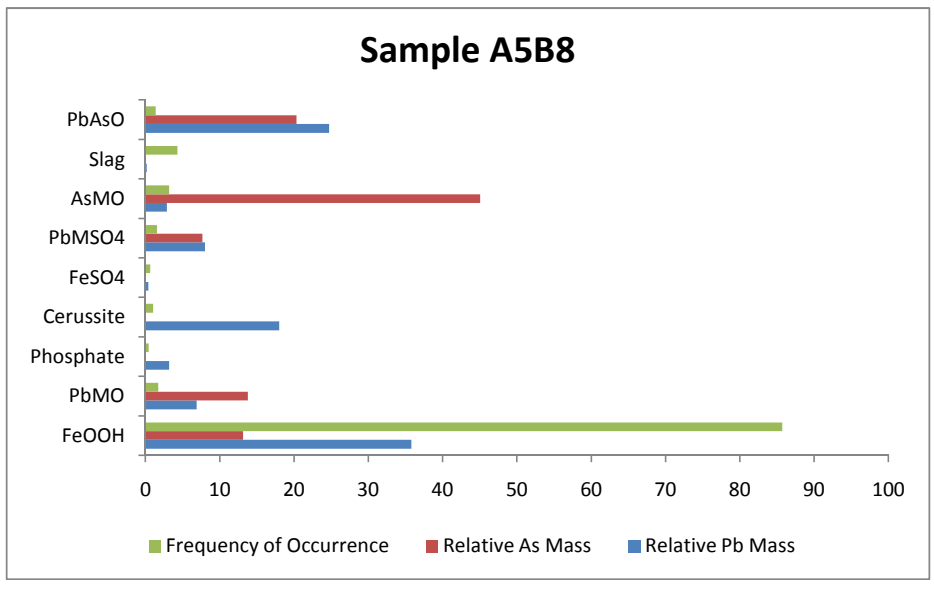

University of Colorado LEGS_S001.pgt
FS: 1400
As
Fe
P
Pb
Sb
Ti
Cu
Pb
Cu
5
10
15
20

R2-0006315

Form	Association	Size (microns)
Fe	Rimming	21
Fe	Rimming	48
Fe	Rimming	42
PbMO	Rimming	22
Fe	Liberated	11
Phos	Inclusion	9
Fe	Rimming	17
Fe	Rimming	50
Fe	Rimming	115
Fe	Liberated	80
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	4
Cer	Inclusion	3
Cer	Inclusion	3
Fe	Liberated	67
Sulf	Rimming	13
Fe	Liberated	42
Fe	Liberated	6
Fe	Liberated	7
Fe	Liberated	5
PbMO	Liberated	2
Fe	Liberated	24
Fe	Liberated	8
Fe	Rimming	55
Fe	Rimming	10
pbmso4	Rimming	17
pbmso4	Rimming	9
pbmso4	Liberated	3
Fe	Liberated	25
Fe	Rimming	10
Fe	Liberated	62
Fe	Liberated	11
Fe	Liberated	6
Fe	Liberated	6
Fe	Liberated	4
Fe	Liberated	8
Fe	Liberated	3
Fe	Rimming	100
Fe	Liberated	9
Fe	Liberated	10
Fe	Liberated	34
Fe	Rimming	22
Fe	Rimming	30
Fe	Liberated	4
Sulf	Liberated	2
Fe	Rimming	35
Fe	Rimming	12
Fe	Rimming	12
Fe	Liberated	3
asmo	Liberated	8
Fe	Liberated	98
Fe	Cemented	5
Fe	Rimming	75
Fe	Liberated	26
Fe	Rimming	47
Fe	Liberated	9
Fe	Cemented	66
Fe	Liberated	9
Fe	Liberated	17
Fe	Liberated	8
Fe	Rimming	112
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	20
Fe	Rimming	39
Fe	Liberated	110
pbmso4	Inclusion	1
pbmso4	Inclusion	3
pbmso4	Inclusion	2
pbmso4	Inclusion	2
pbmso4	Inclusion	2
pbmso4	Inclusion	2
Slag	Liberated	115
Fe	Rimming	10
Phos	Liberated	3
Fe	Rimming	20
Fe	Rimming	26
Fe	Rimming	13
Fe	Rimming	35
Fe	Rimming	25
Fe	Rimming	3
Sulf	Liberated	2

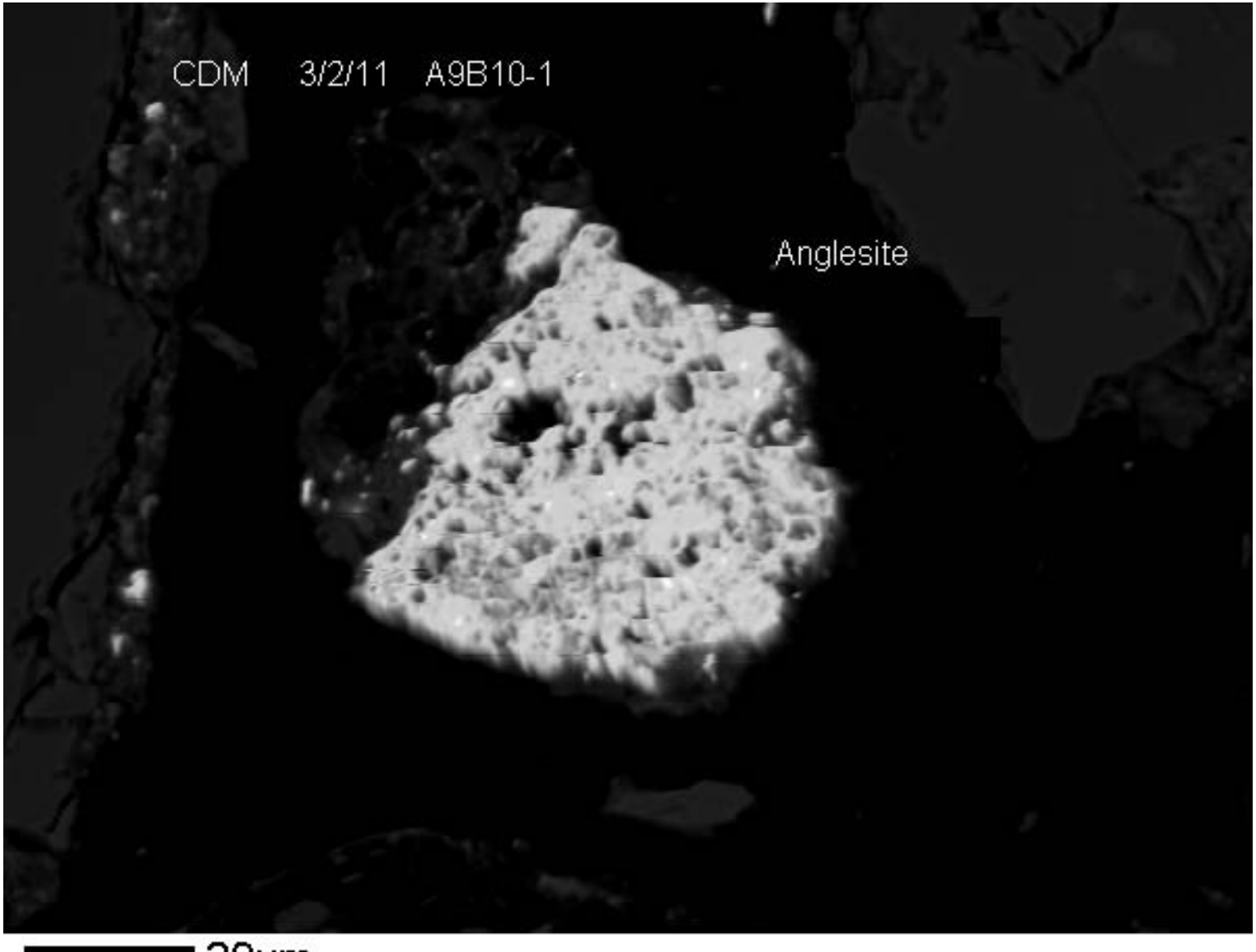
Form	Number	Mean	Std-Dev	Range low	Range high
total	110	24.25	30.69	1	125
FeOOH	69	33.14	32.75	3	125
PbMO	3	15.33	11.55	2	22
Phosphate	2	6	4.24	3	9
Cerussite	12	2.33	0.65	2	4
FeSO4	3	5.67	6.35	2	13
PbMSO4	9	4.56	5.22	1	17
AsMO	3	28.33	22.19	8	52
Slag	1	115	ND	115	115
PbAsO	8	4.63	4.93	1	14

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
FeOOH	85.72	88.51	35.8	55.35	13.12	15.38	6.54
PbMO	1.72	0.93	6.89	4.87	13.79	7.77	2.43
Phosphate	0.45	0.12	3.17	1.22	0.01	0	1.25
Cerussite	1.05	0	17.99	0	0	0	1.9
FeSO4	0.64	0.66	0.4	0.61	0.03	0.03	1.49
PbMSO4	1.54	1.12	8.01	8.44	7.65	8.55	2.3
AsMO	3.19	3.29	2.87	4.44	45.04	52.79	3.28
Slag	4.31	4.45	0.17	0.26	0	0	3.8
PbAsO	1.39	0.93	24.71	24.79	20.35	15.47	2.19



Fe	Liberated	28
Fe	Rimming	125
Fe	Liberated	55
asmo	Rimming	25
PbMO	Inclusion	22
asmo	Liberated	52
PbAsO	Rimming	10
PbAsO	Inclusion	5
PbAsO	Rimming	14
PbAsO	Inclusion	4
PbAsO	Inclusion	1
PbAsO	Inclusion	1
PbAsO	Inclusion	1
PbAsO	Inclusion	1
Fe	Liberated	125
Fe	Liberated	47

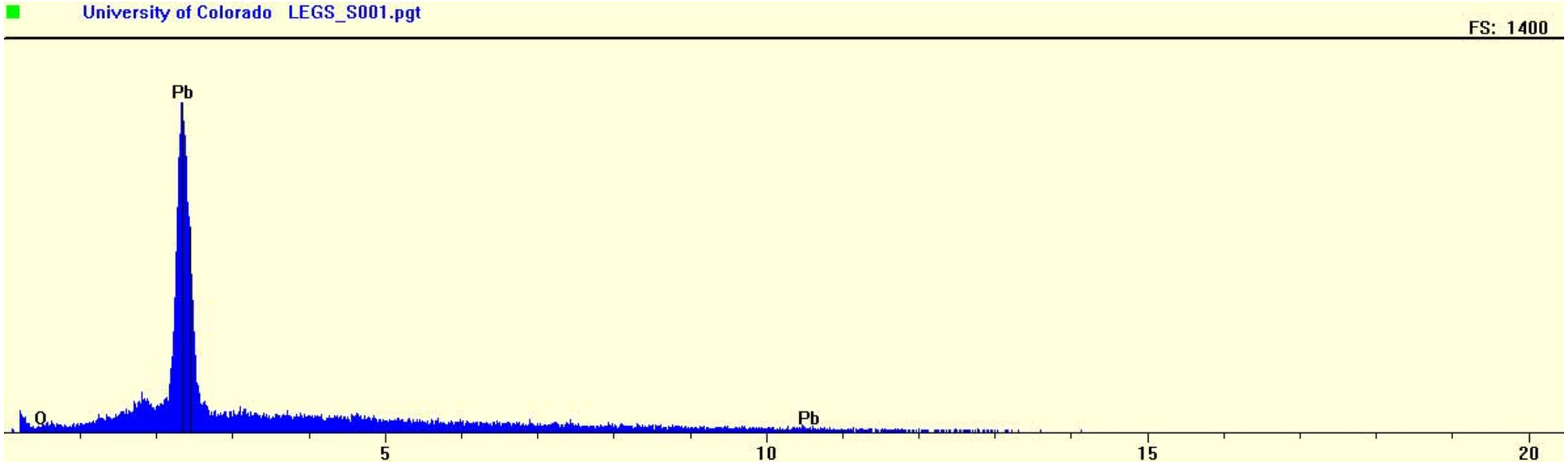
A9B10



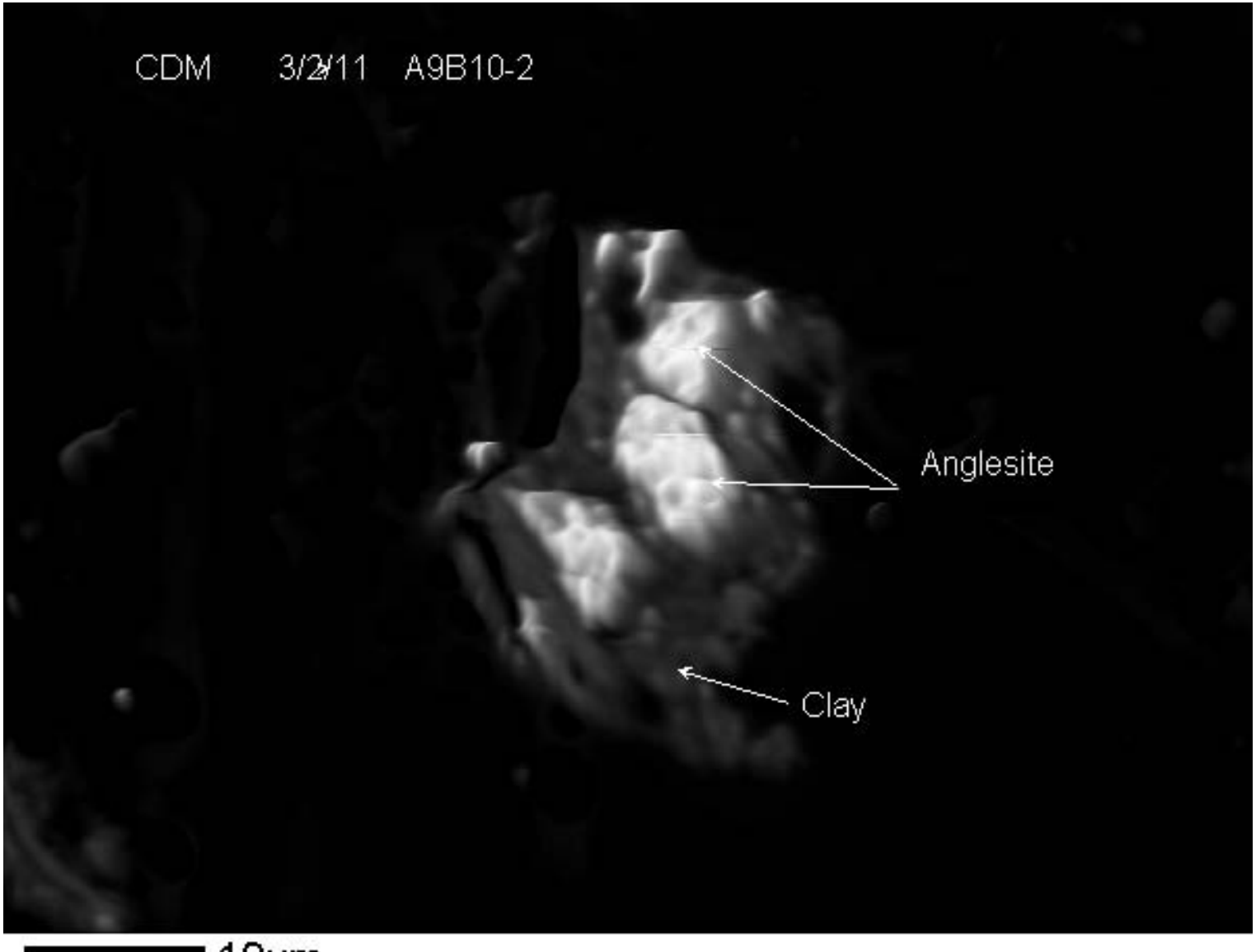
20µm

BEI

R2-0006319



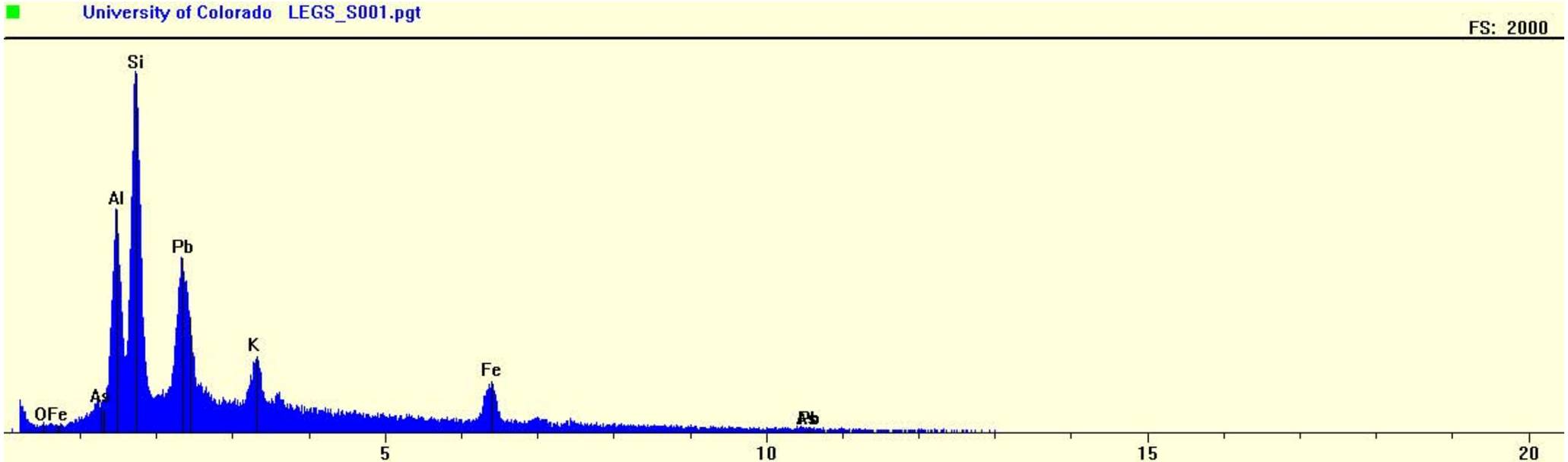
R2-0006320



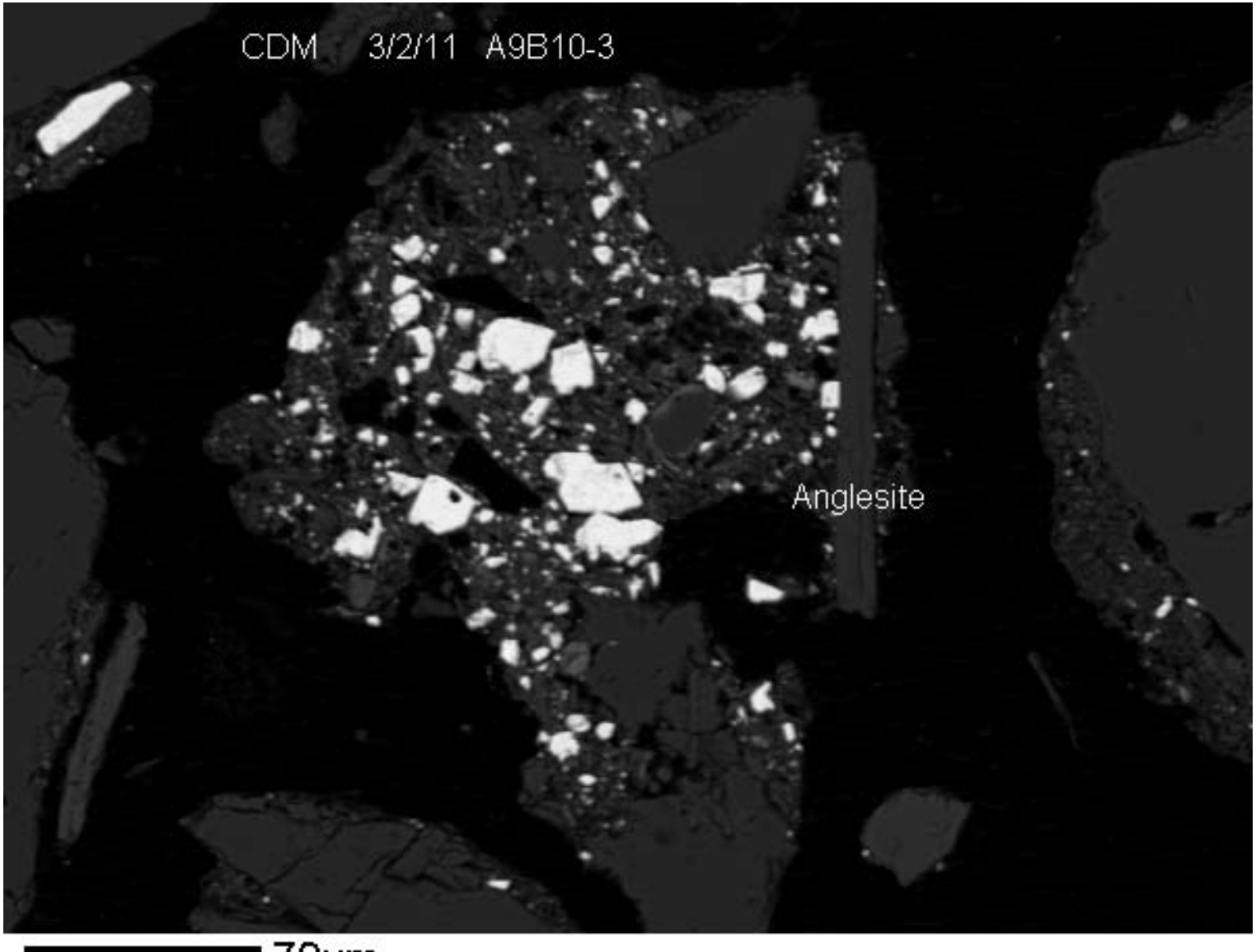
10µm

BEI

R2-0006321


University of Colorado LEGS_S001.pgt
FS: 2000
Si
Al
Pb
K
Fe
OFe
As
Pb
5
10
15
20

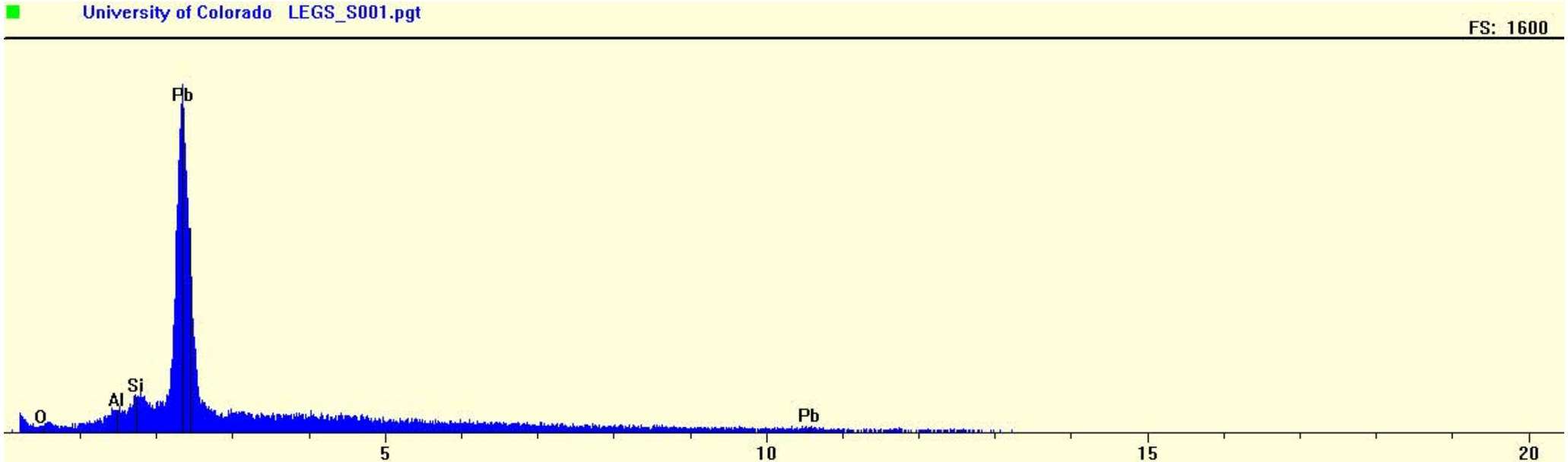
R2-0006322



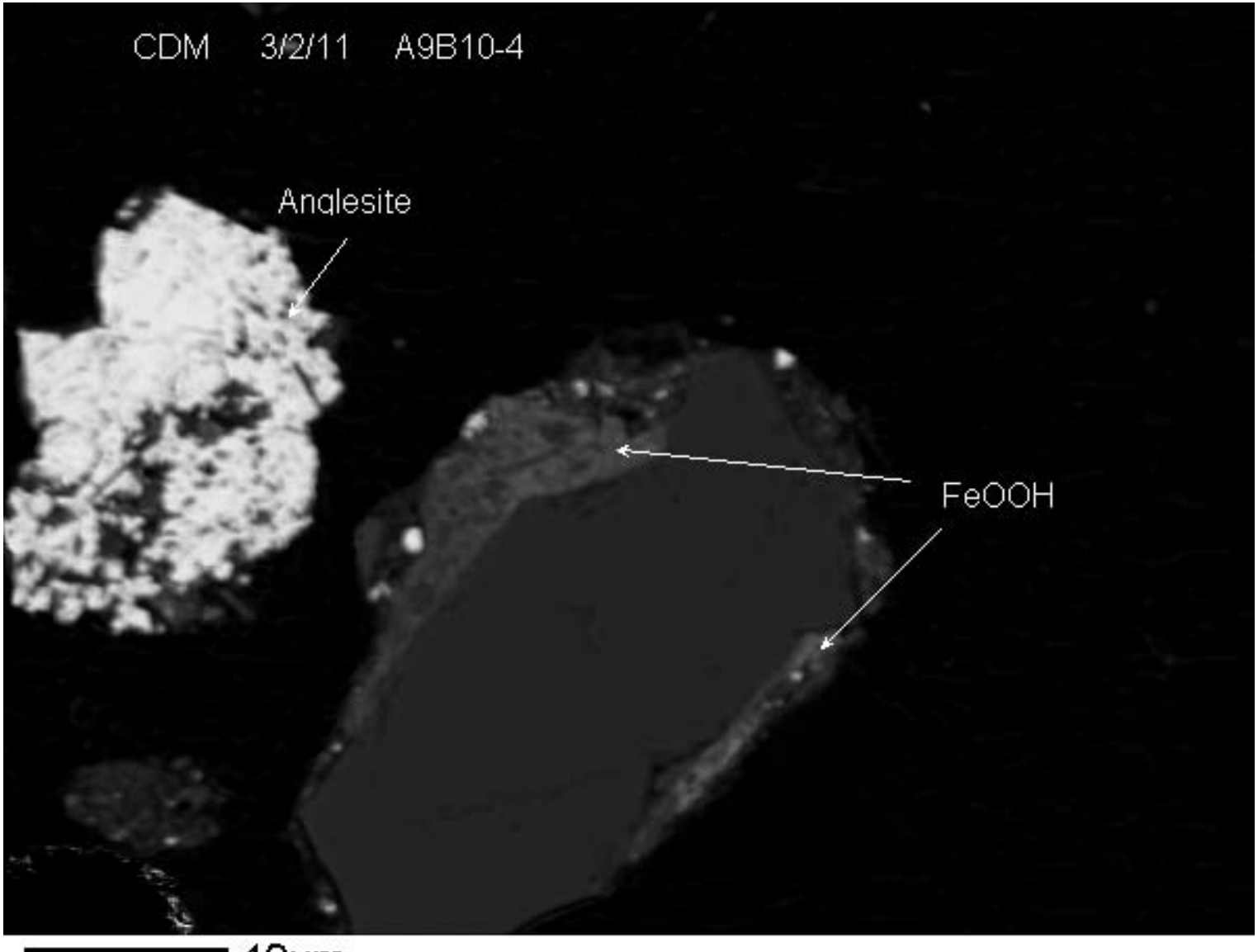
70µm

BEI

R2-0006323


University of Colorado LEGS_S001.pgt
FS: 1600
Pb
Si
Al
O
Pb
5
10
15
20

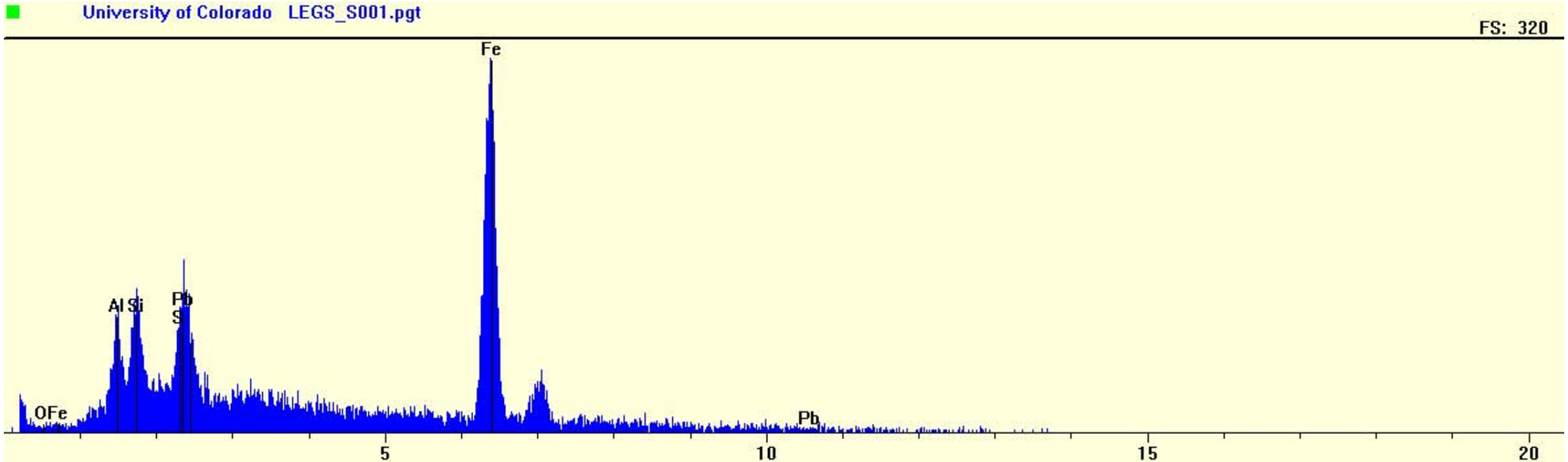
R2-0006324



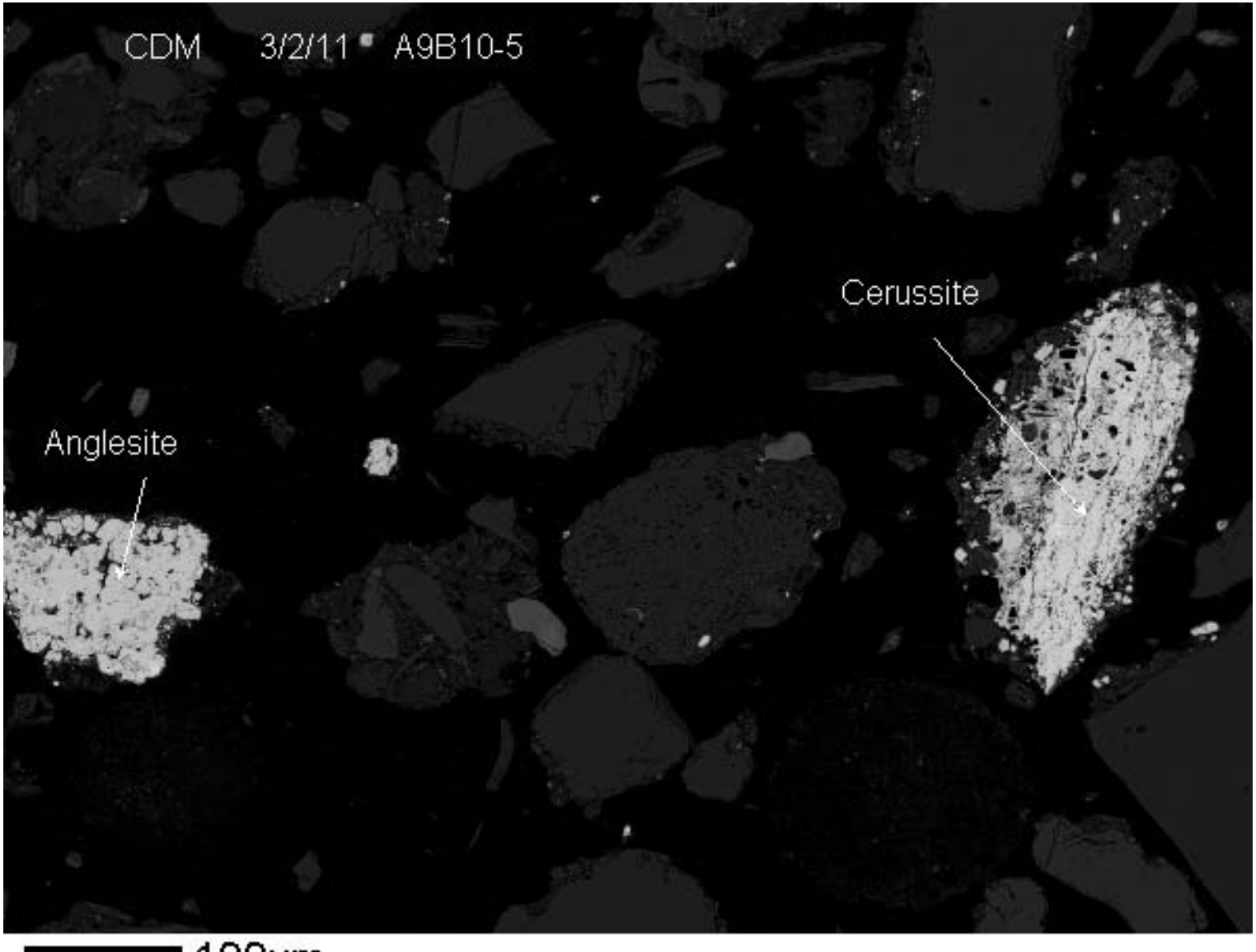
40µm

BEI

R2-0006325


University of Colorado LEGS_S001.pgt
FS: 320
Fe
Al
Si
Pb
S
OFe
Pb
5
10
15
20

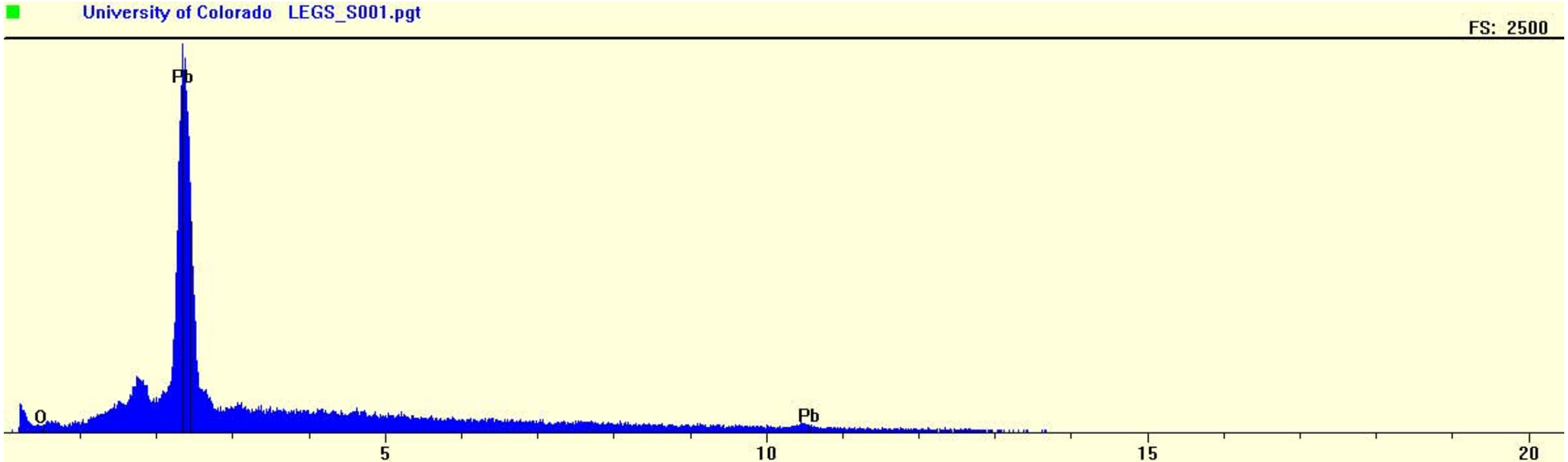
R2-0006326



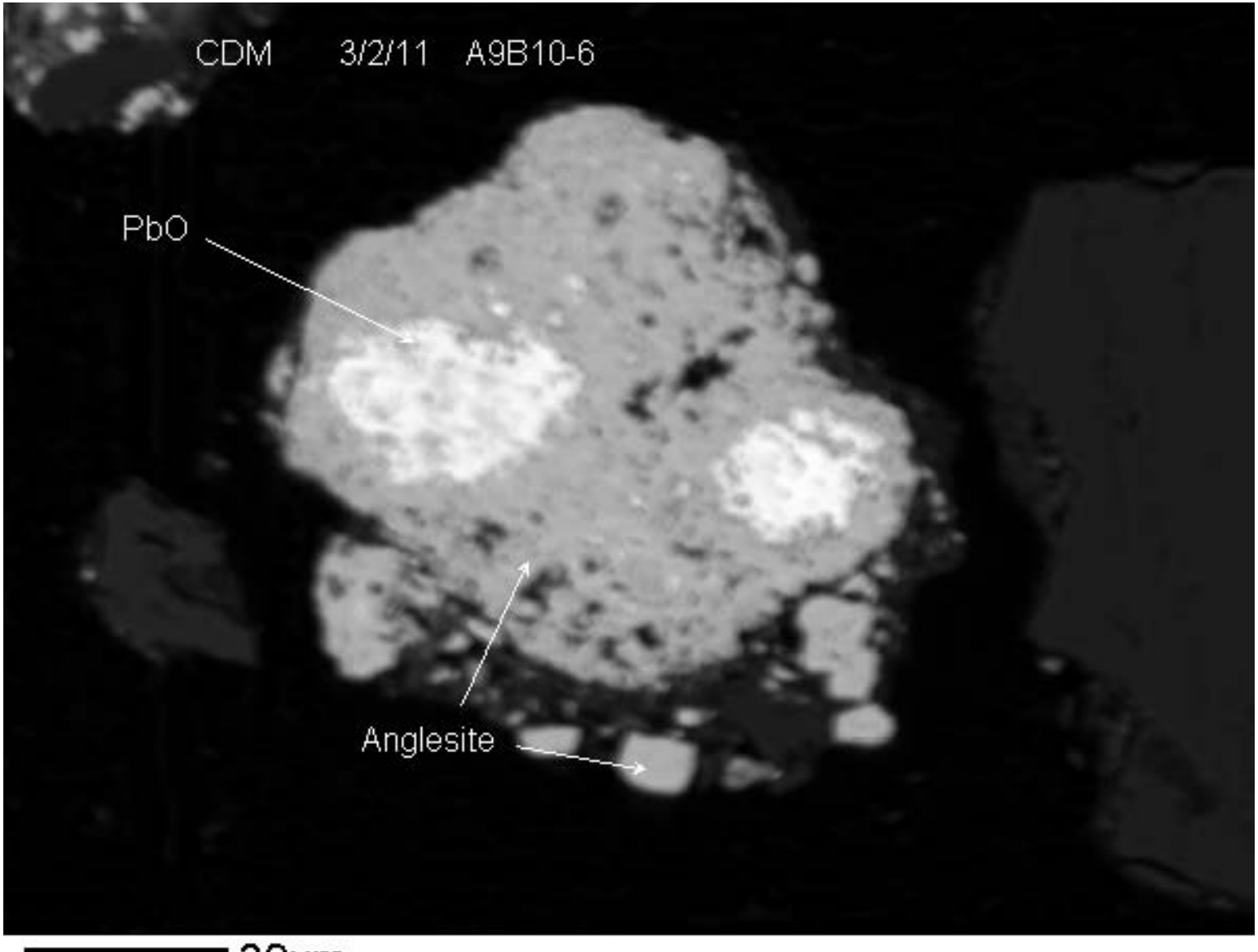
100µm

BEI

R2-0006327



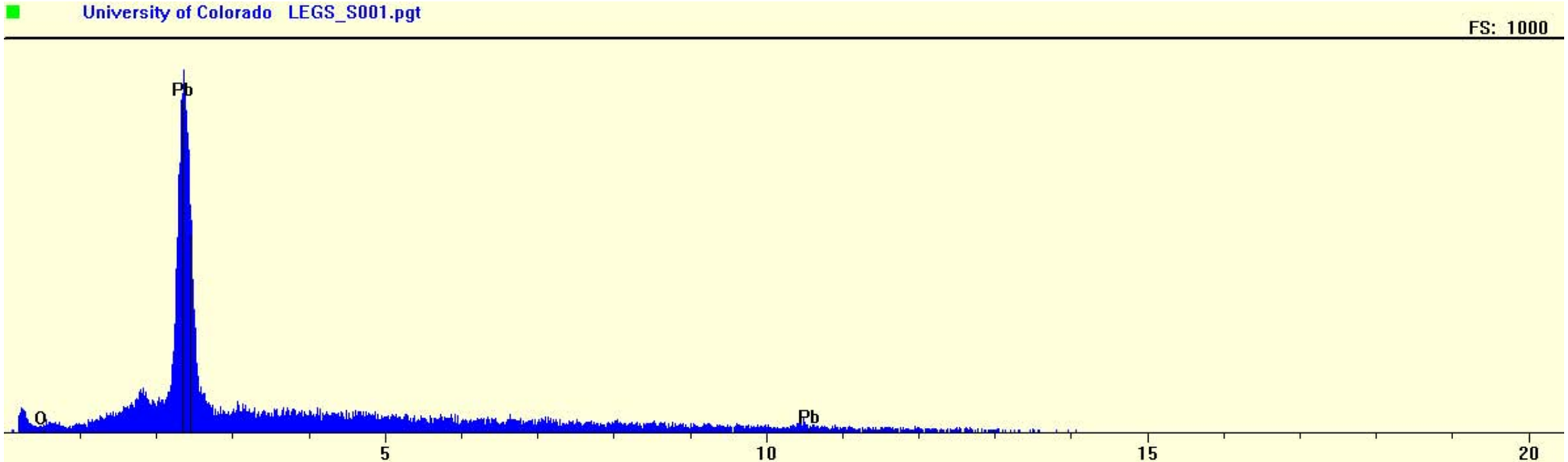
R2-0006328



30µm

BEI

R2-0006329



R2-0006330

Form	Association	Size (microns)
Ang	Liberated	44
Ang	Cemented	2
Ang	Cemented	3
Ang	Liberated	5
Ang	Inclusion	10
Ang	Inclusion	9
Ang	Rimming	4
Ang	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	1
Cer	Inclusion	4
Cer	Inclusion	4
Cer	Inclusion	4
AlSi	Rimming	17
Cer	Liberated	5
Ang	Liberated	15
Cer	Cemented	8
Cer	Cemented	5
Cer	Cemented	5
Cer	Cemented	5
Cer	Cemented	5
Cer	Cemented	2
Cer	Cemented	2
Cer	Cemented	2
Cer	Cemented	2
Cer	Cemented	2
Cer	Cemented	2
Cer	Cemented	2
Cer	Cemented	2
Cer	Liberated	10
Cer	Liberated	10
Cer	Liberated	11
Ang	Liberated	17
Ang	Cemented	3
Ang	Liberated	9
Ang	Liberated	12
Ang	Cemented	1
Ang	Cemented	7
Ang	Cemented	7
Ang	Cemented	7
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
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Ang	Cemented	1
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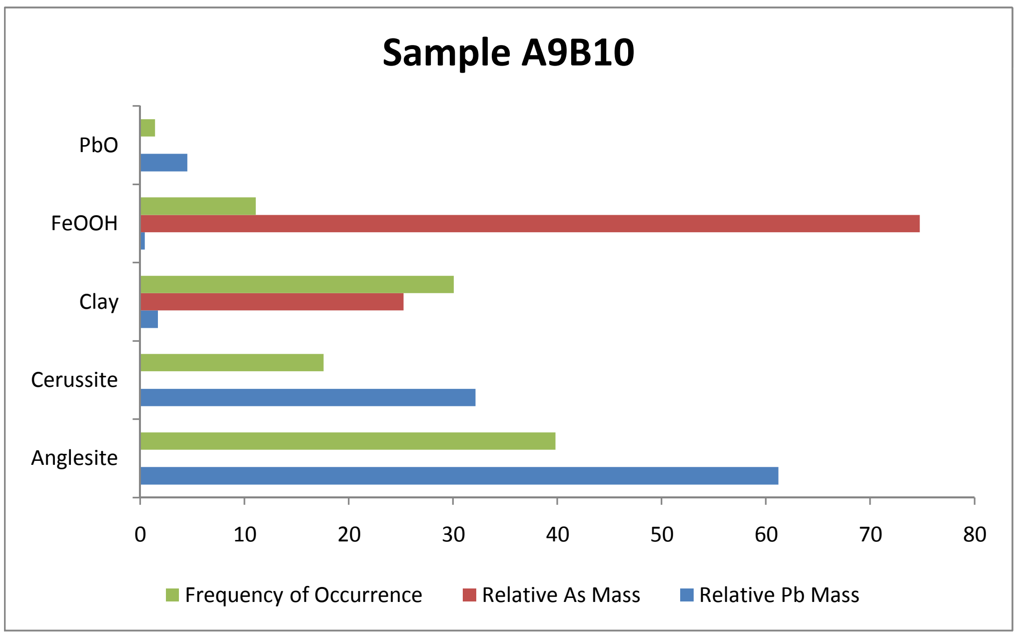
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Cer	Liberated	21
Ang	Inclusion	21
Ang	Inclusion	10
Ang	Inclusion	10
Ang	Inclusion	5
Ang	Inclusion	5

Form	Number	Mean	Std-Dev	Range low	Range high
total	259	15.63	30.11	1	180
Anglesite	181	8.9	20.17	1	115
Cerussite	44	16.18	36.55	1	180
Clay	19	64.05	42.12	15	125
FeOOH	8	56.13	26	15	100
PbO	7	8.29	7.48	1	20

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
Anglesite	39.81	38.62	61.2	63.24	0	0	5.96
Cerussite	17.59	17.64	32.14	34.34	0	0	4.64
Clay	30.07	31.95	1.7	1.93	25.24	25.24	5.58
FeOOH	11.09	11.79	0.44	0.5	74.76	74.76	3.82
PbO	1.43	0	4.52	0	0	0	1.45



R2-0006331

Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Cemented	8
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Rimming	12
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
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Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Liberated	18
Ang	Inclusion	14
Ang	Cemented	11
Ang	Cemented	11
Ang	Cemented	11
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	1
Ang	Liberated	75
Cer	Inclusion	7
Ang	Liberated	15
Ang	Liberated	50
Ang	Liberated	68

Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Fe	Rimming	35
Fe	Rimming	42
Ang	Liberated	25
Ang	Liberated	105
Fe	Liberated	100
Fe	Rimming	55
Fe	Rimming	62
Fe	Cemented	15
Cer	Cemented	32
Ang	Rimming	95
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
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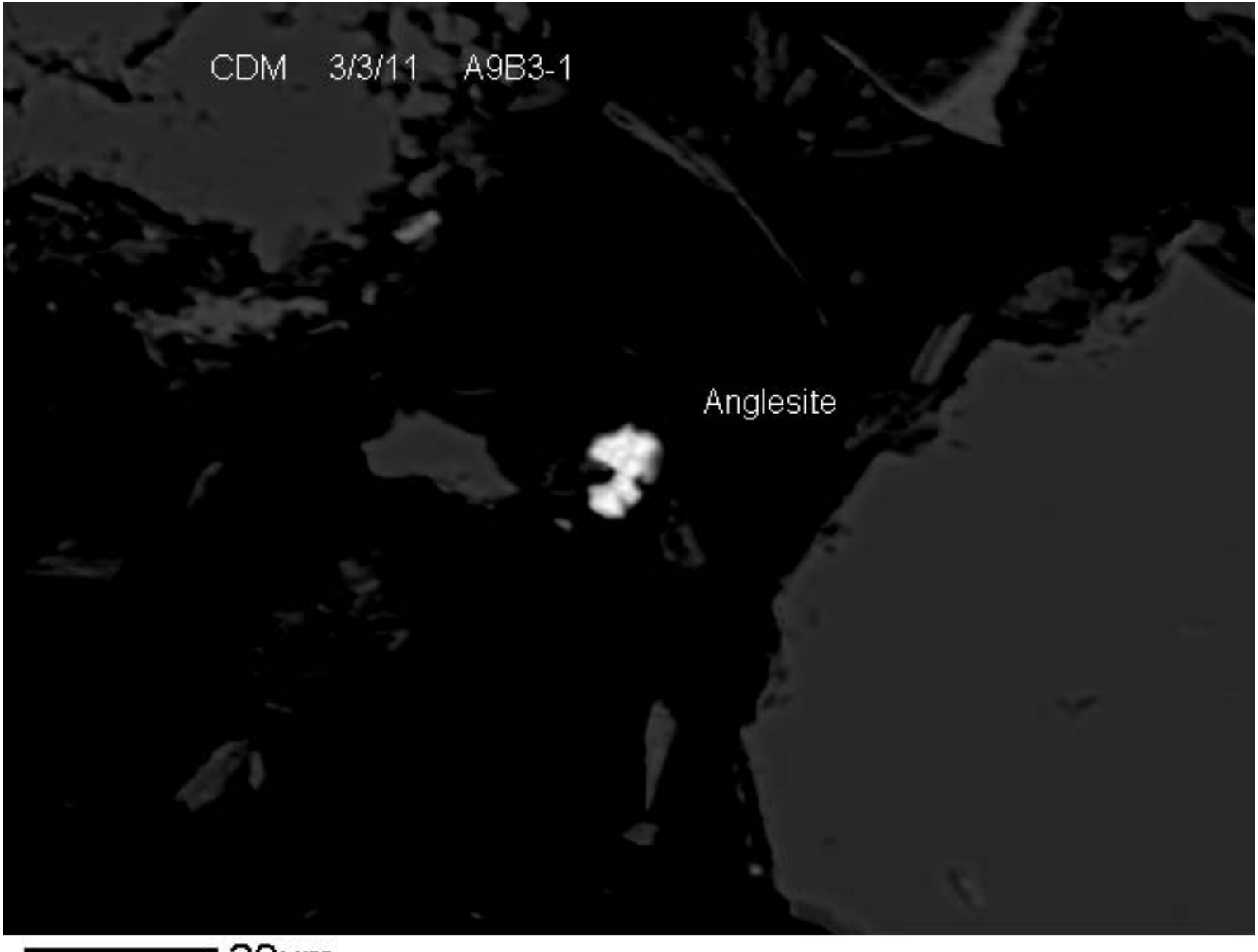
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Fe	Liberated	75
Ang	Liberated	110
Cer	Liberated	180
Ang	Liberated	100
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Cer	Inclusion	2
Fe	Liberated	65
Cer	Cemented	59
Cer	Liberated	125
PbO	Inclusion	12
PbO	Inclusion	20
PbO	Inclusion	1
PbO	Inclusion	1
PbO	Inclusion	1
Ang	Liberated	105
Cer	Liberated	90
Cer	Liberated	85
PbO	Inclusion	10
PbO	Inclusion	13
Ang	Liberated	115
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	50
AlSi	Liberated	65
AlSi	Liberated	45
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	15
AlSi	Liberated	25
AlSi	Liberated	25
AlSi	Liberated	25
AlSi	Liberated	25
AlSi	Liberated	25
AlSi	Liberated	25

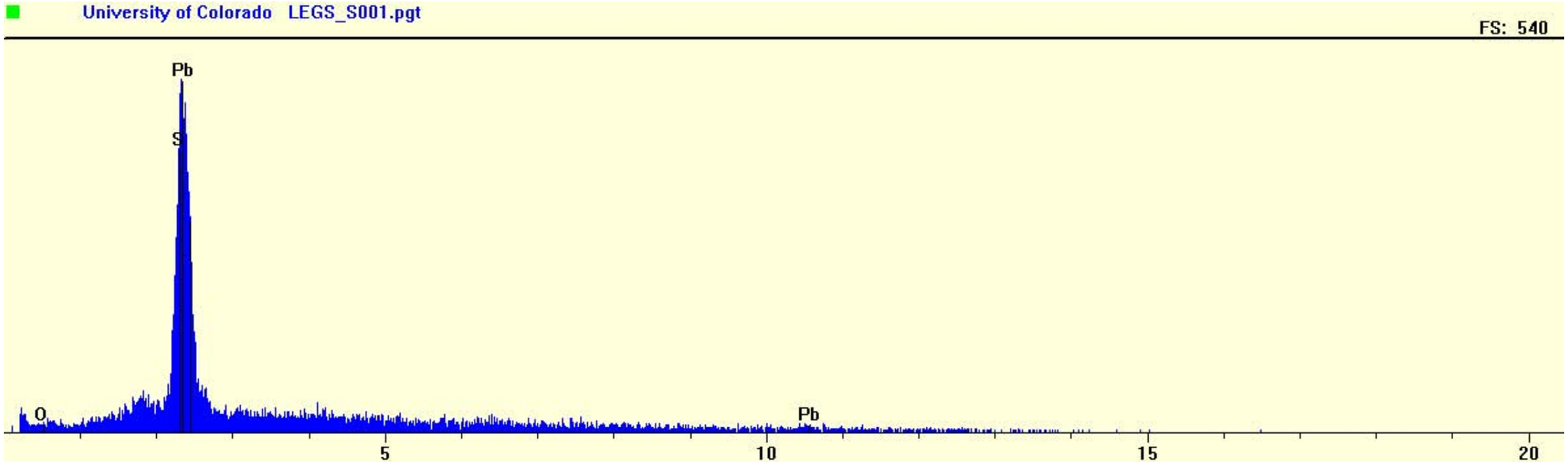
A9B3



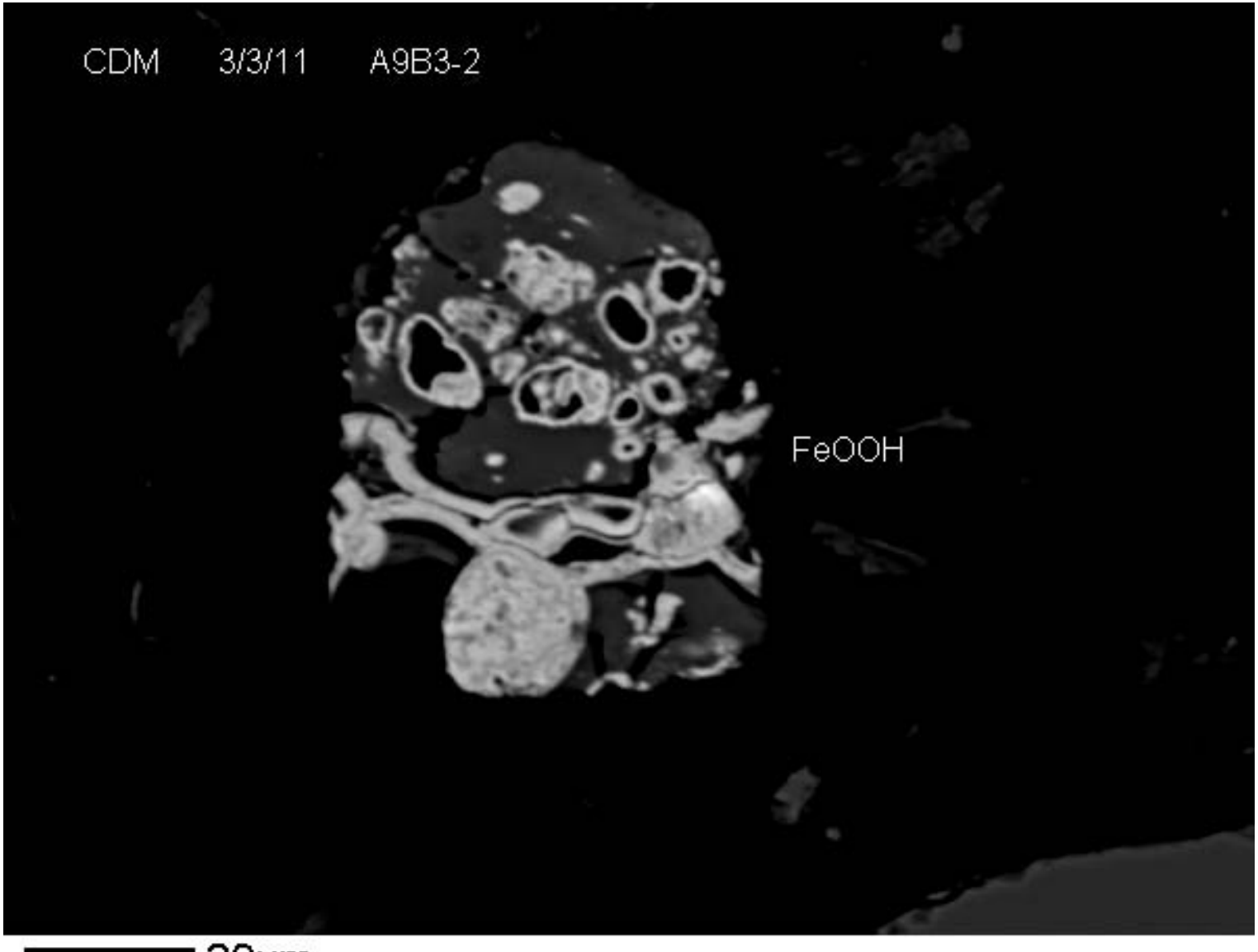
20µm

BEI

R2-0006335



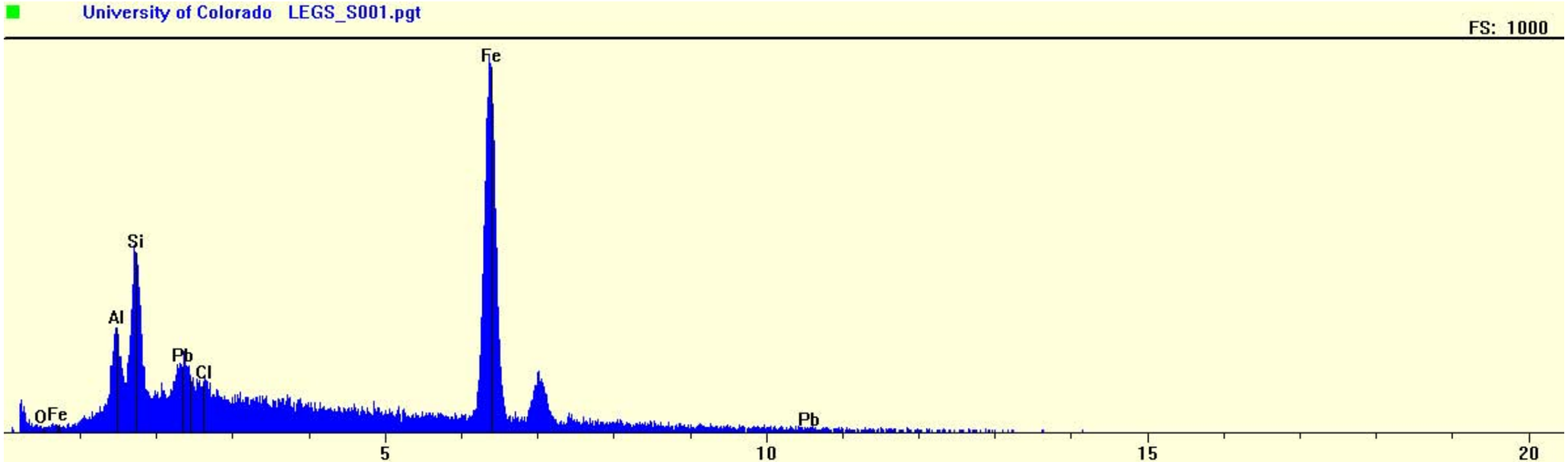
R2-0006336



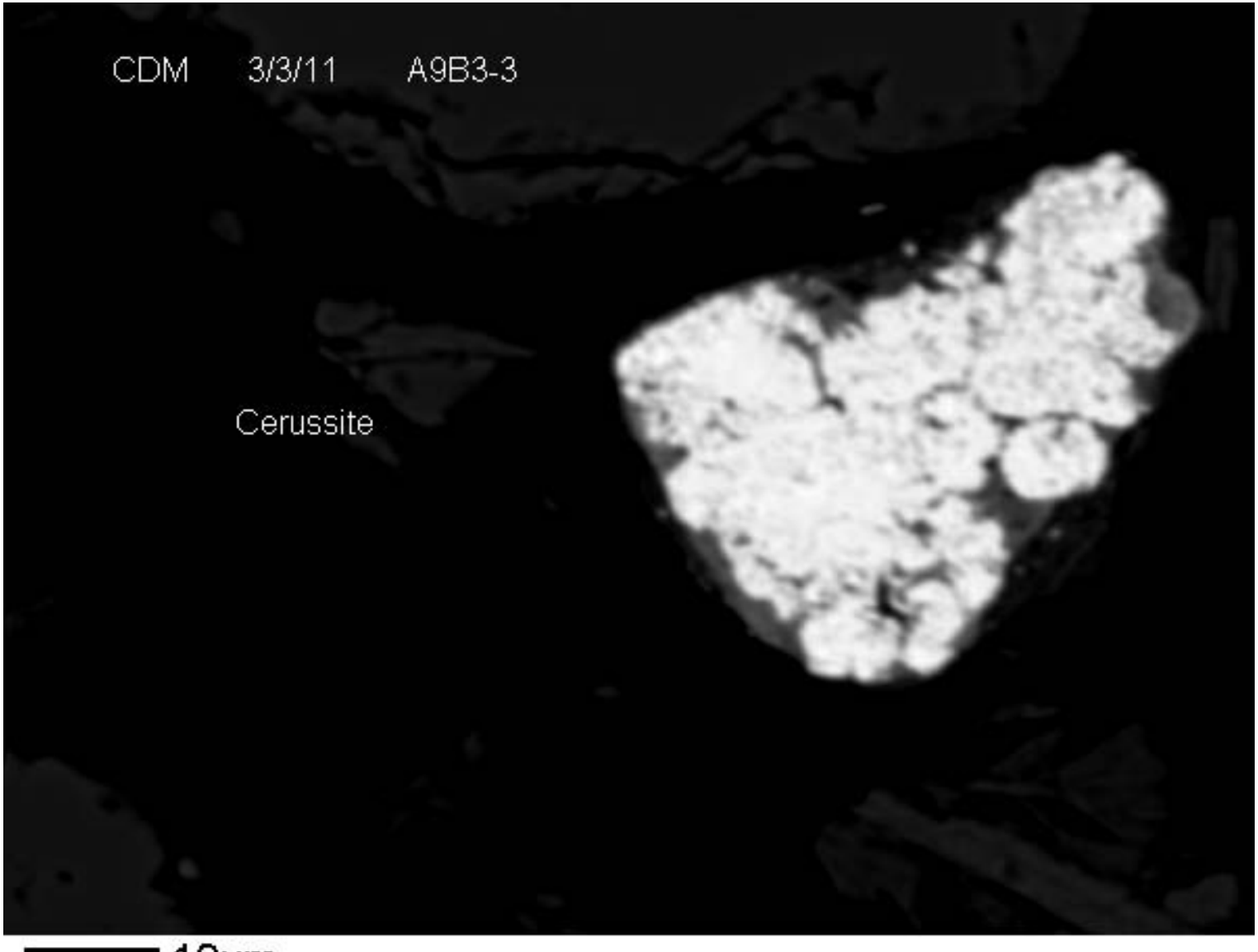
20µm

BEI

R2-0006337


University of Colorado LEGS_S001.pgt
FS: 1000
Fe
Si
Al
Pb
Cl
OFe
Pb
5
10
15
20

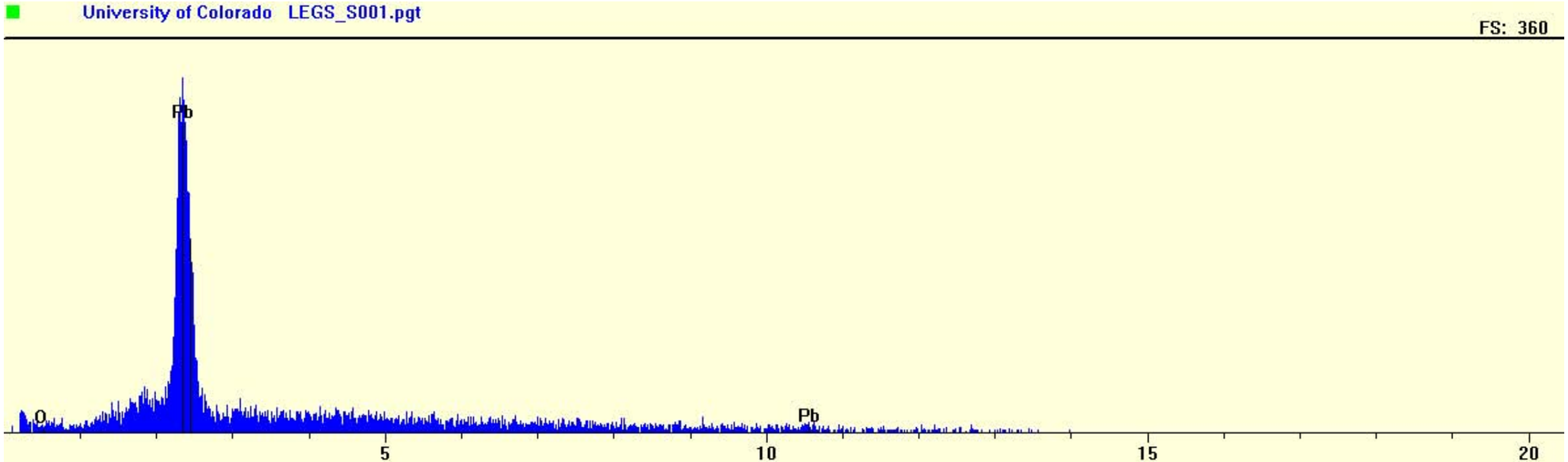
R2-0006338



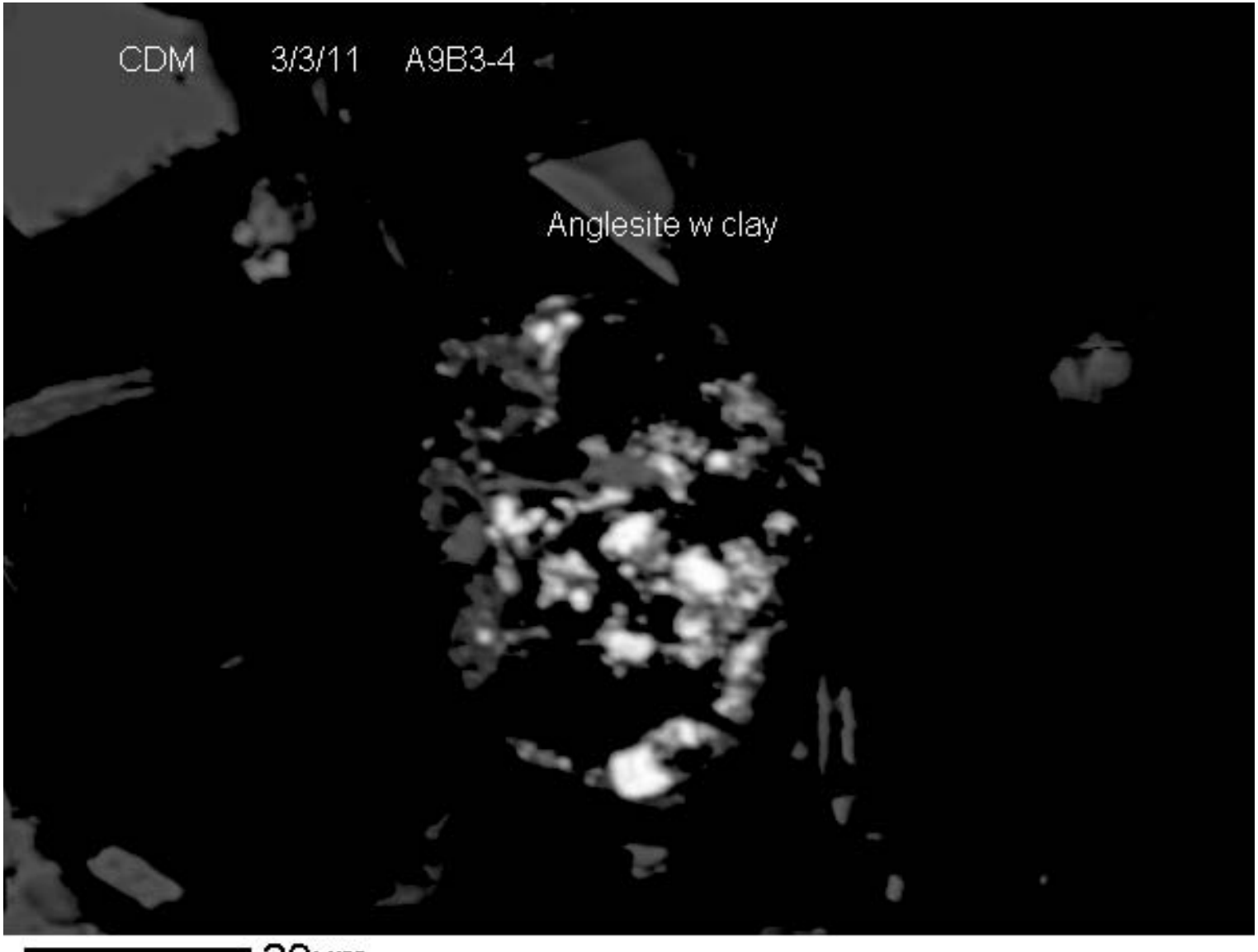
10µm

BEI

R2-0006339



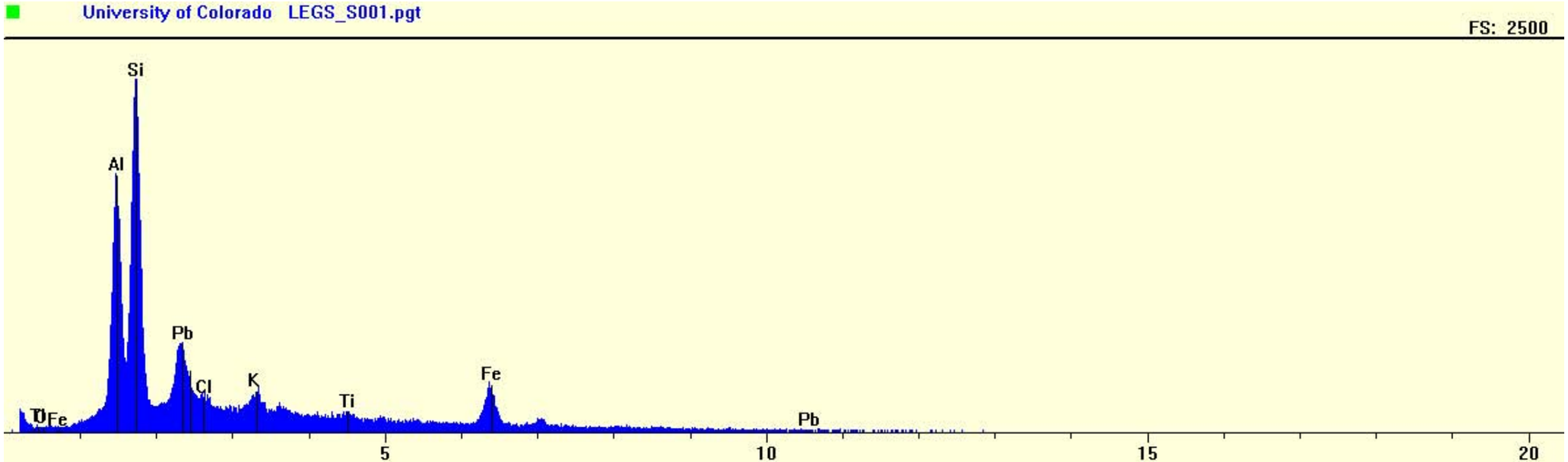
R2-0006340



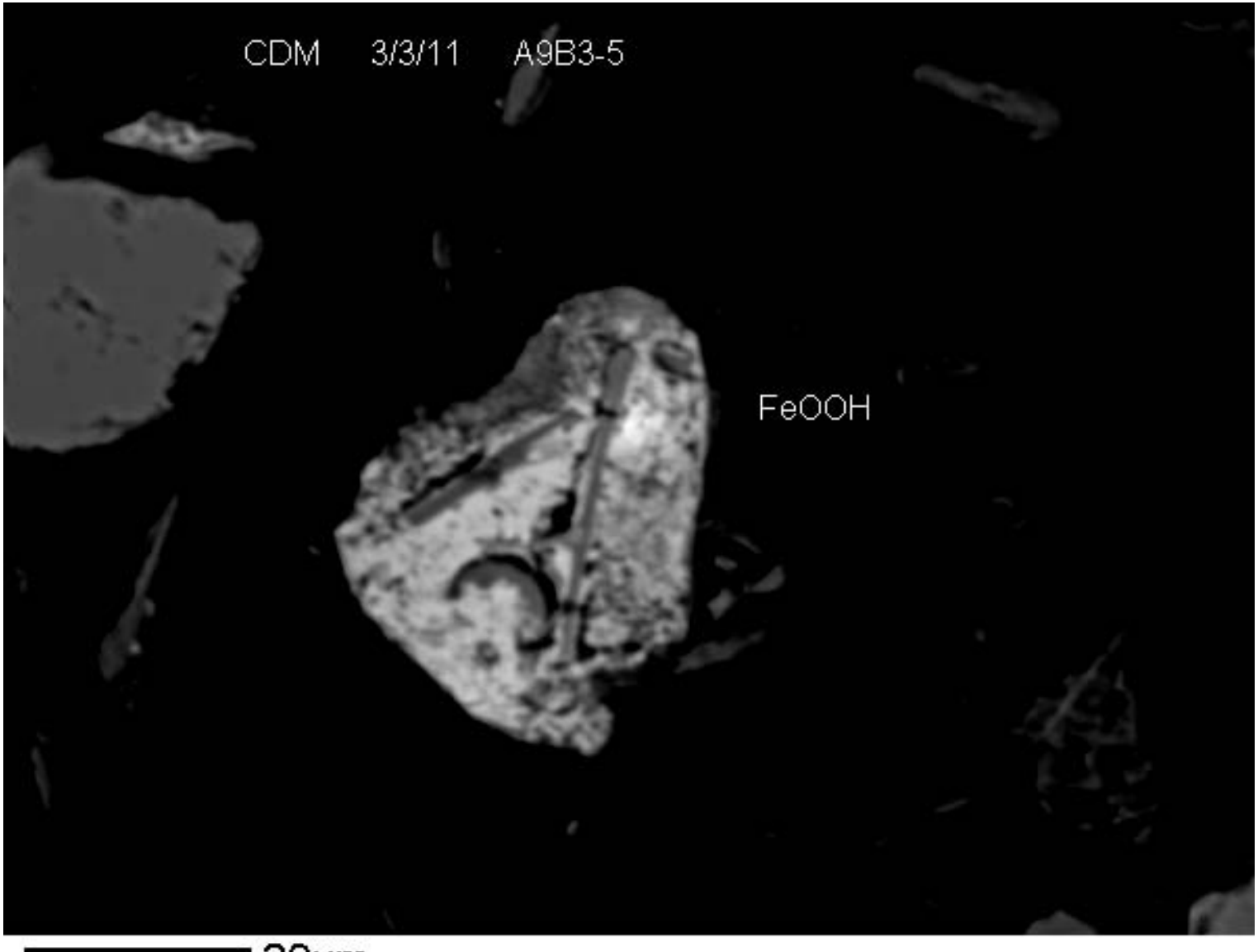
20µm

BEI

R2-0006341


University of Colorado LEGS_S001.pgt
FS: 2500
Si
Al
Pb
Cl
K
Ti
Fe
Pb
5
10
15
20

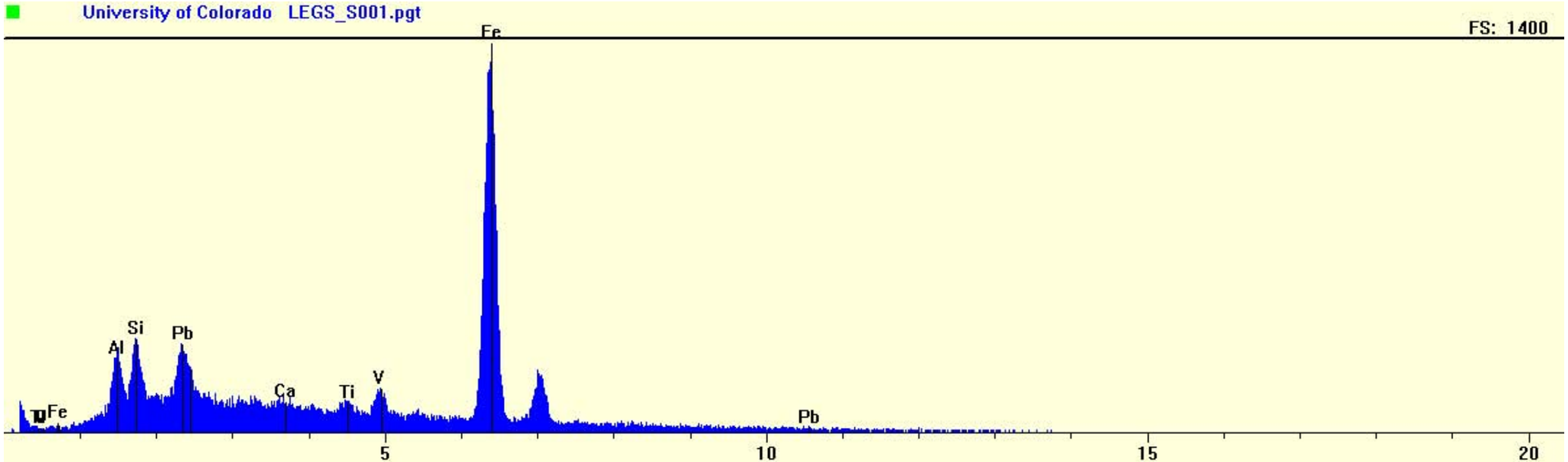
R2-0006342



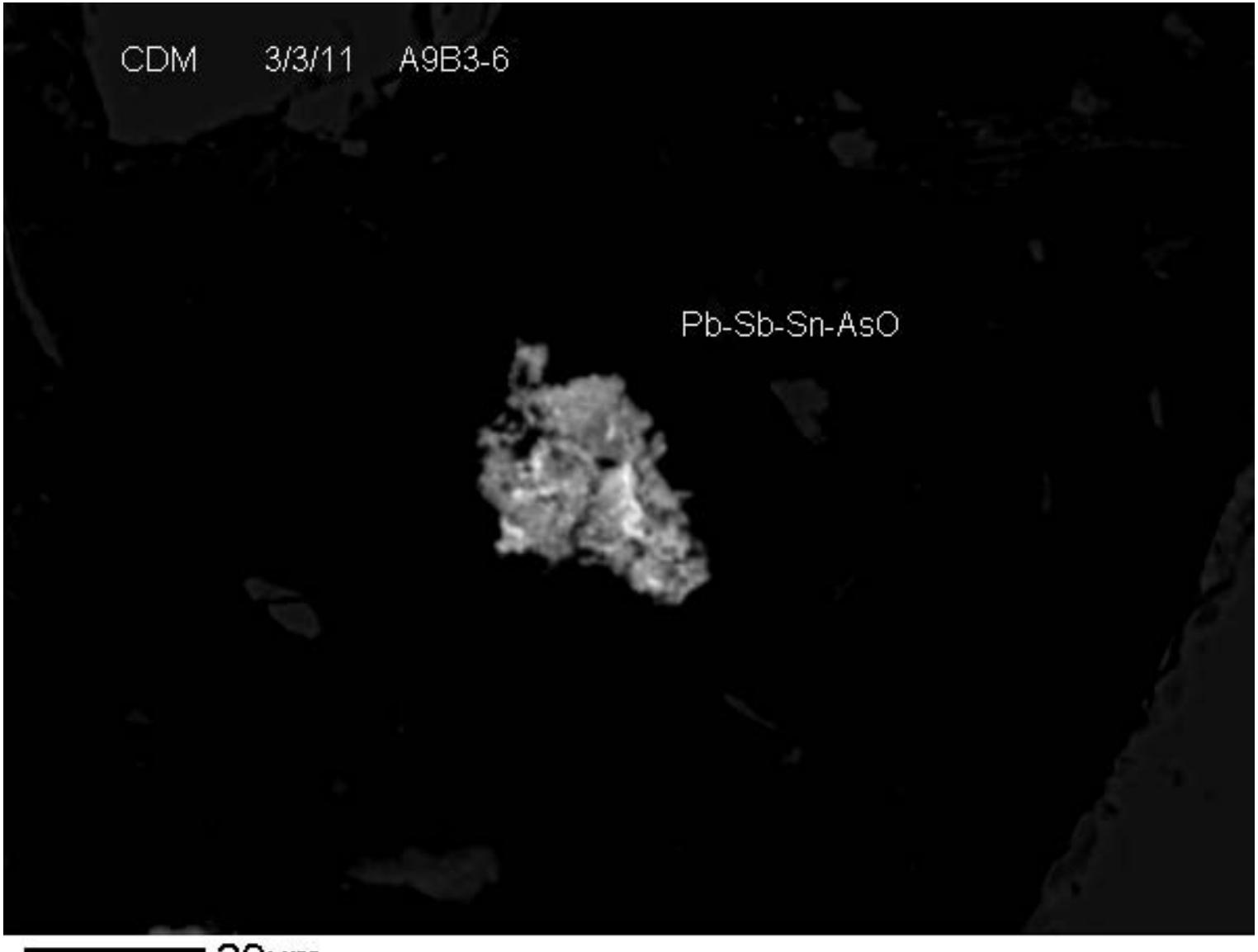
20µm

BEI

R2-0006343


University of Colorado LEGS_S001.pgt
FS: 1400
Fe
Si
Al
Pb
Ca
Ti
V
Fe
Pb
5
10
15
20

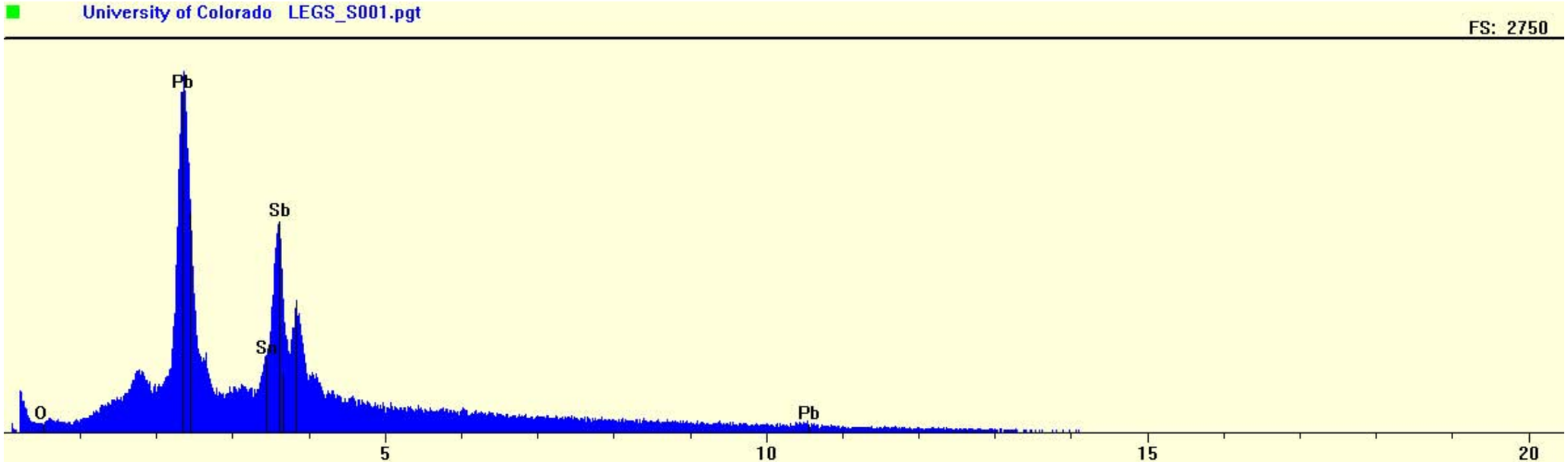
R2-0006344



20µm

BEI

R2-0006345

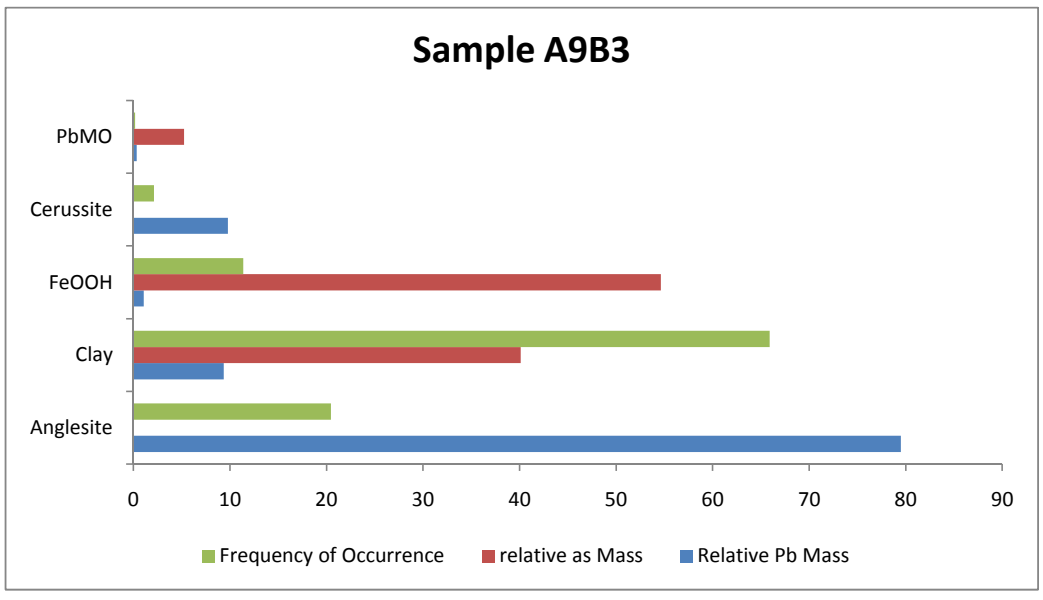

University of Colorado LEGS_S001.pgt
FS: 2750
Pb
Sb
Sn
O
Pb
5
10
15
20

R2-0006346

Form	Association	Size (microns)
Ang	Liberated	8
Ang	Liberated	5
Ang	Liberated	43
Ang	Liberated	8
Ang	Cemented	4
Ang	Cemented	5
Ang	Cemented	2
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
AlSi	Rimming	12
AlSi	Liberated	38
Fe	Liberated	33
Ang	Liberated	3
Ang	Liberated	2
Ang	Rimming	3
Ang	Cemented	2
Ang	Liberated	7
Fe	Cemented	48
Ang	Rimming	4
Ang	Rimming	6
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Liberated	3
Cer	Cemented	2
Ang	Liberated	2
Cer	Liberated	3
Cer	Liberated	4
Cer	Liberated	19
Ang	Liberated	2
Ang	Rimming	3
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
AlSi	Liberated	36
Ang	Rimming	7
Ang	Cemented	4
Ang	Cemented	3
Ang	Cemented	2
AlSi	Liberated	19
Ang	Liberated	3
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Liberated	2
Cer	Liberated	2
Ang	Liberated	14
Ang	Cemented	3
Ang	Liberated	9
Ang	Liberated	3
Ang	Cemented	6
Ang	Cemented	2
Ang	Liberated	2
Ang	Rimming	7
Fe	Liberated	32
Ang	Rimming	14
Ang	Liberated	8
Fe	Liberated	80
Cer	Liberated	13
PbMO	Liberated	6
Ang	Cemented	12
Fe	Rimming	90
Fe	Rimming	32
Cer	Cemented	6

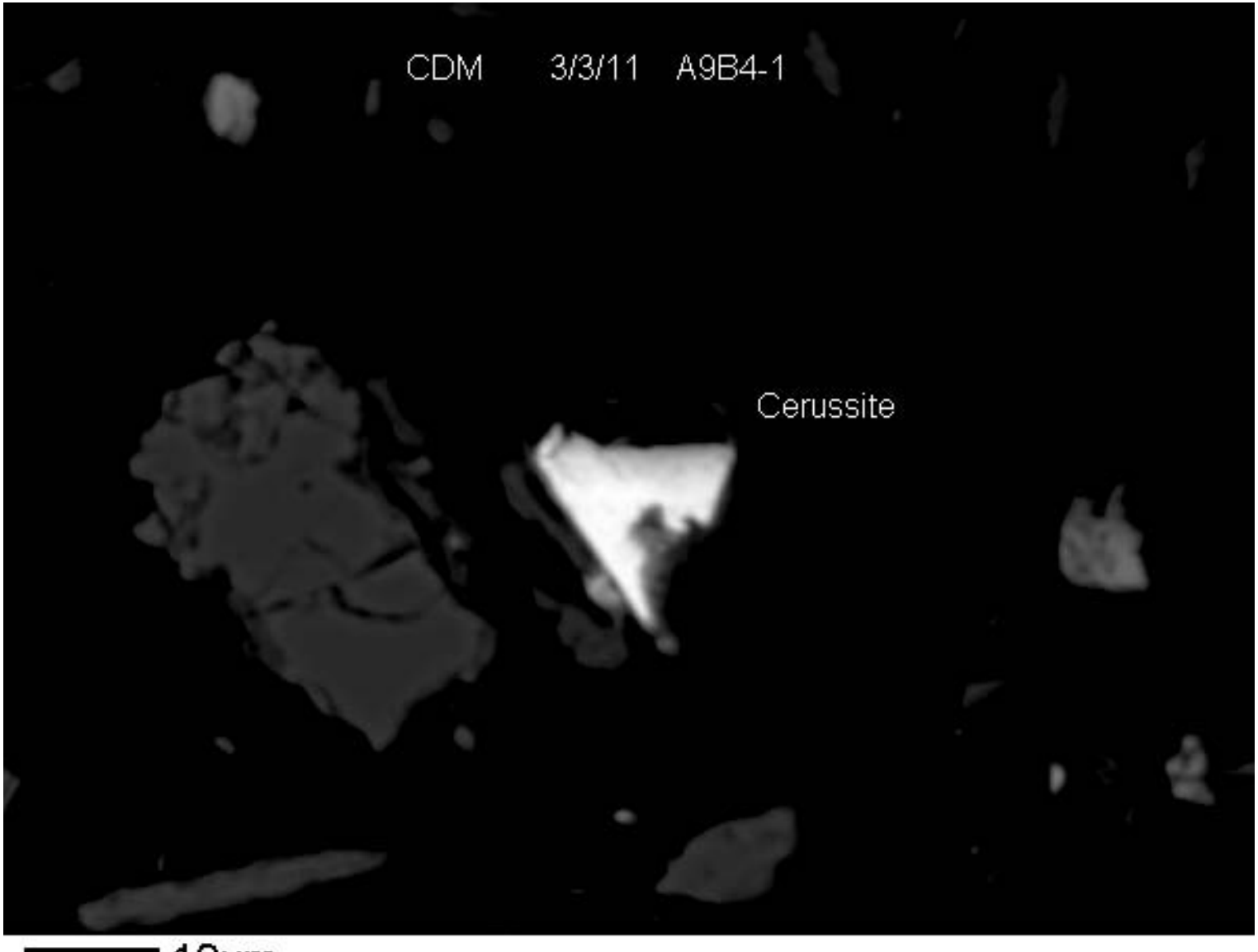
Form	Number	Mean	Std-Dev	Range low	Range high
total	171	21.3	36.49	1	155
Anglesite	123	6.06	13.04	1	105
Clay	28	85.71	40.9	12	155
FeOOH	8	51.75	26.84	21	90
Cerussite	11	7	8.29	1	25
PbMO	1	6	ND	6	6

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm As	Error-95%
%	%	%	%	%	%	%	
Anglesite	20.46	20.46	79.5	79.5	0	0	6.05
Clay	65.9	65.9	9.34	9.34	40.11	40.11	7.11
FeOOH	11.37	11.37	1.06	1.06	54.65	54.65	4.76
Cerussite	2.11	2.11	9.77	9.77	0	0	2.16
PbMO	0.16	0.16	0.33	0.33	5.25	5.25	0.61



Cer	Cemented	1
Cer	Cemented	1
Cer	Cemented	1
Ang	Cemented	2
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Liberated	7
Fe	Liberated	78
Fe	Liberated	21
Ang	Liberated	5
Ang	Cemented	4
Ang	Cemented	3
Ang	Cemented	3
Ang	Cemented	3
Ang	Cemented	3
Ang	Liberated	9
Ang	Liberated	6
Ang	Liberated	5
Ang	Rimming	7
Ang	Liberated	4
Ang	Liberated	4
Ang	Liberated	6
Ang	Liberated	18
Ang	Liberated	14
Ang	Cemented	7
Ang	Rimming	43
Ang	Rimming	31
Ang	Liberated	13
Ang	Cemented	78
Ang	Liberated	105
Cer	Liberated	25
Ang	Liberated	12
Ang	Cemented	22
Ang	Cemented	10
Ang	Cemented	10
Ang	Cemented	10
Ang	Cemented	10
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	50
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	75
AlSi	Liberated	65
AlSi	Liberated	25
AlSi	Liberated	25
AlSi	Liberated	25
AlSi	Liberated	155

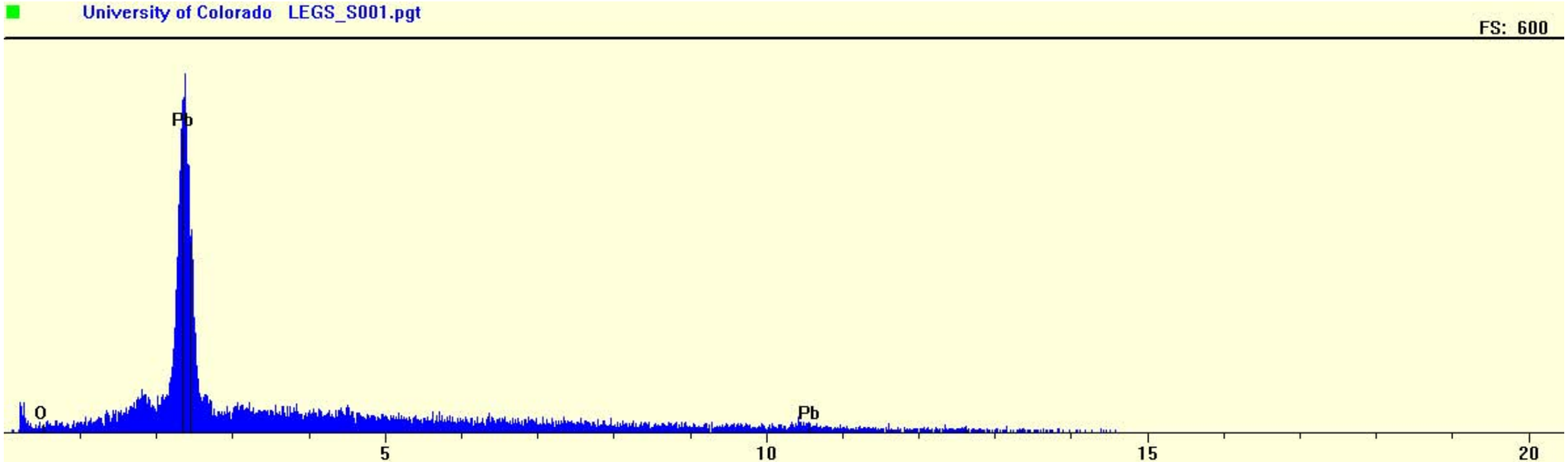
A9B4



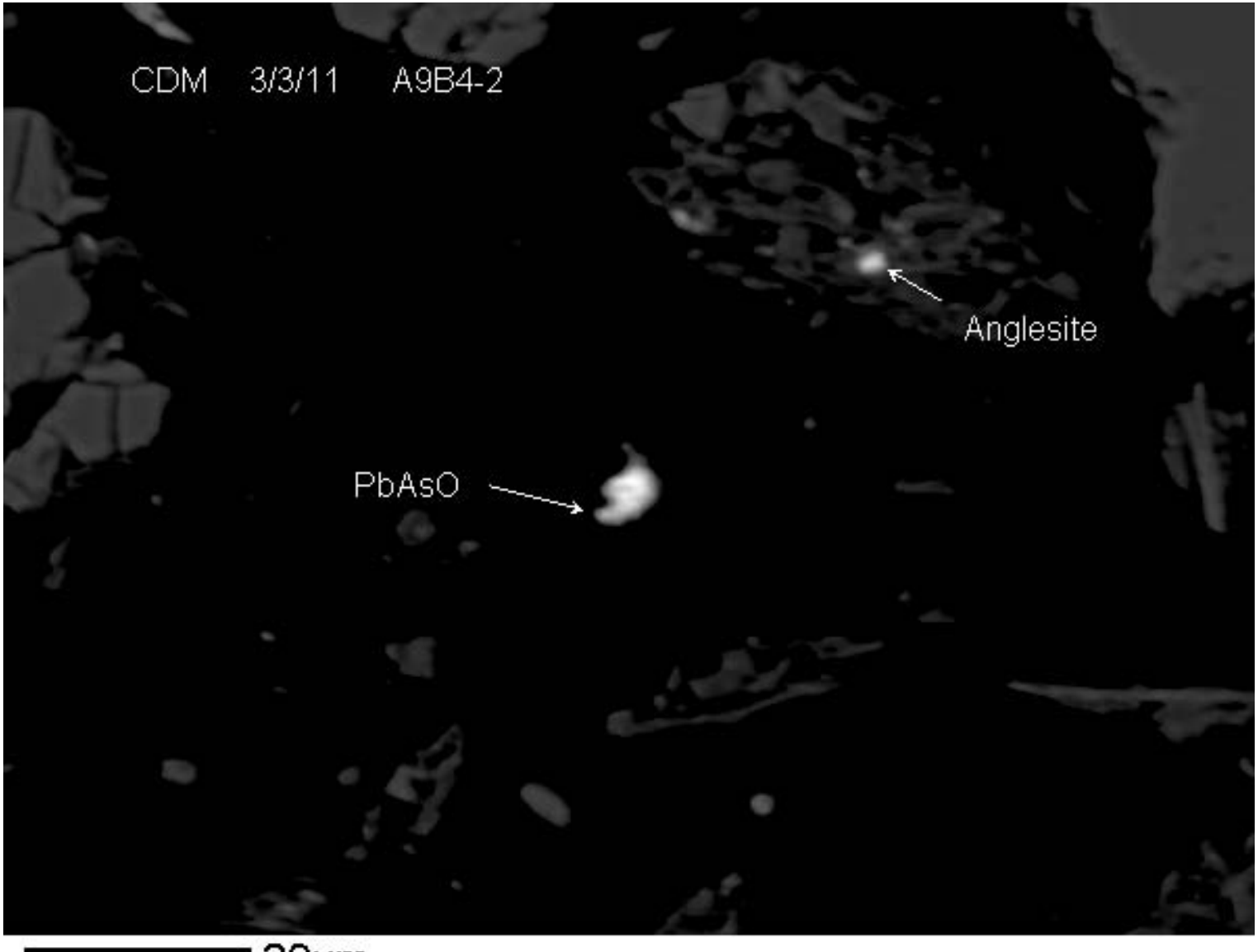
10µm

BEI

R2-0006350



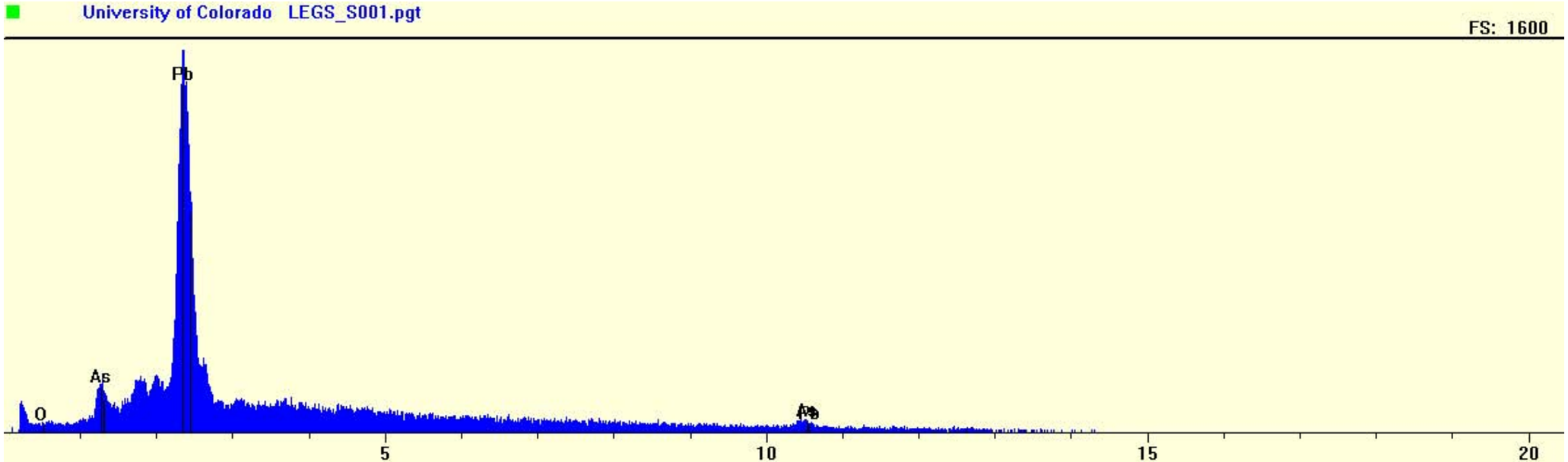
R2-0006351



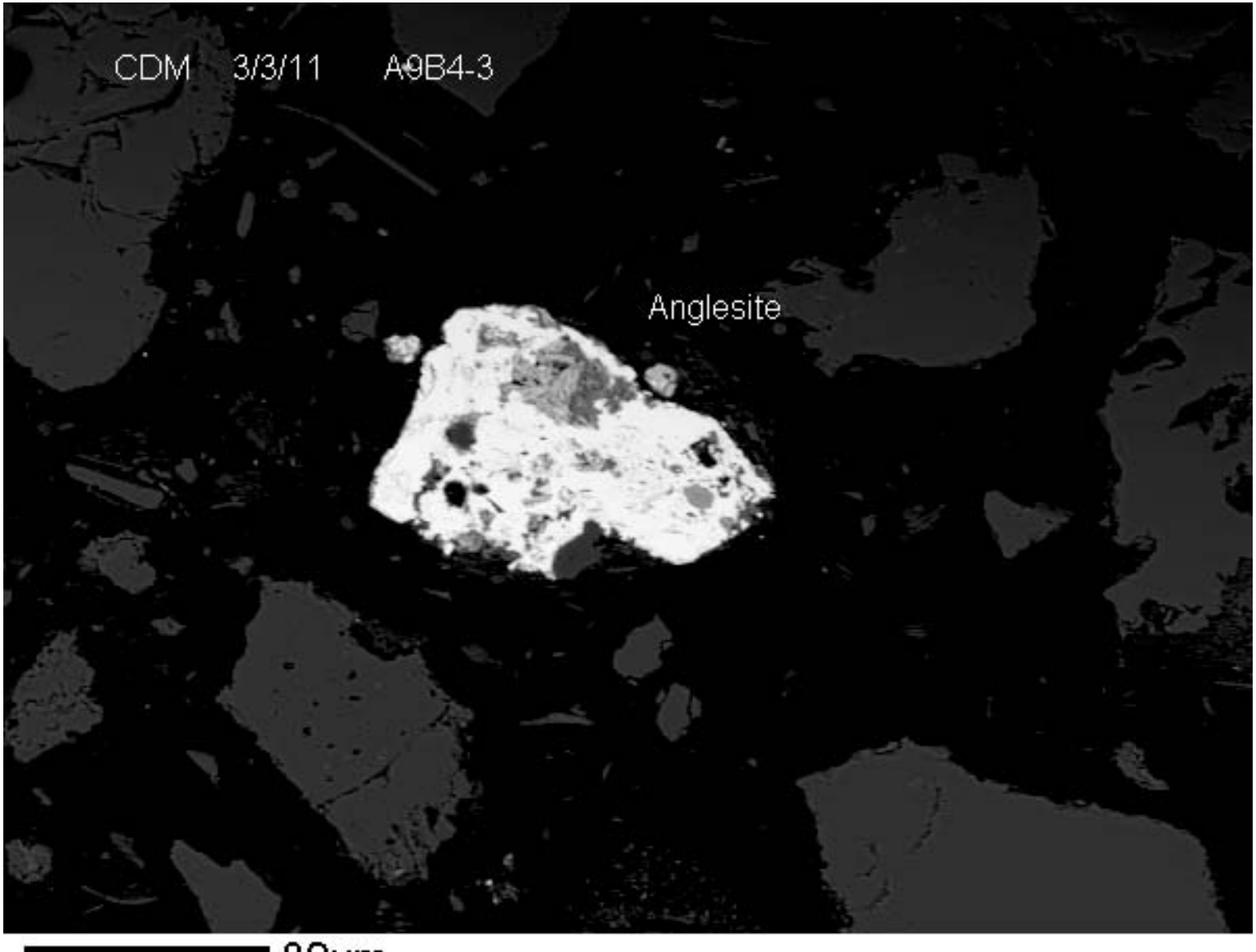
20µm

BEI

R2-0006352


University of Colorado LEGS_S001.pgt
FS: 1600
Pb
As
O
Pb
5
10
15
20

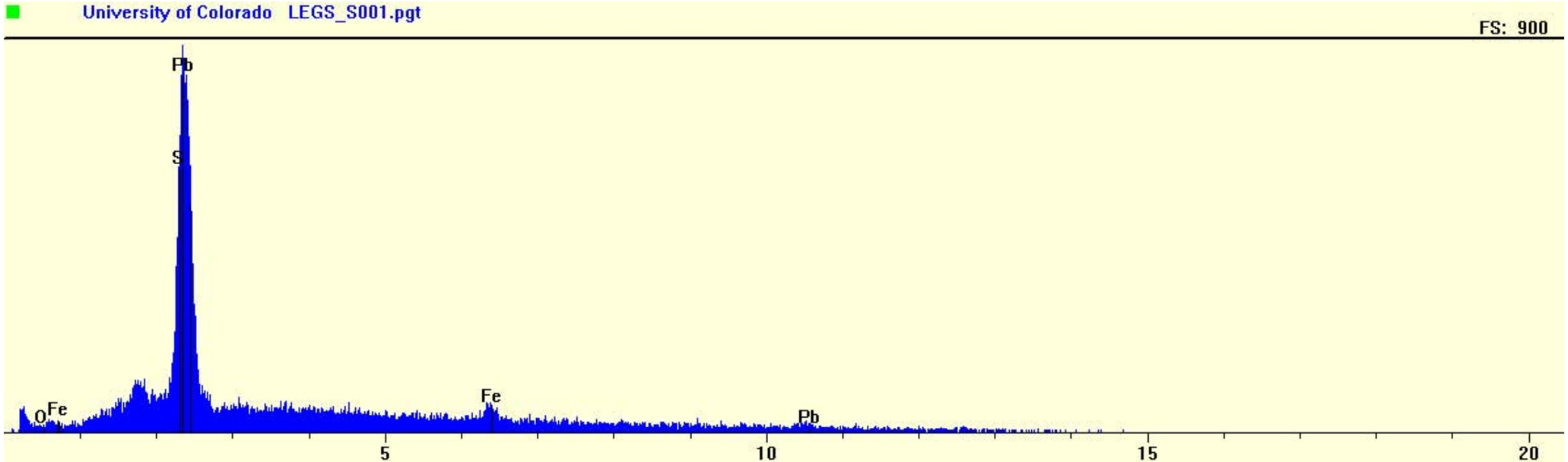
R2-0006353



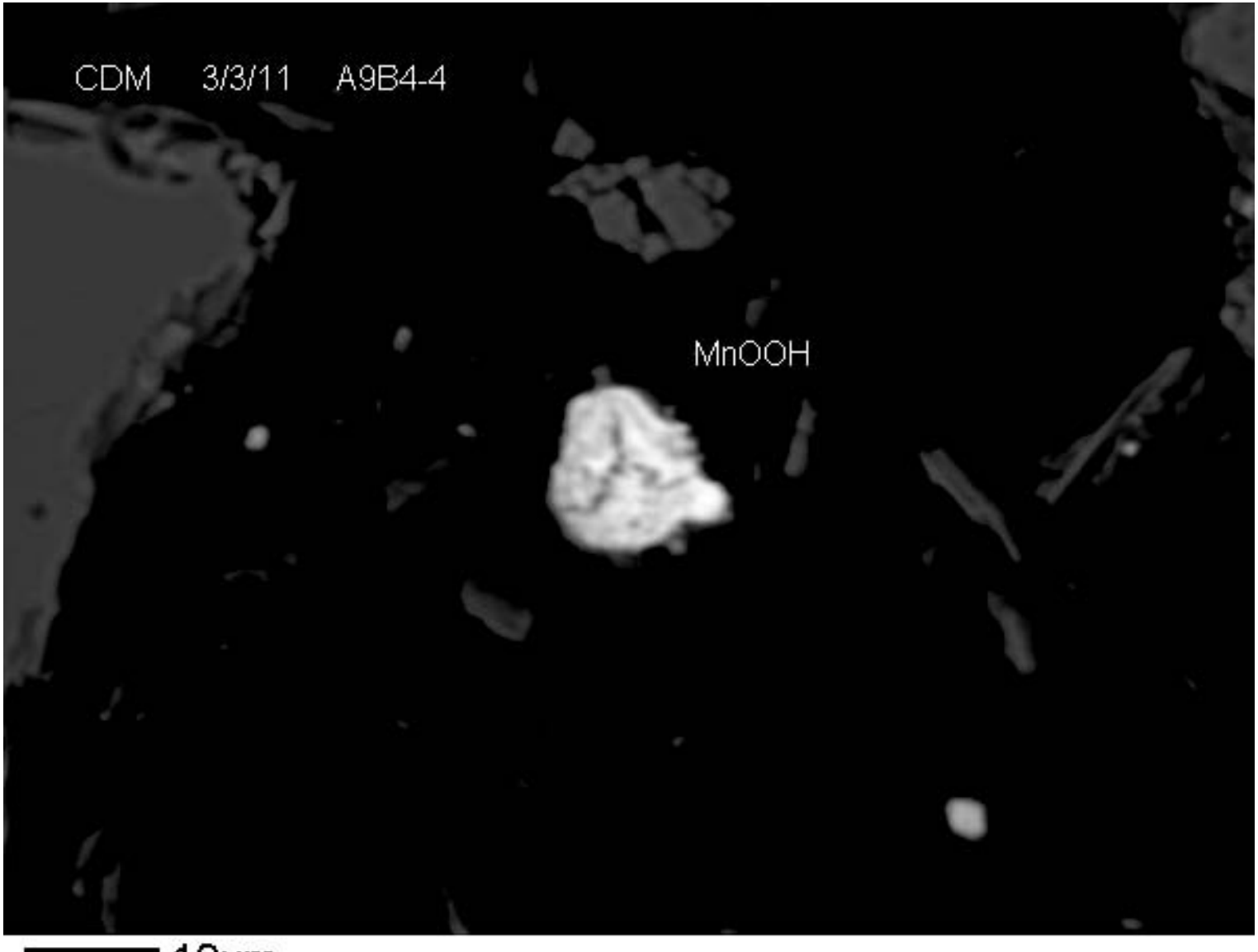
80µm

BEI

R2-0006354


University of Colorado LEGS_S001.pgt
FS: 900
Pb
S
O
Fe
Fe
Pb
5
10
15
20

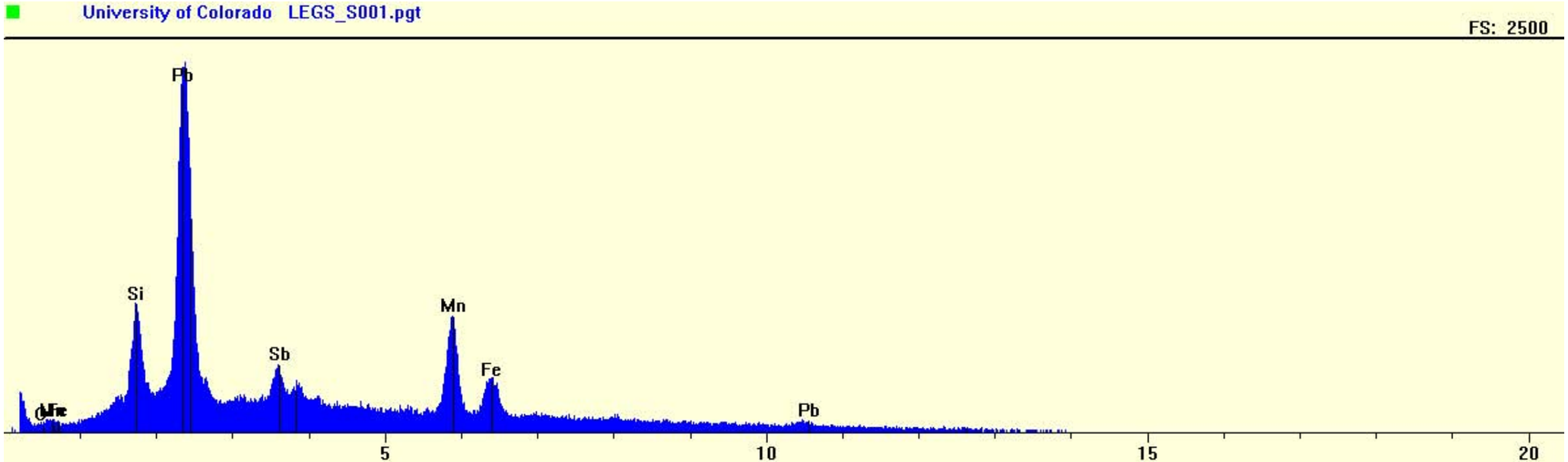
R2-0006355



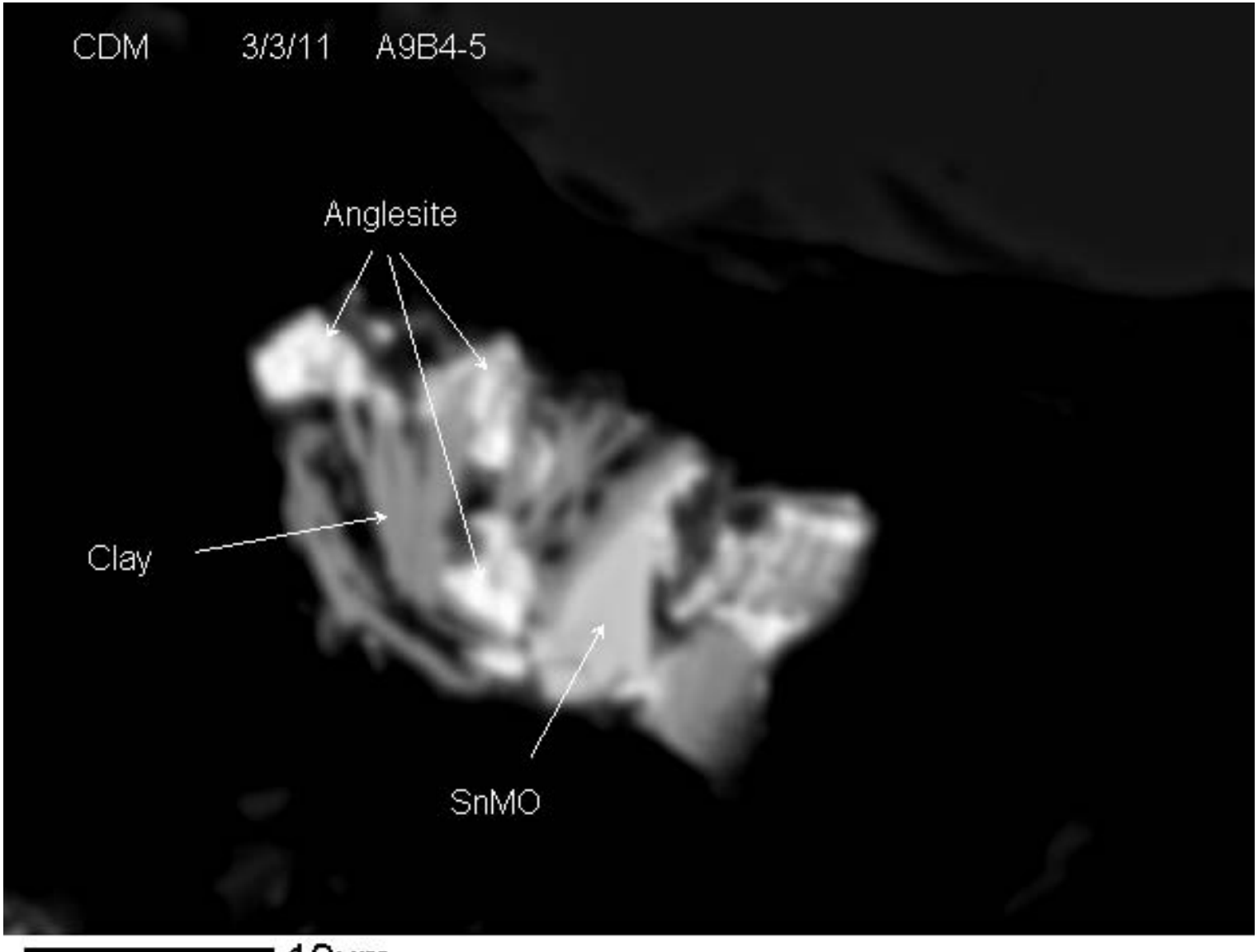
10µm

BEI

R2-0006356


University of Colorado LEGS_S001.pgt
FS: 2500
Pb
Si
Sb
Mn
Fe
Pb
5
10
15
20

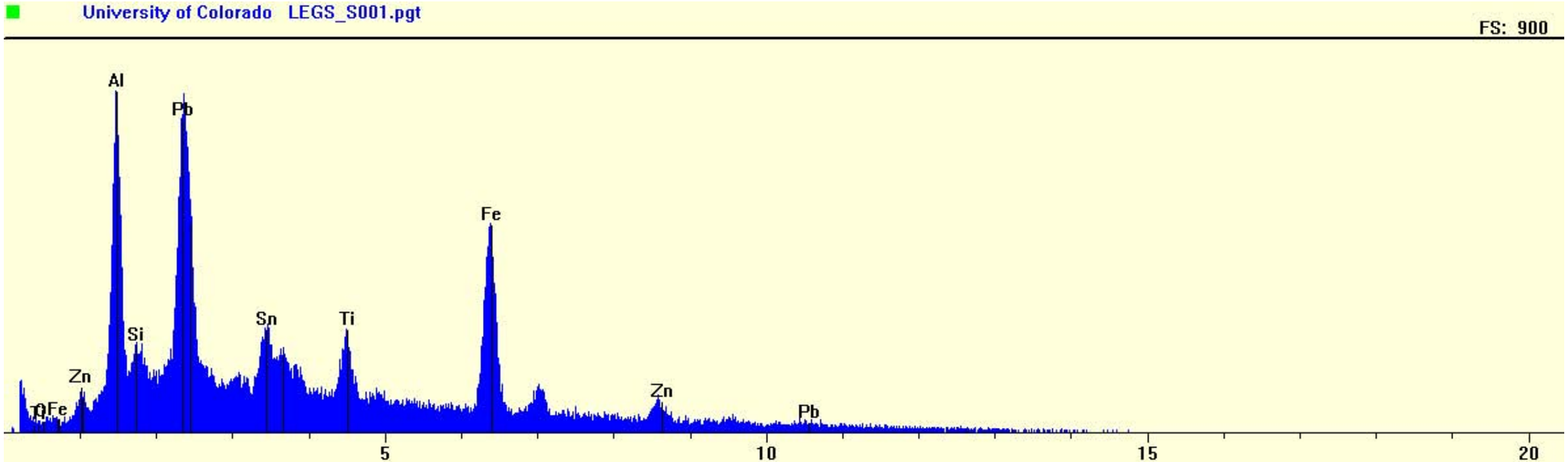
R2-0006357



10µm

BEI

R2-0006358

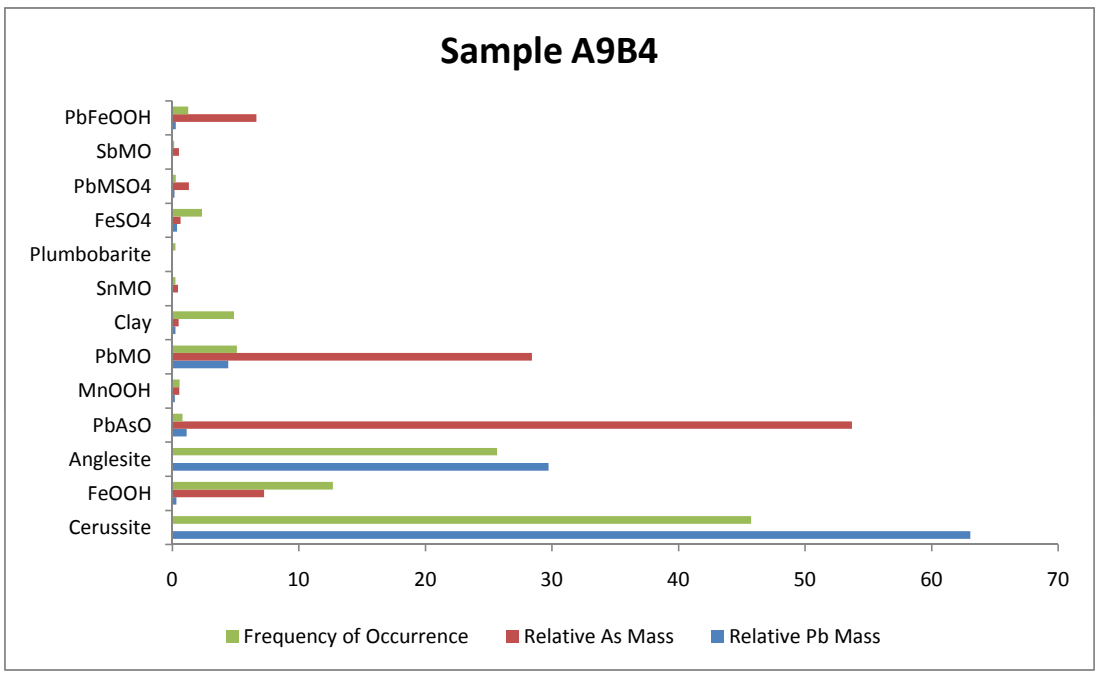

University of Colorado LEGS_S001.pgt
FS: 900
Al
Pb
Fe
Si
Sn
Ti
Zn
Fe
Zn
Pb
5
10
15
20

R2-0006359

Form	Association	Size (microns)
Cer	Rimming	18
Fe	Rimming	28
Ang	Liberated	9
Cer	Cemented	5
Ang	Cemented	5
Cer	Cemented	1
Ang	Liberated	2
Cer	Liberated	11
PbAsO	Liberated	5
Ang	Cemented	2
Cer	Liberated	1
Fe	Liberated	8
Cer	Liberated	5
Fe	Liberated	5
Fe	Liberated	6
Mn	Liberated	5
Ang	Rimming	3
Cer	Cemented	4
Ang	Liberated	2
Ang	Liberated	3
Ang	Liberated	1
Ang	Liberated	1
Ang	Liberated	1
Ang	Rimming	3
Ang	Cemented	2
Cer	Rimming	18
Cer	Liberated	18
Cer	Cemented	19
Ang	Liberated	4
Fe	Cemented	58
Cer	Liberated	9
PbMO	Liberated	10
Cer	Liberated	10
Ang	Liberated	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	5
Ang	Liberated	102
Ang	Liberated	6
Ang	Liberated	15
Ang	Liberated	4
Mn	Liberated	9
Ang	Liberated	11
Cer	Liberated	14
Cer	Liberated	36
AlSi	Rimming	8
Ang	Rimming	3
Ang	Rimming	3
Ang	Rimming	3
snmo	Rimming	6
AlSi	Rimming	4
Ang	Cemented	2
Ang	Cemented	9
PbMO	Cemented	2
bar	Cemented	6
Fe	Rimming	48
Cer	Liberated	12
Ang	Liberated	30
Ang	Liberated	8
Cer	Rimming	14
PbMO	Rimming	31
Sulf	Liberated	58
pbmso4	Liberated	7
Ang	Liberated	3
AlSi	Liberated	48
Cer	Liberated	9
Cer	Cemented	4
Cer	Cemented	4
Cer	Cemented	4
Cer	Cemented	4
Ang	Liberated	7
Ang	Liberated	6
Ang	Rimming	15
Cer	Liberated	9
Cer	Rimming	31
Ang	Liberated	17
Cer	Liberated	20
Ang	Liberated	12
Cer	Liberated	7
Cer	Liberated	52
Cer	Cemented	11
Cer	Cemented	6
Cer	Cemented	6
Cer	Cemented	6
Cer	Cemented	6
Fe	Rimming	55
Fe	Cemented	11

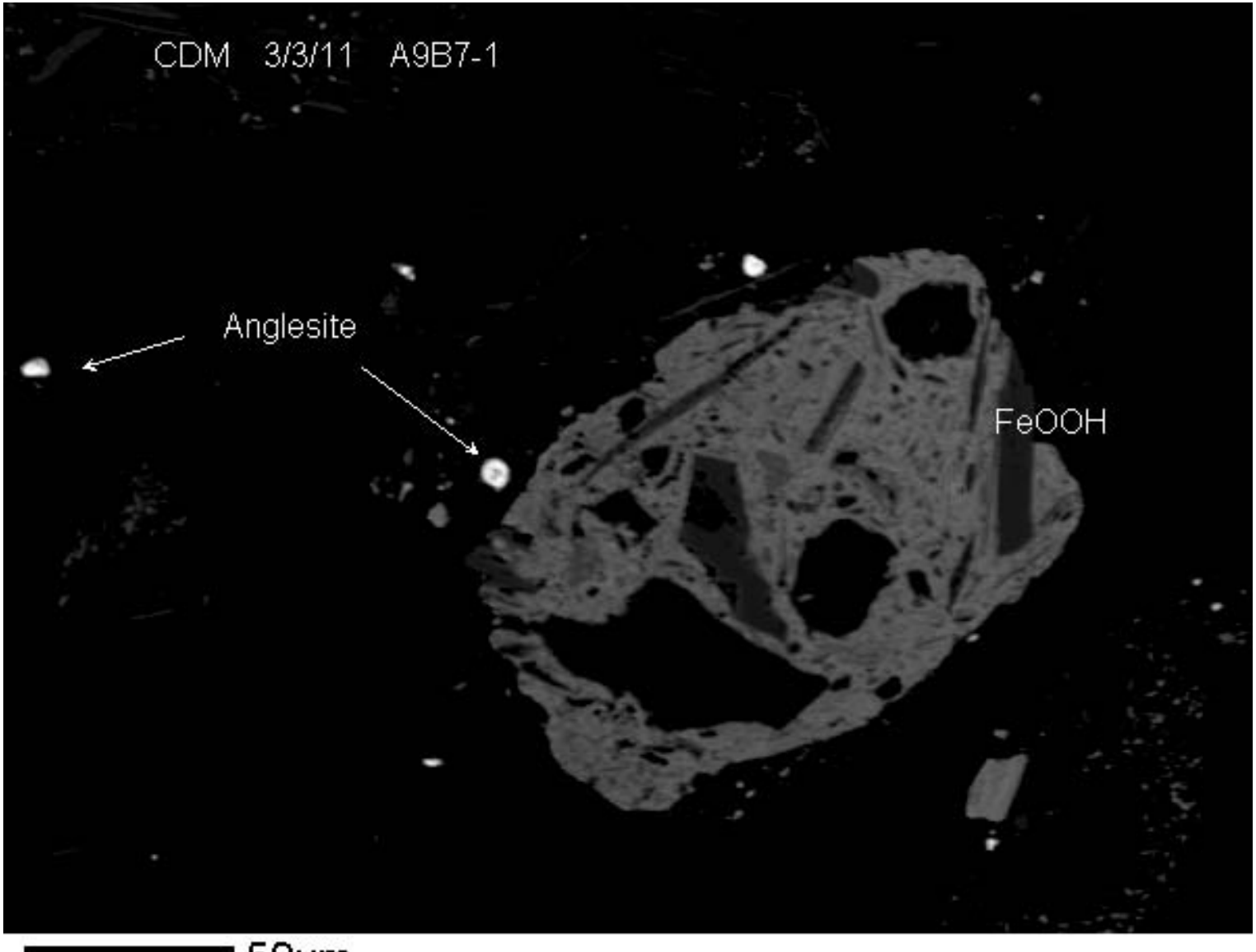
Form	Number	Mean	Std-Dev	Range low	Range high
total	172	14.33	18.29	1	102
Cerussite	60	18.78	17.94	1	72
FeOOH	10	31.3	25.63	5	75
Anglesite	78	8.1	15.21	1	102
PbAsO	2	10	7.07	5	15
MnOOH	2	7	2.83	5	9
PbMO	8	15.75	20.09	2	60
Clay	5	24	20.26	4	48
SnMO	1	6	ND	6	6
Plumbobarite	1	6	ND	6	6
FeSO4	1	58	ND	58	58
PbMSO4	1	7	ND	7	7
SbMO	1	4	ND	4	4
PbFeOOH	2	15.5	2.12	14	17

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm as	Error-95%
%	%	%	%	%	%	%	
Cerussite	45.74	45.74	63.04	63.04	0	0	7.45
FeOOH	12.7	12.7	0.33	0.33	7.26	7.26	4.98
Anglesite	25.65	25.65	29.74	29.74	0	0	6.53
PbAsO	0.81	0.81	1.13	1.13	53.69	53.69	1.34
MnOOH	0.57	0.57	0.2	0.2	0.55	0.55	1.12
PbMO	5.11	5.11	4.42	4.42	28.41	28.41	3.29
Clay	4.87	4.87	0.24	0.24	0.51	0.51	3.22
SnMO	0.24	0.24	0.03	0.03	0.45	0.45	0.74
Plumbobarite	0.24	0.24	0.01	0.01	0	0	0.74
FeSO4	2.35	2.35	0.39	0.39	0.66	0.66	2.27
PbMSO4	0.28	0.28	0.18	0.18	1.31	1.31	0.8
SbMO	0.16	0.16	0	0	0.53	0.53	0.6
PbFeOOH	1.26	1.26	0.28	0.28	6.65	6.65	1.67



Ang	Liberated	14
Cer	Liberated	8
Cer	Liberated	11
Cer	Liberated	10
Cer	Liberated	12
Cer	Liberated	3
Cer	Liberated	15
Cer	Liberated	13
Ang	Liberated	7
Cer	Liberated	12
Fe	Rimming	75
sbmo	Cemented	4
PbMO	Cemented	4
PbMO	Cemented	4
Cer	Liberated	23
PbMO	Liberated	7
Ang	Rimming	13
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
PbAsO	Liberated	15
Ang	Liberated	9
Cer	Liberated	10
pbfe	Liberated	14
Fe	Liberated	19
Ang	Liberated	19
PbMO	Liberated	8
Ang	Liberated	9
Cer	Liberated	14
Cer	Liberated	5
Cer	Cemented	55
pbfe	Liberated	17
AlSi	Liberated	17
Cer	Cemented	70
Cer	Liberated	46
Cer	Liberated	52
Cer	Rimming	6
Cer	Rimming	2
AlSi	Liberated	43
Cer	Cemented	72
Cer	Liberated	14
Ang	Cemented	15
Ang	Cemented	8
Ang	Cemented	5
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Cer	Liberated	15
Cer	Liberated	23
Cer	Rimming	13
Cer	Rimming	25
Cer	Cemented	38
PbMO	Rimming	60
Cer	Liberated	60
Cer	Cemented	35
Ang	Liberated	52
Cer	Rimming	40
Ang	Rimming	60
Cer	Liberated	51
Ang	Liberated	48

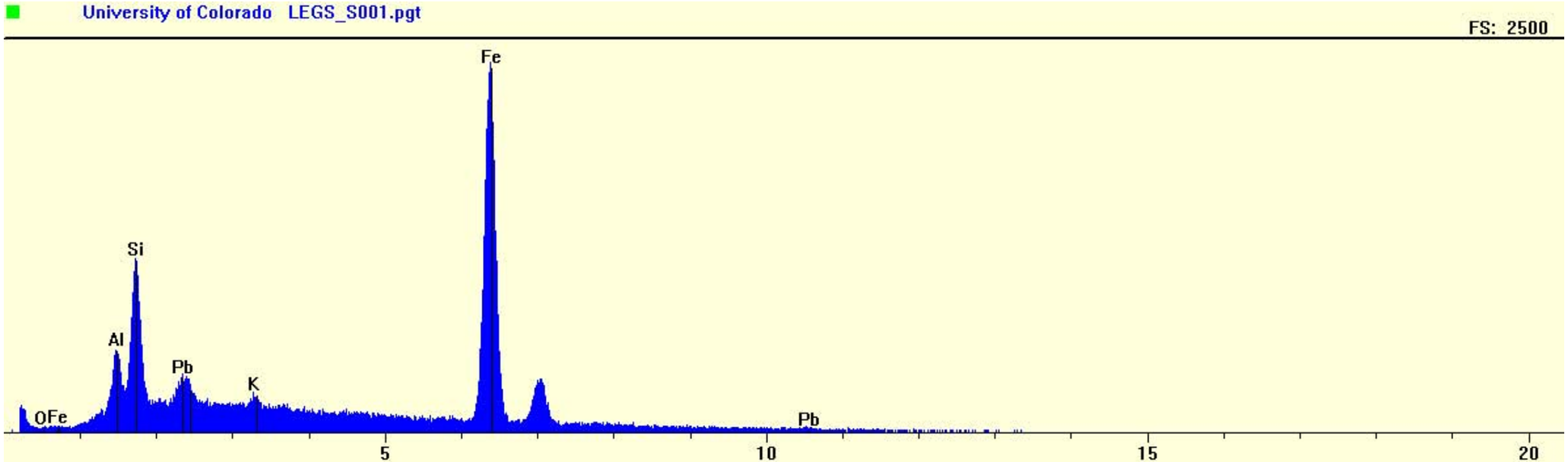
A9B7



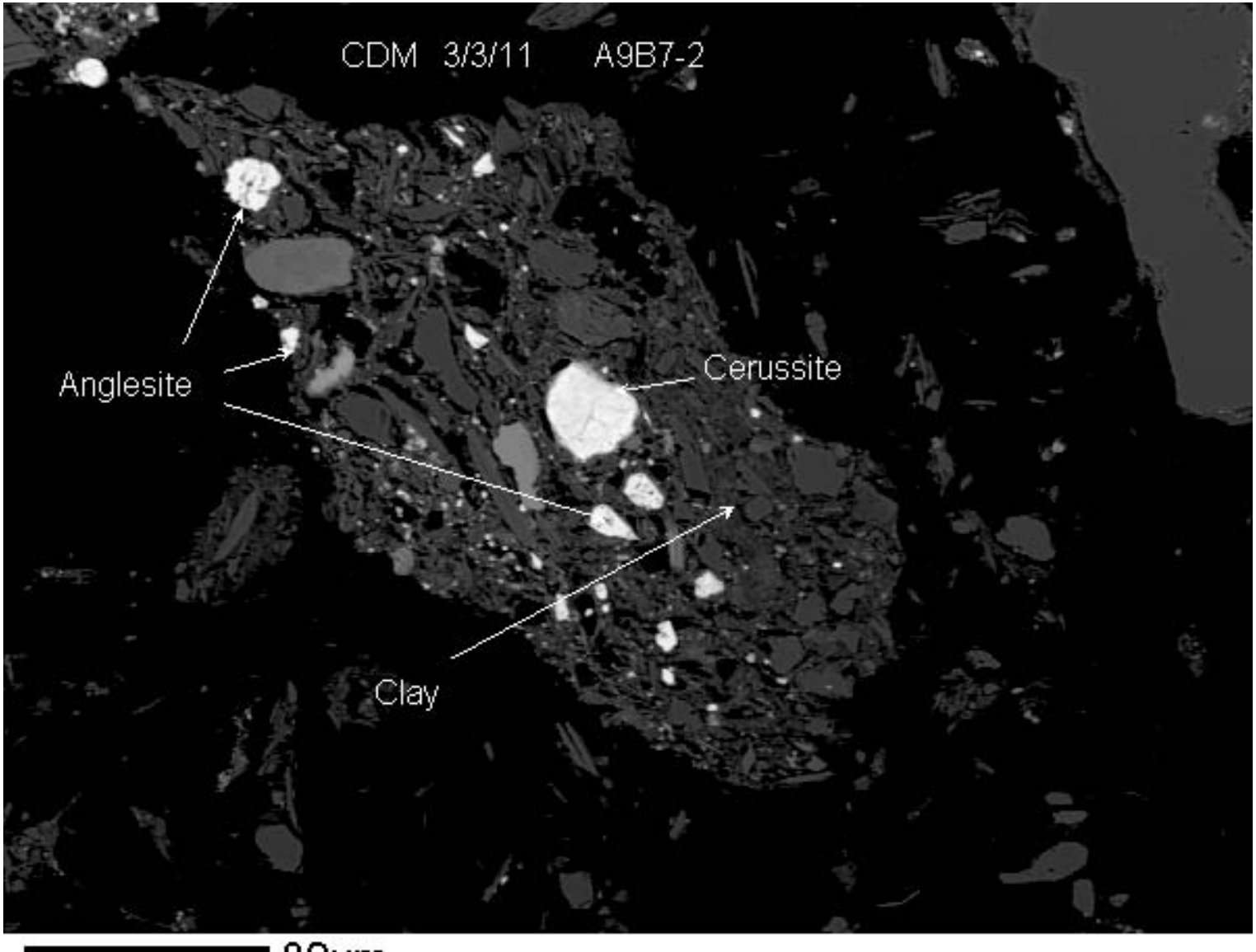
50µm

BEI

R2-0006363


University of Colorado LEGS_S001.pgt
FS: 2500
Fe
Si
Al
Pb
K
OFe
Pb
5
10
15
20

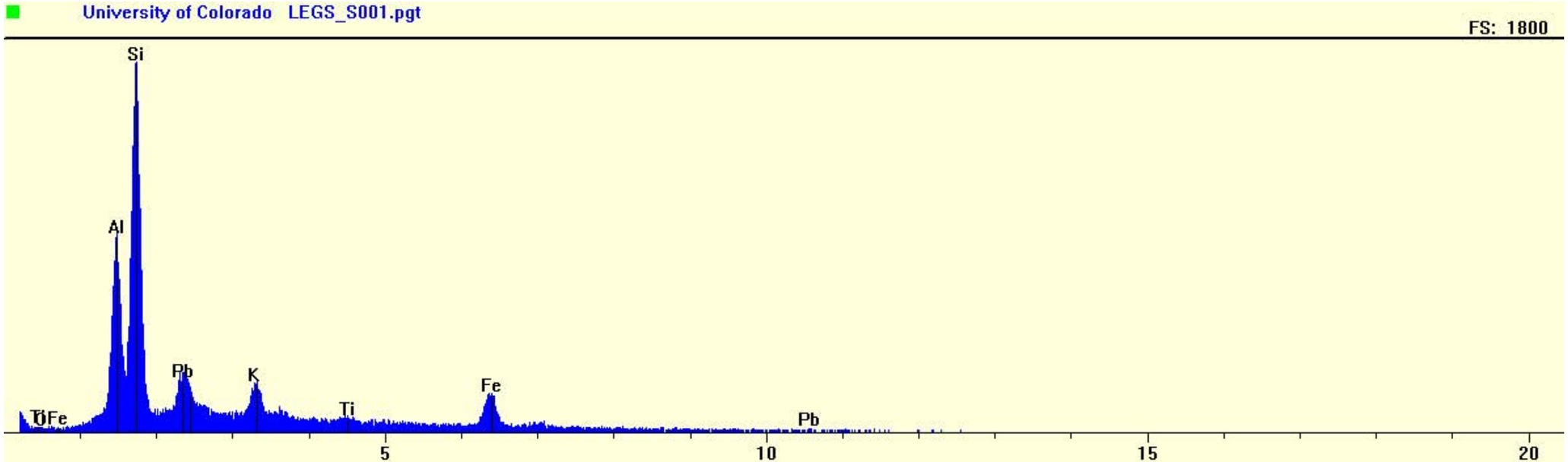
R2-0006364



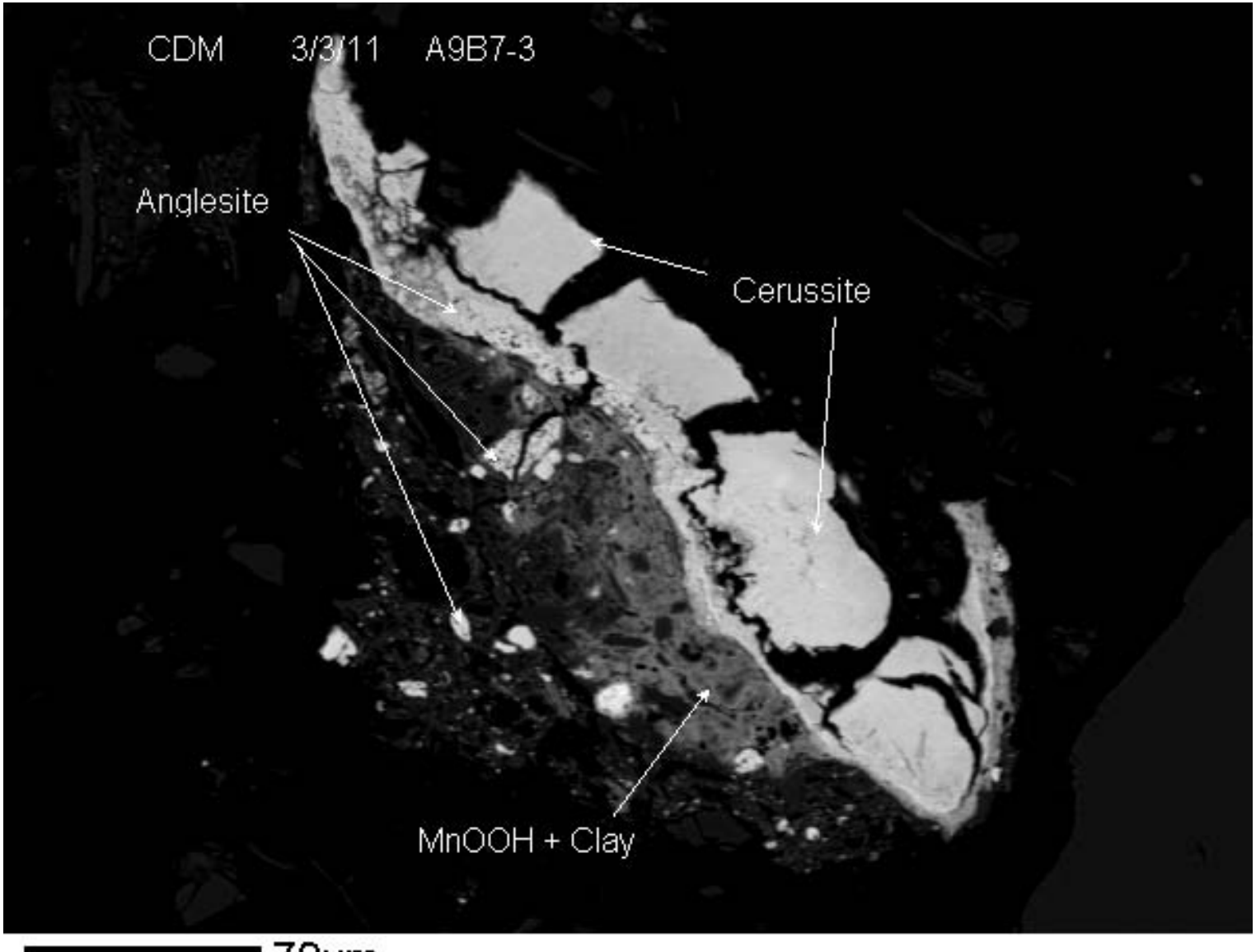
80µm

BEI

R2-0006365


University of Colorado LEGS_S001.pgt
FS: 1800
Si
Al
Pb
K
Ti
Fe
Pb
5
10
15
20

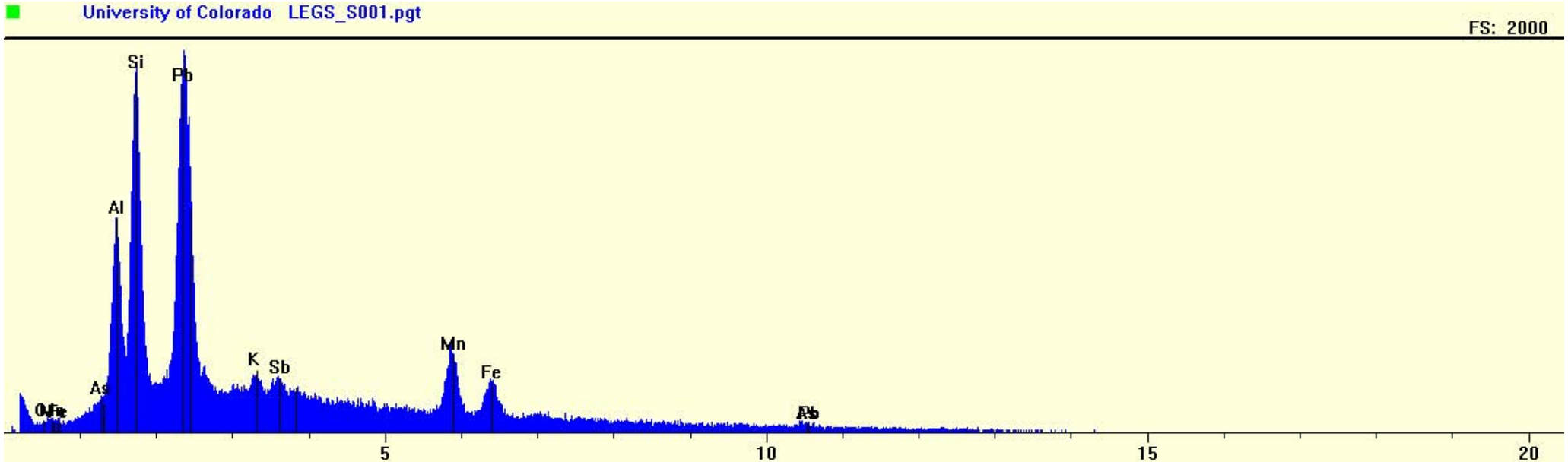
R2-0006366



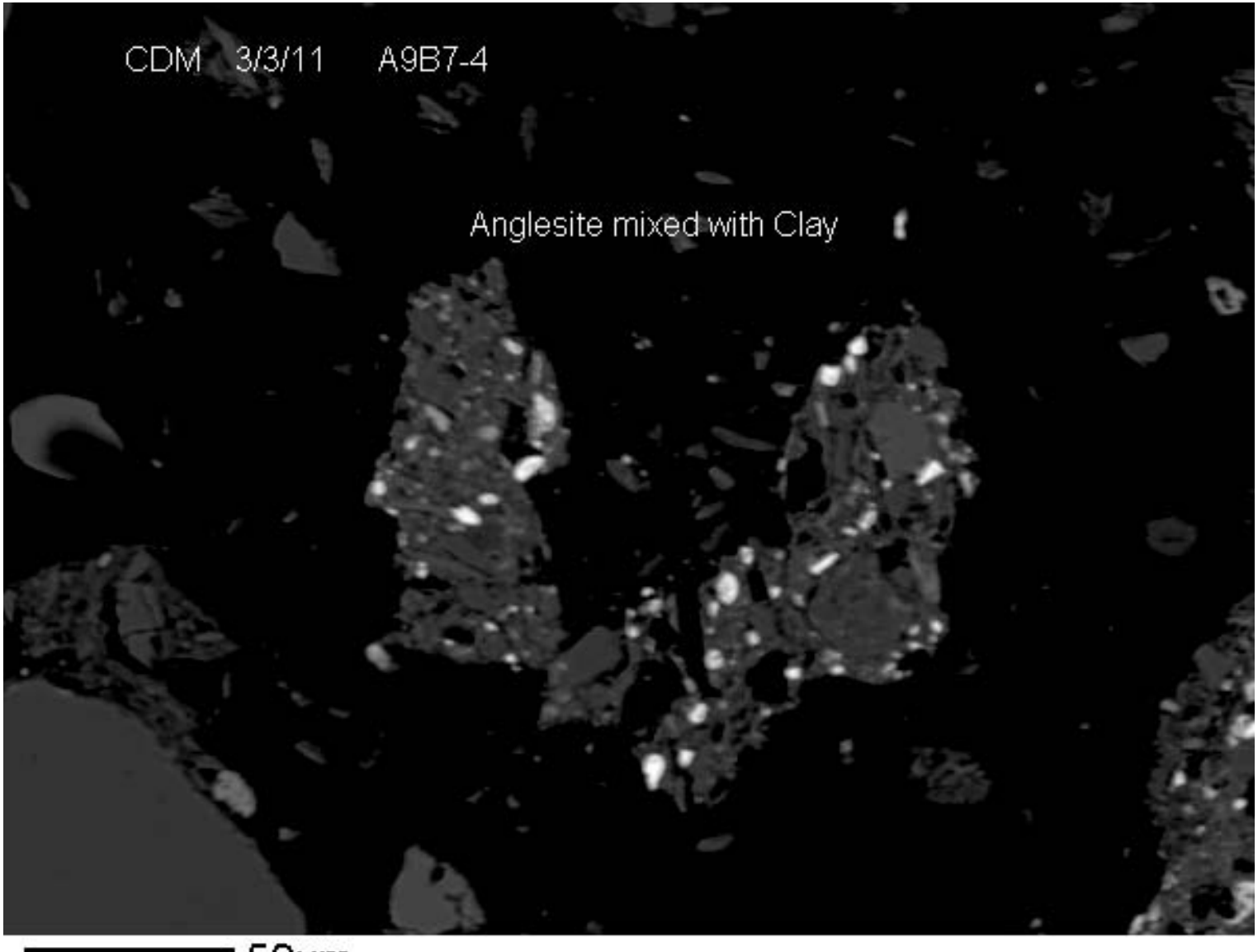
70µm

BEI

R2-0006367


University of Colorado LEGS_S001.pgt
FS: 2000
Si
Pb
Al
K
Sb
Mn
Fe
As
5
10
15
20

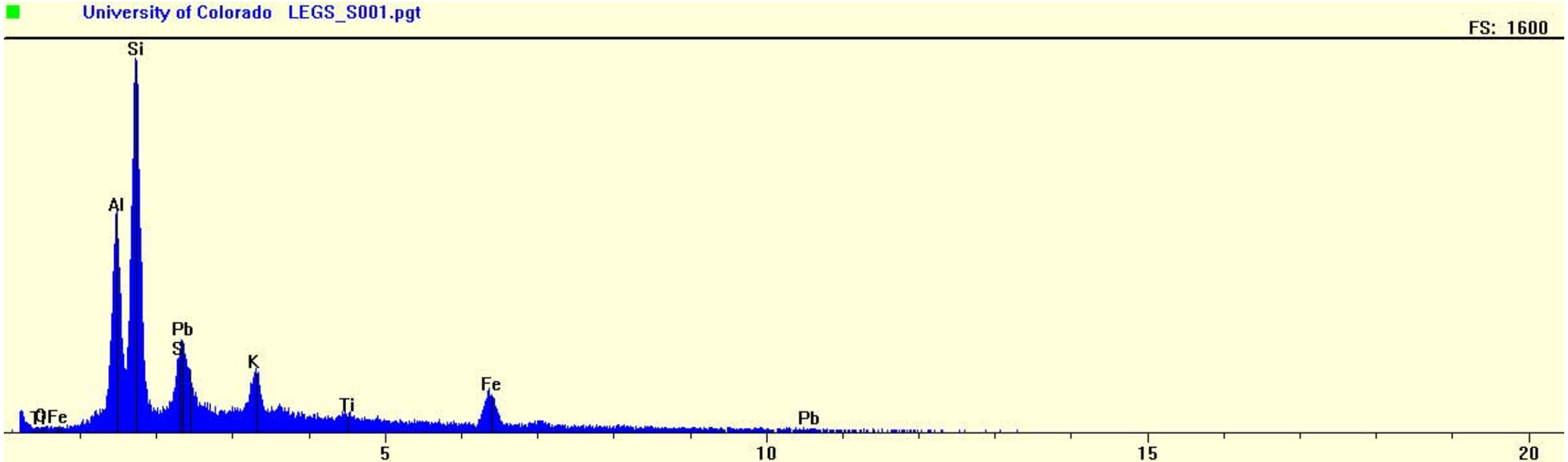
R2-0006368



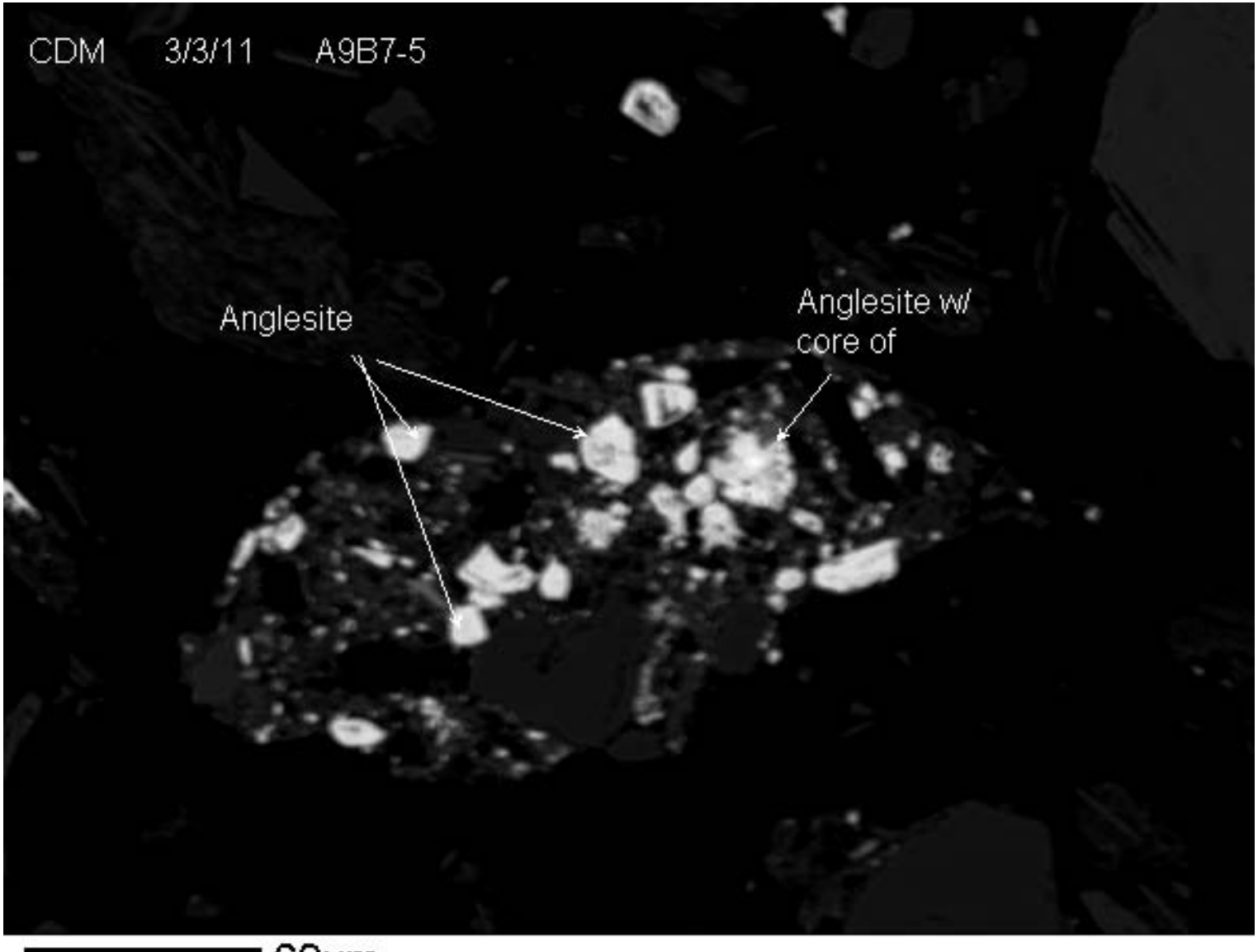
50µm

BEI

R2-0006369


University of Colorado LEGS_S001.pgt
FS: 1600
Si
Al
Pb
S
K
Ti
Fe
O
Fe
Pb
5
10
15
20

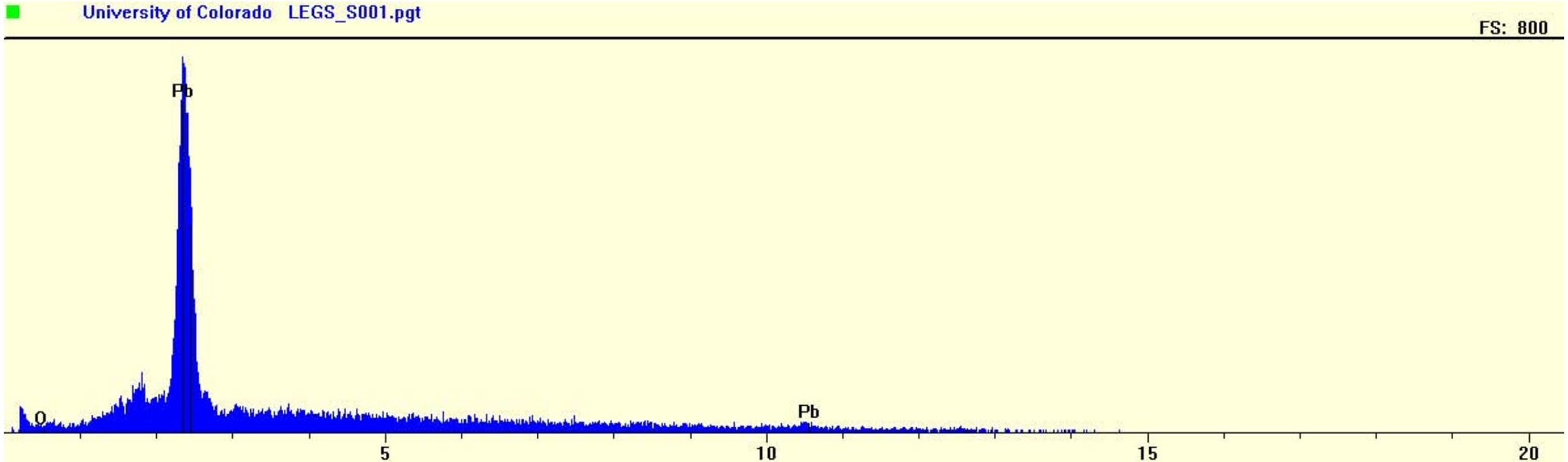
R2-0006370



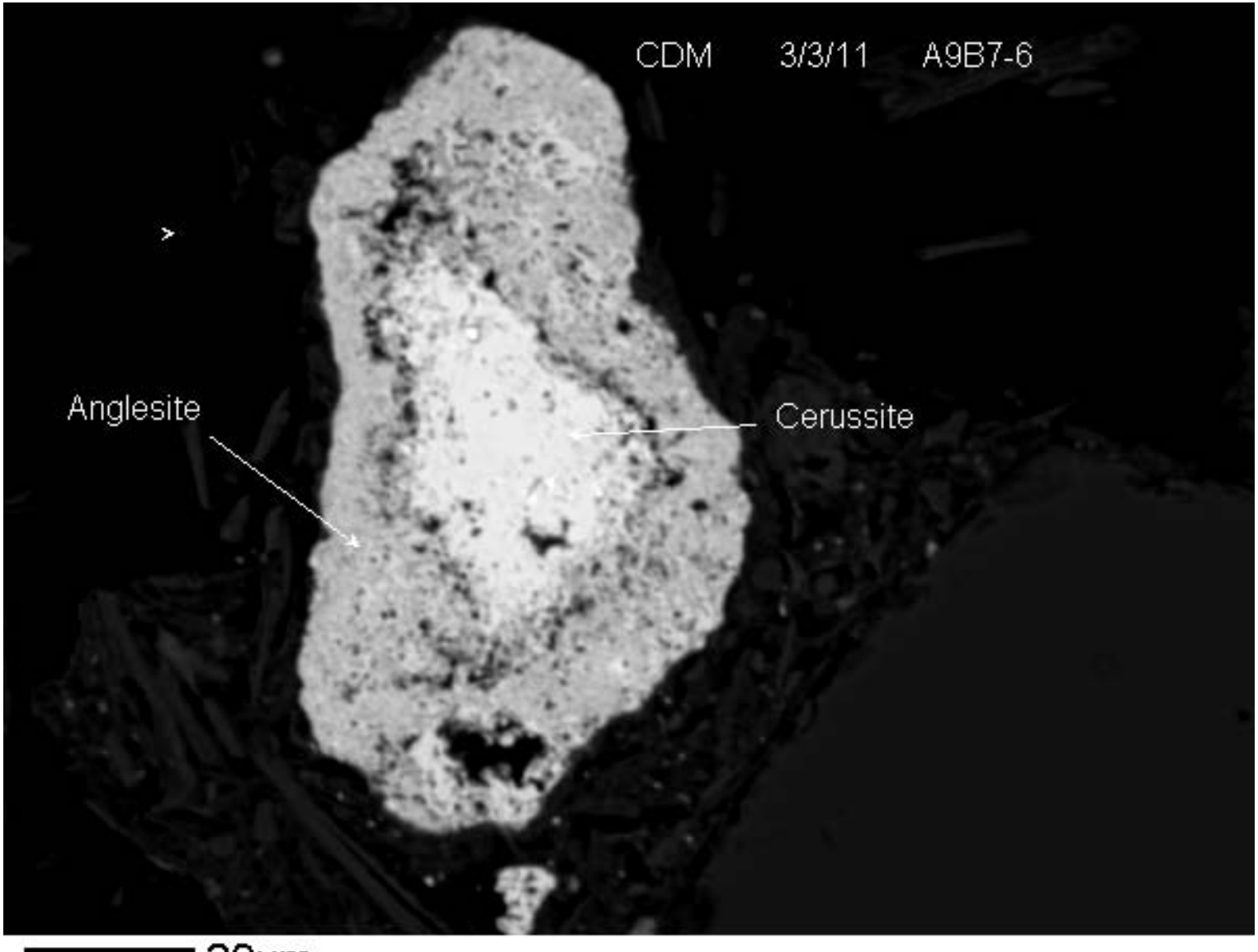
60µm

BEI

R2-0006371



R2-0006372



20µm

BEI

R2-0006373

Form	Association	Size (microns)
Cer	Liberated	118
Ang	Liberated	7
Ang	Cemented	4
Ang	Liberated	1
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Liberated	7
Ang	Liberated	3
Ang	Rimming	6
Ang	Inclusion	2
Ang	Inclusion	3
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Liberated	9
Ang	Rimming	10
Ang	Inclusion	10
Ang	Rimming	9
Cer	Cemented	42
Ang	Cemented	5
Ang	Cemented	5
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Liberated	17
Fe	Liberated	68
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Ang	Liberated	6
Fe	Liberated	105
Ang	Liberated	19
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
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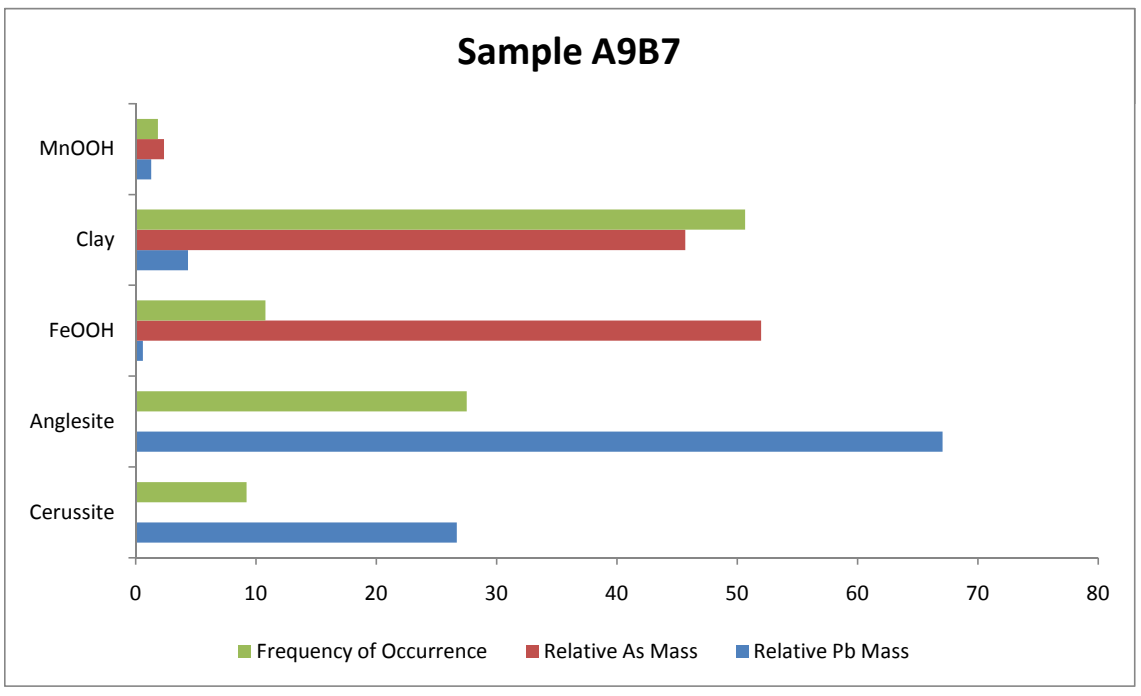
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2

Form	Number	Mean	Std-Dev	Range low	Range high
total	317	17.18	35.88	1	200
Cerussite	11	45.64	27.98	3	118
Anglesite	272	5.51	12.58	1	155
FeOOH	7	83.86	36.55	48	155
Clay	26	106.08	48.42	25	200
MnOOH	1	100	ND	100	100

Form	(linear) freq	Bio freq	Rm Pb	Biorm Pb	Rm As	Biorm as	Error-95%
%	%	%	%	%	%	%	
Cerussite	9.22	8.59	26.7	28.74	0	0	3.18
Anglesite	27.52	22.55	67.07	63.43	0	0	4.92
FeOOH	10.78	11.73	0.59	0.74	51.98	51.98	3.41
Clay	50.64	55.13	4.34	5.46	45.68	45.68	5.5
MnOOH	1.84	2	1.3	1.63	2.34	2.34	1.48



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Ang	Liberated	7
AlSi	Liberated	175
Cer	Inclusion	29
Ang	Inclusion	10
Ang	Inclusion	10
Ang	Inclusion	9
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	5
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	125
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	100
AlSi	Liberated	200
AlSi	Liberated	200
AlSi	Liberated	200
AlSi	Liberated	25
Ang	Inclusion	6
Ang	Inclusion	9
Ang	Inclusion	3
Ang	Inclusion	3
Ang	Inclusion	3
Ang	Inclusion	3
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Inclusion	1
Ang	Liberated	35
Fe	Rimming	155
Ang	Liberated	10
Ang	Liberated	7
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
Ang	Cemented	2
AlSi	Liberated	135
Ang	Inclusion	15
Ang	Inclusion	15
Ang	Inclusion	15
Ang	Inclusion	10
Ang	Inclusion	10
Ang	Inclusion	10
Ang	Inclusion	10
Ang	Inclusion	10
Ang	Inclusion	10
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Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Inclusion	2
Ang	Liberated	20
Ang	Liberated	18
Ang	Liberated	14
Ang	Liberated	15
Mn	Cemented	100
Ang	Rimming	155
Cer	Rimming	35
Cer	Rimming	50
Cer	Rimming	55
Cer	Rimming	40
Ang	Cemented	4
Ang	Cemented	4

Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
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Ang	Cemented	1
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Ang	Cemented	1
AlSi	Liberated	95
AlSi	Liberated	50
AlSi	Liberated	50
AlSi	Liberated	50
AlSi	Liberated	50
AlSi	Liberated	75
Ang	Cemented	1
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Ang	Cemented	1
Fe	Liberated	85
Cer	Rimming	35
AlSi	Liberated	90
Ang	Inclusion	19
Ang	Inclusion	13
Ang	Inclusion	6
Ang	Liberated	38
Fe	Rimming	70
Fe	Rimming	56
Ang	Liberated	28
Ang	Liberated	47
AlSi	Liberated	70
AlSi	Liberated	78
AlSi	Liberated	65
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	4
Ang	Cemented	3
Ang	Cemented	3
Ang	Cemented	3
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Ang	Cemented	1

Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	15
Ang	Cemented	10
Ang	Liberated	43
Ang	Liberated	68
Ang	Rimming	20
Ang	Cemented	16
Ang	Cemented	10
Ang	Cemented	8
Ang	Cemented	1
Ang	Cemented	1
Ang	Cemented	1
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Ang	Cemented	1
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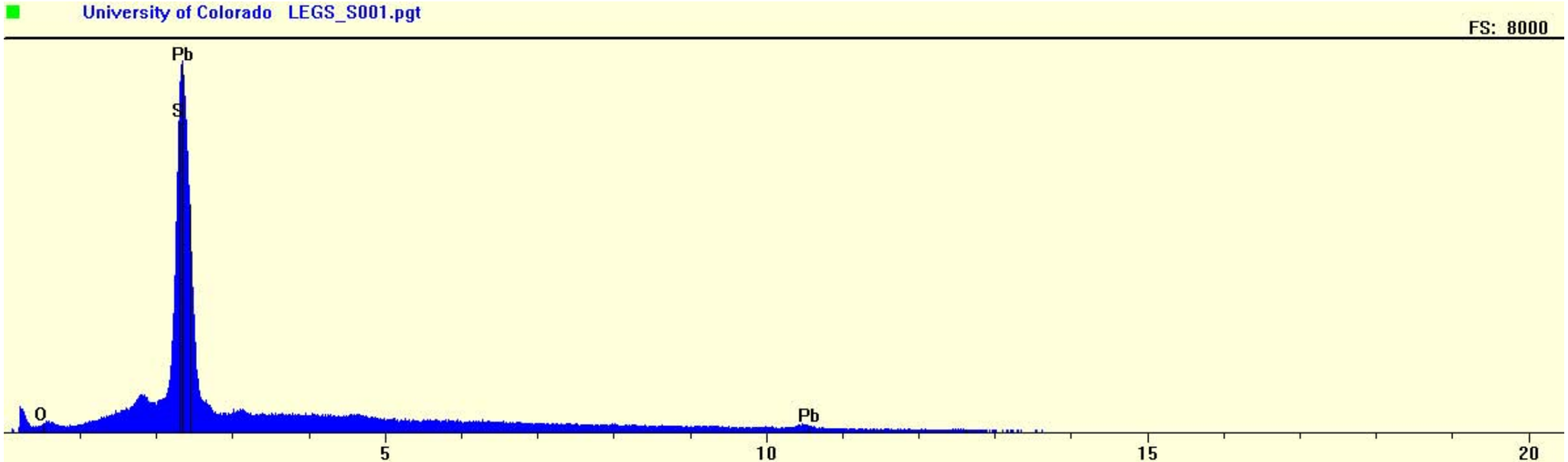
Ang	Cemented	1
Ang	Cemented	1
Cer	Inclusion	3
Fe	Rimming	48
Cer	Liberated	55
Cer	Inclusion	40
Ang	Rimming	68
Ang	Liberated	7
Ang	Liberated	50
Ang	Cemented	12


University of Colorado LEGS_S001.pgt
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R2-0006378

Appendix E
Lead Models

Appendix E Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Outputs from the Integrated Exposure Uptake Biokinetic Model

Figure E-1 Current/Future Recreational Users - Areas 5, 6, and the Beach Area of Area 9
Figure E-2 Future Recreational Users - Area 2 (Fine Fraction Soil)
Figure E-3 Future Recreational Users - Area 2 (Total Soil)
Figure E-4 Future Residents
Figure E-5 Current/Future Children Consuming Hard Clam
Figure E-6 Current/Future Children Consuming Ribbed Mussel
Figure E-7 Current/Future Children Consuming Blue Crab Muscle
Figure E-8 Current/Future Children Consuming Blue Crab Muscle and Hepatopancreas
Figure E-9 Additive Effect of Lead Exposure

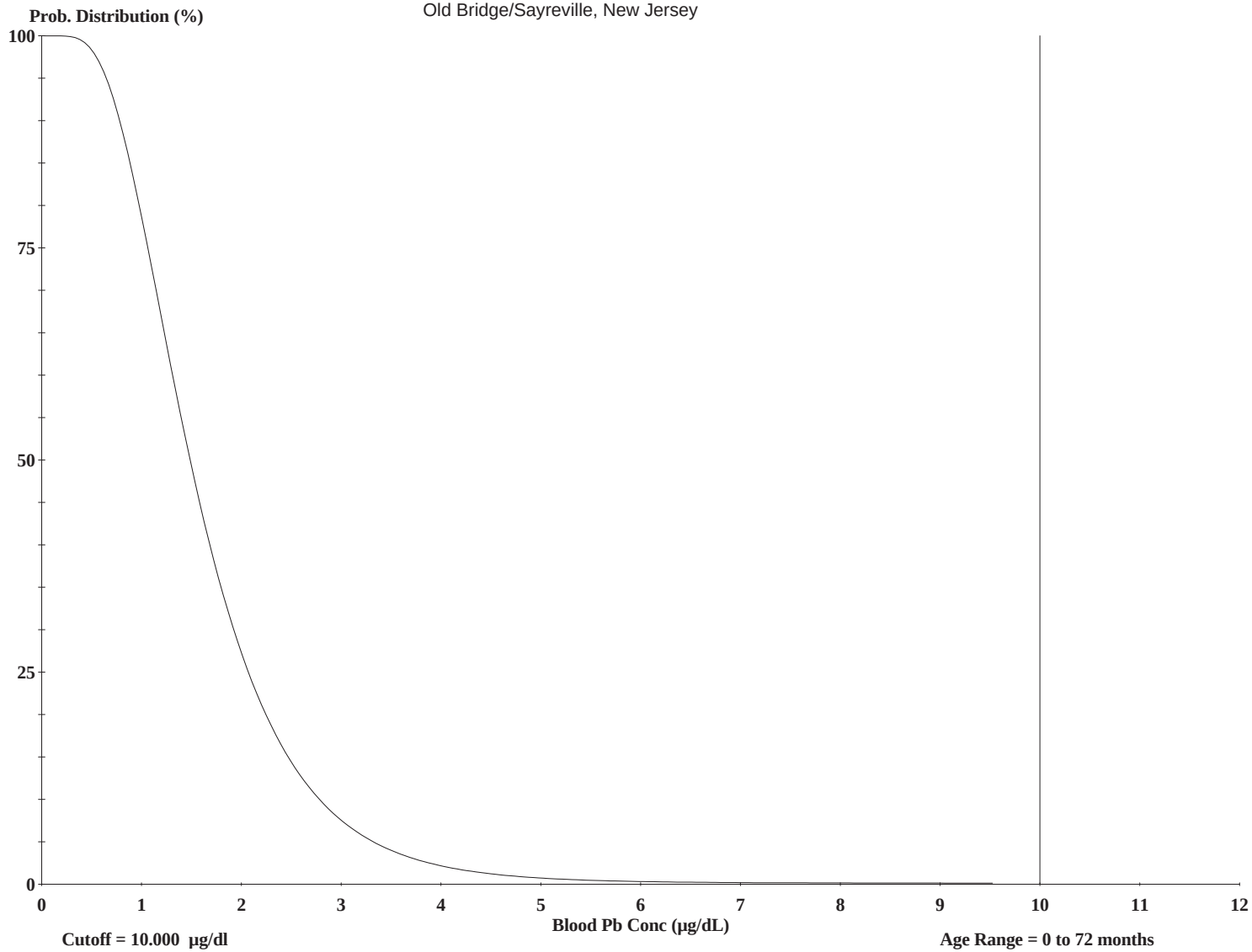
Outputs from the Adult Lead Model

Table E-1 Current/Future Recreational Users - Area 1
Table E-2 Future Recreational Users - Area 2 (Total Soil)
Table E-3 Future Recreational Users - Area 2 (Fine Fraction Soil)
Table E-4 Current/Future Recreational Users - Areas 5, 6, and the Beach Area of Area 9
Table E-5 Current/Future Recreational Users - Upland Area of Area 9
Table E-6 Current Pedestrians - All Areas (except Areas 2, 8, and 11)
Table E-7 Future Pedestrians - All Areas (except Areas 8 and 11)
Table E-8 Current/Future Construction Workers - All Upland Areas
Table E-9 Current/Future Adult Recreational Users - Wetland Area of Area 9
Table E-10 Current/Future Adolescent Recreational Users - Wetland Area of Area 9
Table E-11 Current/Future Angler (Hard Clam)
Table E-12 Current and Future Adult Angler (Ribbed Mussel)
Table E-13 Current/Future Angler (Blue Crab Muscle)
Table E-14 Current/Future Angler (Blue Crab Muscle plus Hepatopancreas)

Sensitivity Analysis Based on Different Lead Absorption Fractions

Table E-15 Current/Future Adolescent Recreational Users - Area 1
Table E-16 Current/Future Adolescent Recreational Users - Areas 5, 6, and the Beach Area of Area 9
Table E-17 Current/Future Adolescent Recreational Users - Upland Area of Area 9
Table E-18 Current/Future Adolescent Recreational Users - Wetland Area of Area 9
Table E-19 Current Adolescent Pedestrians - All Areas (except Areas 2, 8, and 11)
Table E-20 Future Adolescent Pedestrians - All Areas (except 8 and 11)

Figure E-1
Current/Future Recreational Users - Areas 5, 6, and the Beach Area of Area 9
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 1.558
GSD = 1.600
% Above = 0.004

Age Range = 0 to 72 months

Run Mode = Research
Comment = Raritan Exposure Area 5, 6, 9

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: TRM
Date: 7/27/11
Site Name: Raritan Bay Slag Superfund Site
Operable Unit: Exposure Area 5,6,and 9
Run Mode: Site Risk Assessment

 # Soil/Dust Data
Soil Concentration 67.96 mg/kg
==========

******** 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: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 57.572 µg/g

R2-0006382

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	67.960	57.572
1-2	67.960	57.572
2-3	67.960	57.572
3-4	67.960	57.572
4-5	67.960	57.572
5-6	67.960	57.572
6-7	67.960	57.572

******** 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

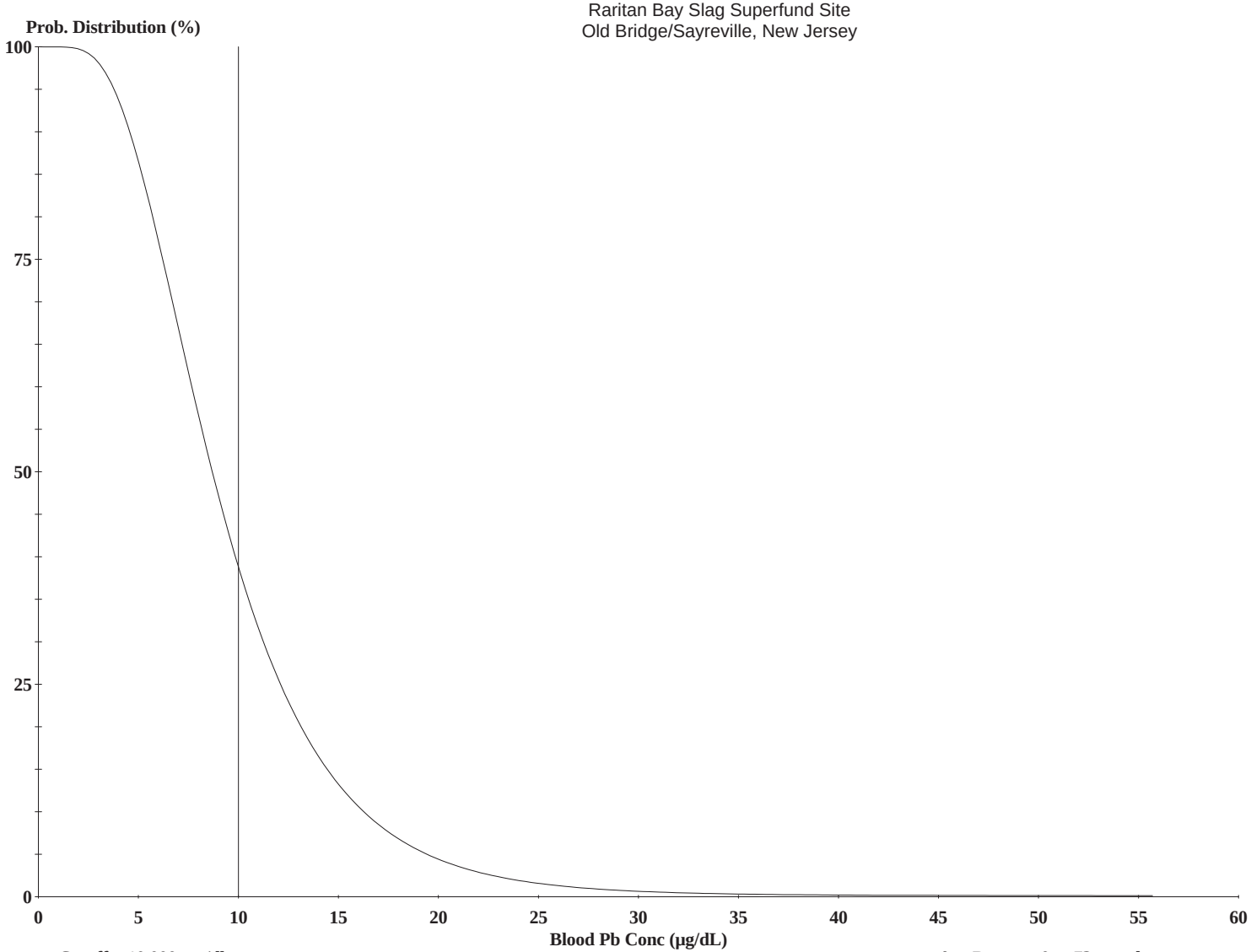
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.092	0.000	0.387
1-2	0.034	0.944	0.000	0.963
2-3	0.062	1.030	0.000	1.006
3-4	0.067	0.992	0.000	1.030
4-5	0.067	0.955	0.000	1.077
5-6	0.093	1.006	0.000	1.139
6-7	0.093	1.091	0.000	1.160

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	1.534	3.034	1.7
1-2	2.428	4.369	1.8
2-3	2.439	4.537	1.7
3-4	2.451	4.539	1.6
4-5	1.829	3.927	1.4
5-6	1.650	3.889	1.2
6-7	1.561	3.906	1.1

R2-0006383

Figure E-2
Future Recreational Users - Area 2 (Fine Fraction Soil)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 9.112
GSD = 1.600
% Above = 42.160

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Raritan EA 2 fine fraction PB

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 6/27/11
Site Name: Raritan Bay Slag Superfund SIte
Operable Unit: Exposure Area 2
Run Mode: Site Risk Assessment

 # GSD, Cutoff and Age Type
Fine Fraction PB 685.4 mg/kg
==========

******** 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: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 489.780 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	685.400	489.780
1-2	685.400	489.780
2-3	685.400	489.780
3-4	685.400	489.780
4-5	685.400	489.780
5-6	685.400	489.780
6-7	685.400	489.780

******** 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

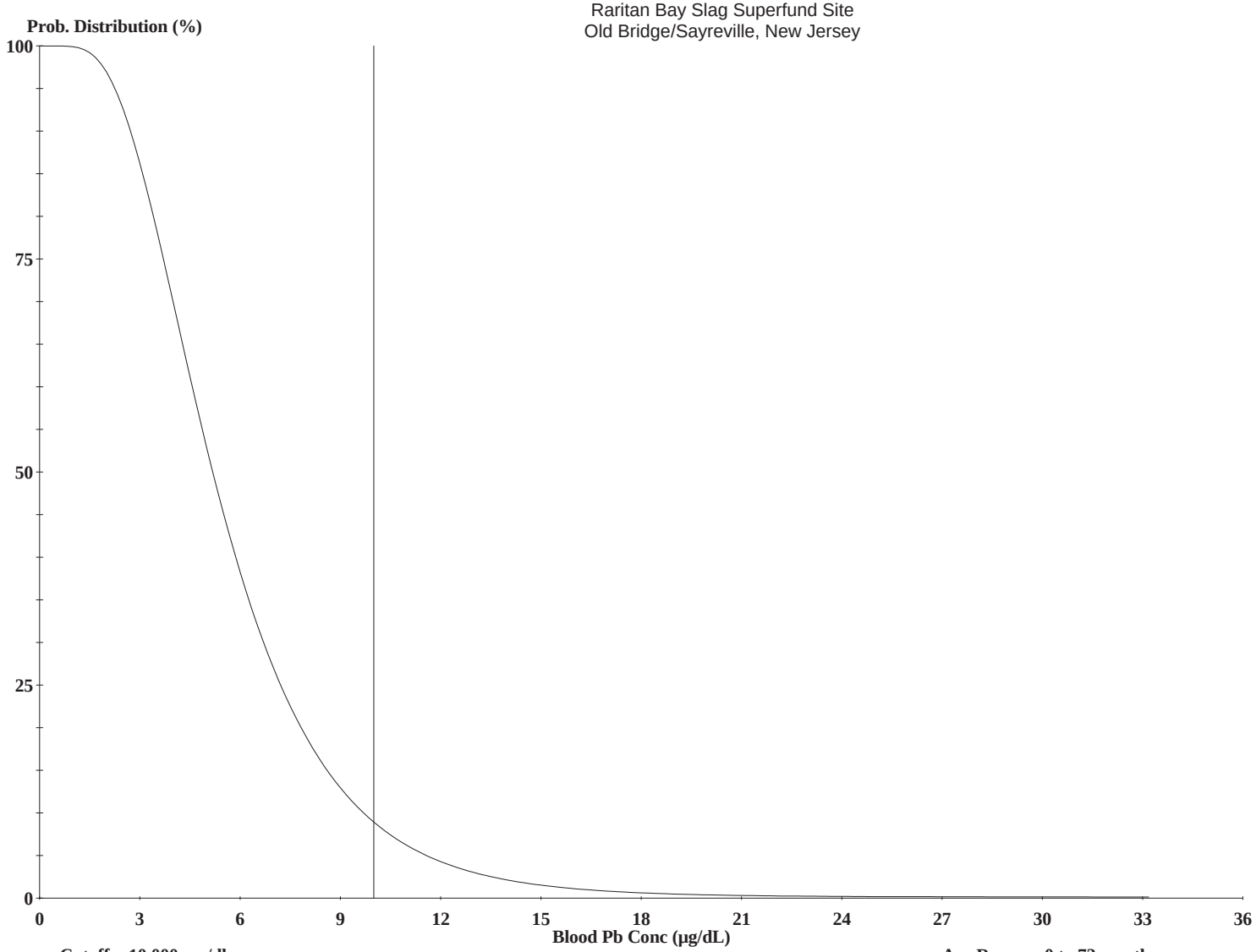
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	0.916	0.000	0.324
1-2	0.034	0.766	0.000	0.782
2-3	0.062	0.859	0.000	0.838
3-4	0.067	0.845	0.000	0.878
4-5	0.067	0.857	0.000	0.967
5-6	0.093	0.922	0.000	1.043
6-7	0.093	1.010	0.000	1.074

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	16.720	17.981	9.5
1-2	25.617	27.200	11.0
2-3	26.411	28.170	10.3
3-4	27.139	28.928	9.9
4-5	21.329	23.220	8.2
5-6	19.637	21.694	6.9
6-7	18.776	20.954	6.1

R2-0006386

Figure E-3
Future Recreational Users - Area 2 (Total Soil)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 5.428
GSD = 1.600
% Above = 9.683

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Raritan EA 2, total PB

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 6/27/11
Site Name: Raritan Bay Slag Superfund Site
Operable Unit: Exposure Area 2
Run Mode: Site Risk Assessment

 # Soil/Dust Data
Total Load 485 mg/kg
==========

******** 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: 4.000 µg Pb/L

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 349.500 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	485.000	349.500
1-2	485.000	349.500
2-3	485.000	349.500
3-4	485.000	349.500
4-5	485.000	349.500
5-6	485.000	349.500
6-7	485.000	349.500

******** 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

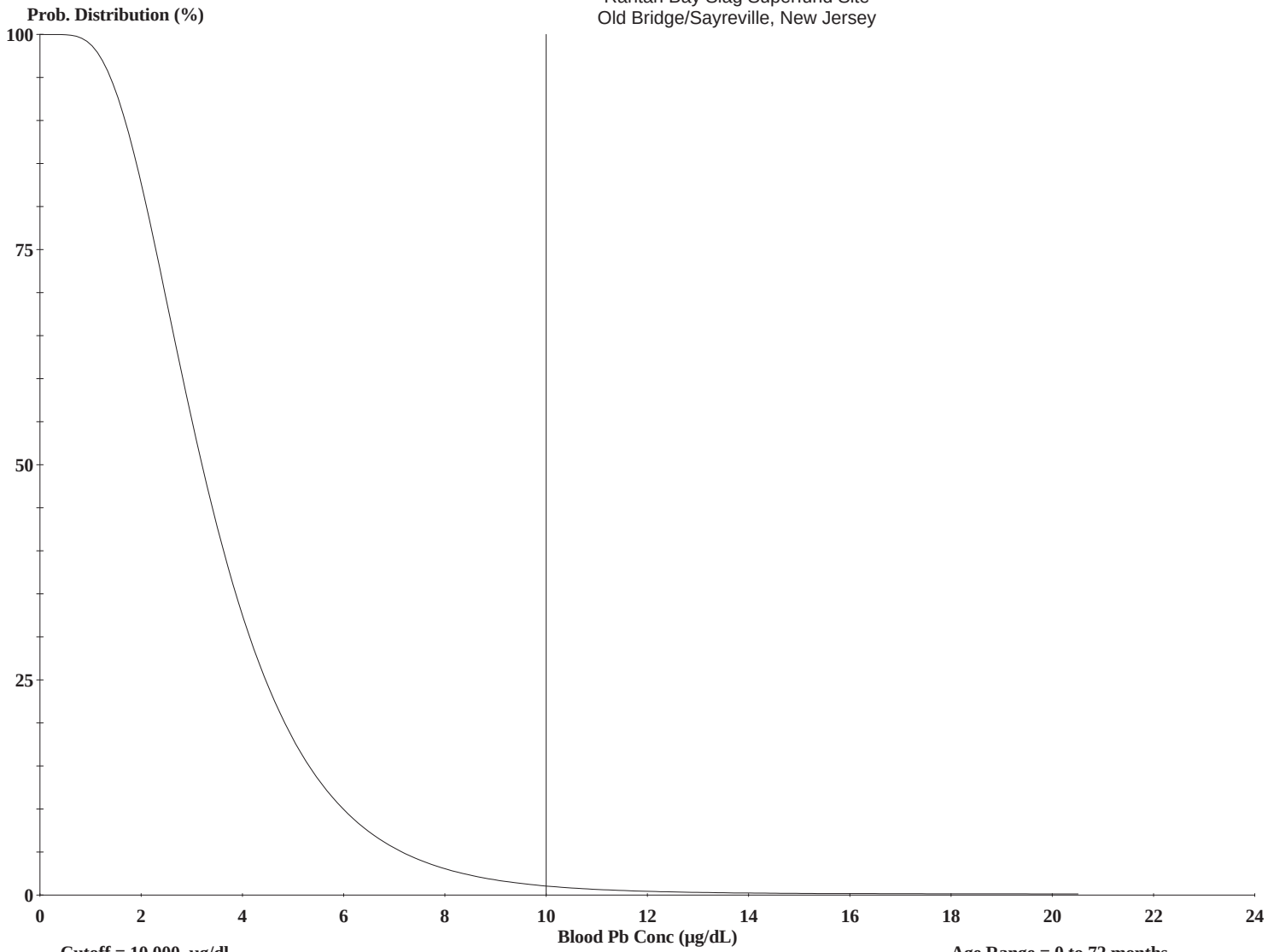
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.000	0.000	0.354
1-2	0.034	0.849	0.000	0.866
2-3	0.062	0.940	0.000	0.918
3-4	0.067	0.916	0.000	0.952
4-5	0.067	0.906	0.000	1.022
5-6	0.093	0.964	0.000	1.091
6-7	0.093	1.052	0.000	1.118

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	9.262	10.636	5.7
1-2	14.401	16.151	6.6
2-3	14.674	16.594	6.2
3-4	14.923	16.857	5.9
4-5	11.440	13.434	4.8
5-6	10.428	12.577	4.0
6-7	9.917	12.180	3.5

R2-0006389

Figure E-4
Future Residents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 3.355
GSD = 1.600
% Above = 1.007

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Groundwater

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 6/27/11
Site Name: Raritan Bay Slag Superfunf SIte
Operable Unit: Groundwater
Run Mode: Site Risk Assessment

#All default values

==========

******** 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: 10.570 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

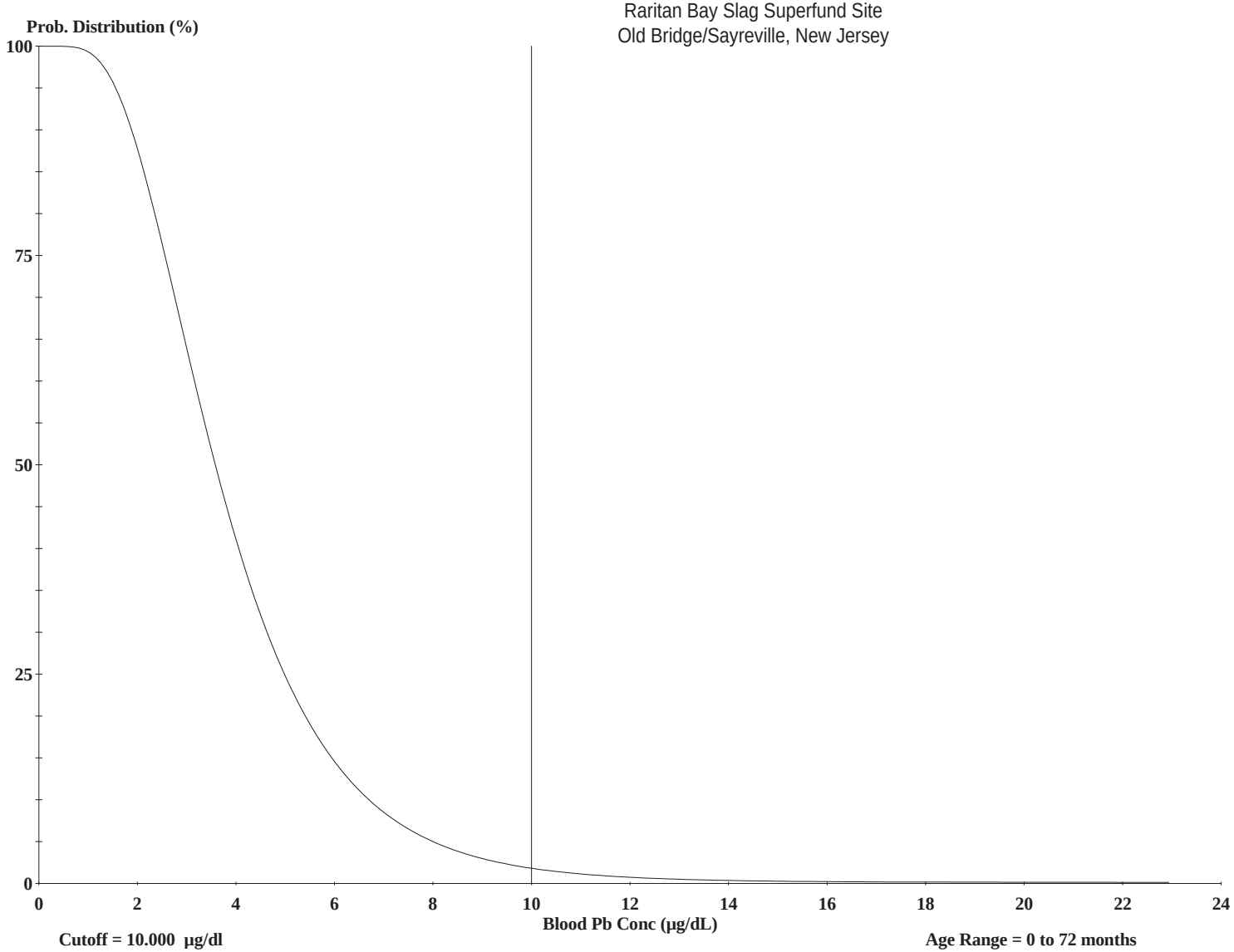
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.054	0.000	0.985
1-2	0.034	0.899	0.000	2.425
2-3	0.062	0.988	0.000	2.550
3-4	0.067	0.956	0.000	2.626
4-5	0.067	0.930	0.000	2.772
5-6	0.093	0.984	0.000	2.943
6-7	0.093	1.070	0.000	3.005

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.101	6.161	3.3
1-2	6.412	9.771	4.0
2-3	6.482	10.083	3.8
3-4	6.550	10.199	3.6
4-5	4.936	8.705	3.1
5-6	4.471	8.492	2.7
6-7	4.239	8.407	2.4

R2-0006392

Figure E-5
Current/Future Children Consuming Hard Clam
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 3.752
GSD = 1.600
% Above = 1.851

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Hard clam

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 6/27/11
Site Name: Rairtan Bay Slag Superfund Site
Operable Unit: All Areas Except 3 and 4
Run Mode: Site Risk Assessment

Diet Data
Hard Clam
==========

****** 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	4.057
1-2	6.971
2-3	8.581
3-4	8.964
4-5	9.350
5-6	10.059
6-7	11.448

Alternative Dietary Values
Home grown fruits concentration: 0.000 µg/g
Home grown vegetables concentration: 0.000 µg/g
Fish from fishing concentration: 1.696 µg/g
Game animals from hunting concentration: 0.000 µg/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 10.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** 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

R2-0006394

6-7 0.590

Drinking Water Concentration: 4.000 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

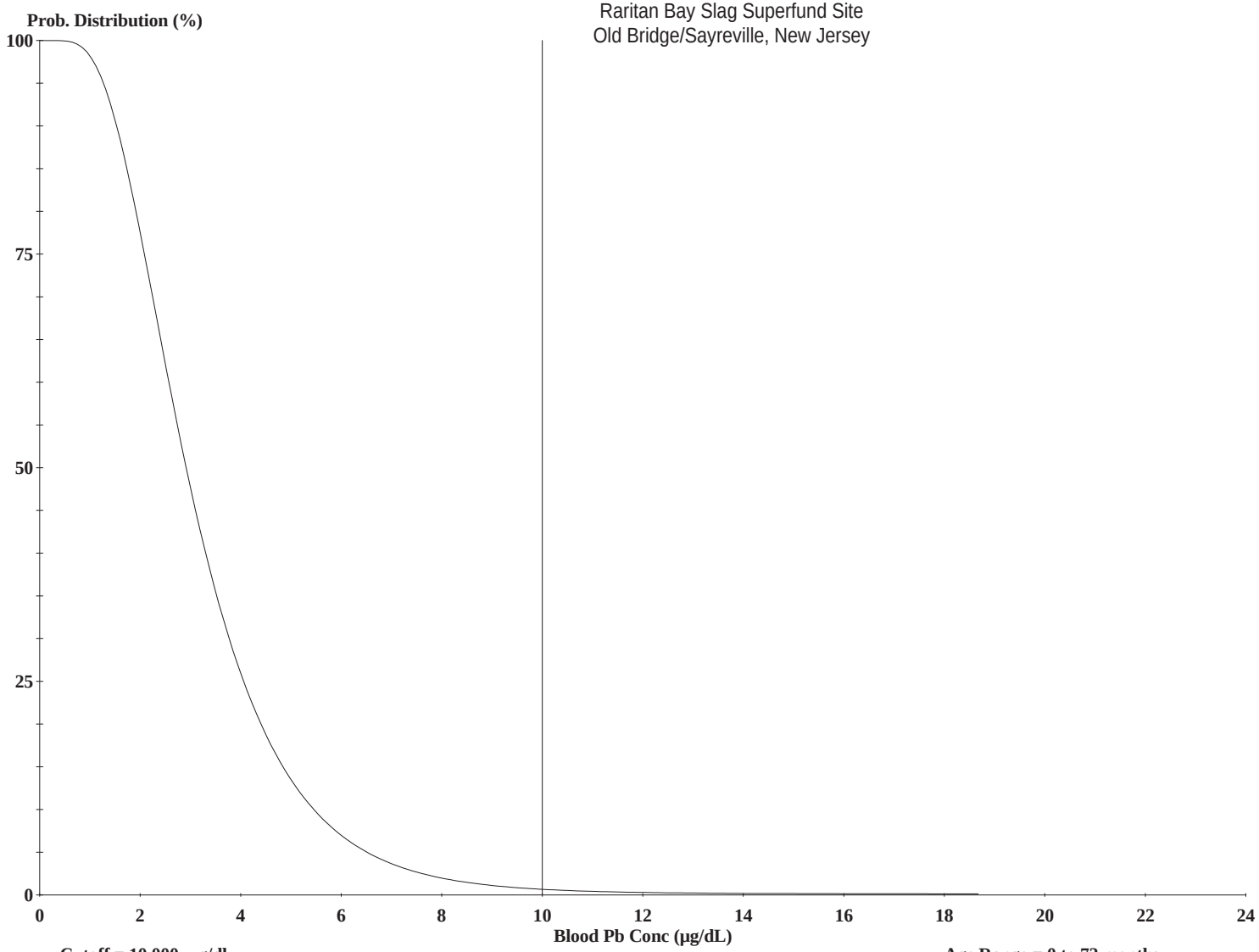
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.887	0.000	0.372
1-2	0.034	3.178	0.000	0.912
2-3	0.062	3.942	0.000	0.956
3-4	0.067	4.161	0.000	0.984
4-5	0.067	4.417	0.000	1.039
5-6	0.093	4.783	0.000	1.103
6-7	0.093	5.455	0.000	1.125

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.091	6.371	3.5
1-2	6.371	10.495	4.3
2-3	6.419	11.378	4.2
3-4	6.486	11.698	4.1
4-5	4.889	10.412	3.6
5-6	4.429	10.409	3.2
6-7	4.192	10.866	3.1

R2-0006395

Figure E-6
Current/Future Children Consuming Ribbed Mussel
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 3.055
GSD = 1.600
% Above = 0.582

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Ribbed Mussel

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 6/27/11
Site Name: Raritan Bay Slag Superfund Site
Operable Unit: All Areas Except 3 and 4
Run Mode: Site Risk Assessment

Diet Data
Hard Clam
GSD, Cutoff and Age Type
Hard Clam
Diet Data
Blue Crab plus hepatopancreas
GSD, Cutoff and Age Type
Blue Crab plus hepa
Diet Data
Ribbed Mussel
Diet Data
==========

****** 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	2.639
1-2	3.019
2-3	3.493
3-4	3.500
4-5	3.509
5-6	3.735
6-7	4.165

Alternative Dietary Values
Home grown fruits concentration: 0.000 µg/g
Home grown vegetables concentration: 0.000 µg/g
Fish from fishing concentration: 0.361 µg/g
Game animals from hunting concentration: 0.000 µg/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 10.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** Drinking Water ******

R2-0006397

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: 4.000 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:
****

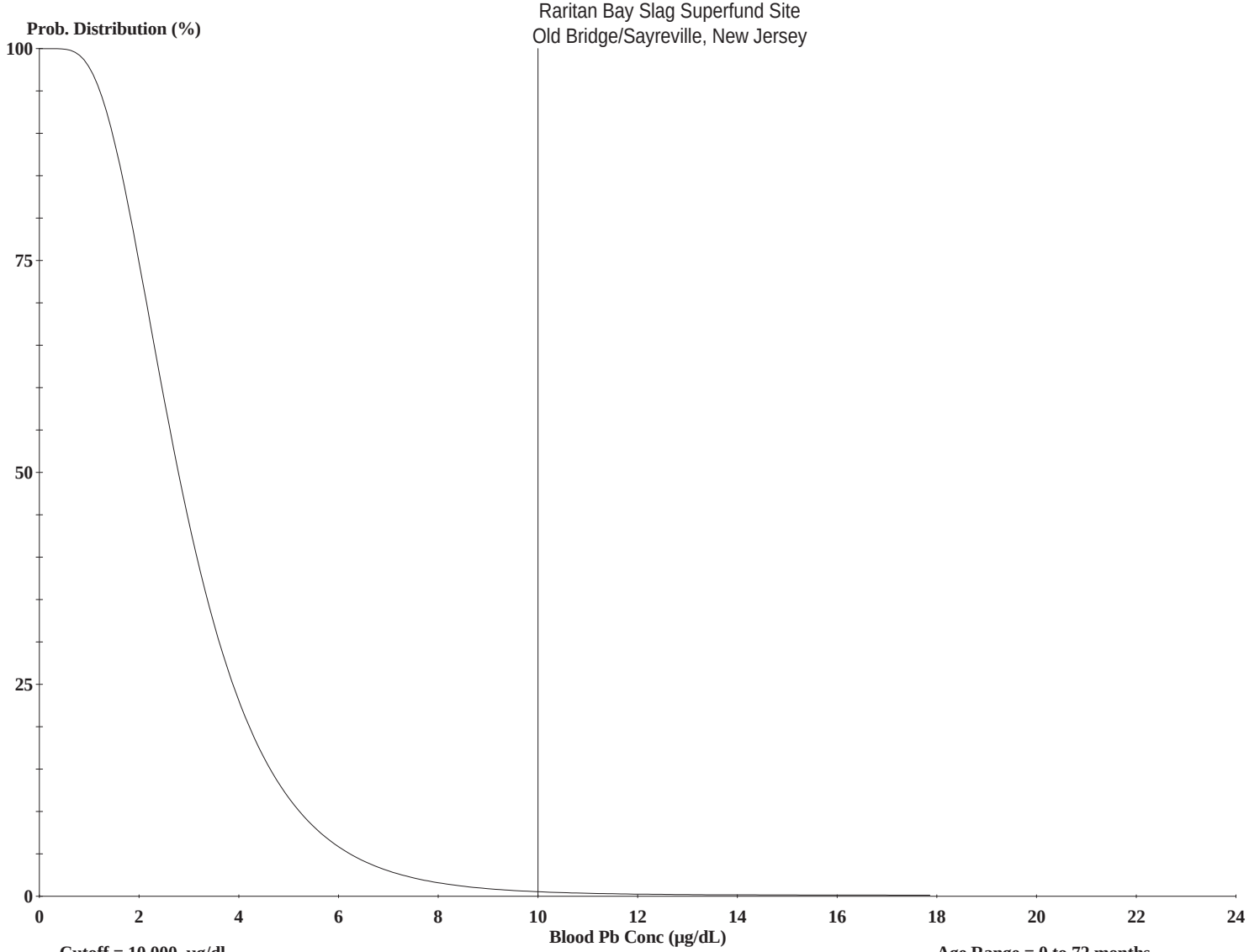
Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.236	0.000	0.375
1-2	0.034	1.397	0.000	0.926
2-3	0.062	1.632	0.000	0.972
3-4	0.067	1.650	0.000	1.000
4-5	0.067	1.682	0.000	1.055
5-6	0.093	1.802	0.000	1.119
6-7	0.093	2.015	0.000	1.142

Year	Soil+Dust	Total	Blood

	(µg/day)	(µg/day)	(µg/dL)
.5-1	4.121	5.753	3.1
1-2	6.467	8.824	3.6
2-3	6.526	9.191	3.4
3-4	6.588	9.304	3.3
4-5	4.962	7.765	2.7
5-6	4.493	7.507	2.4
6-7	4.256	7.506	2.2

R2-0006399

Figure E-7
Current/Future Children Consuming Blue Crab Muscle
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 2.922
GSD = 1.600
% Above = 0.443

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Raritan Blue Crab Tissue

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 6/27/11
Site Name: Raritan Bay Slag Superfund Site
Operable Unit: All Areas Except 3 and 4
Run Mode: Site Risk Assessment

#All default values

==========

******** 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	2.374
1-2	2.280
2-3	2.542
3-4	2.478
4-5	2.417
5-6	2.553
6-7	2.803

Alternative Dietary Values
Home grown fruits concentration: 0.000 µg/g
Home grown vegetables concentration: 0.000 µg/g
Fish from fishing concentration: 0.111 µg/g
Game animals from hunting concentration: 0.000 µg/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 10.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** 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: 4.000 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

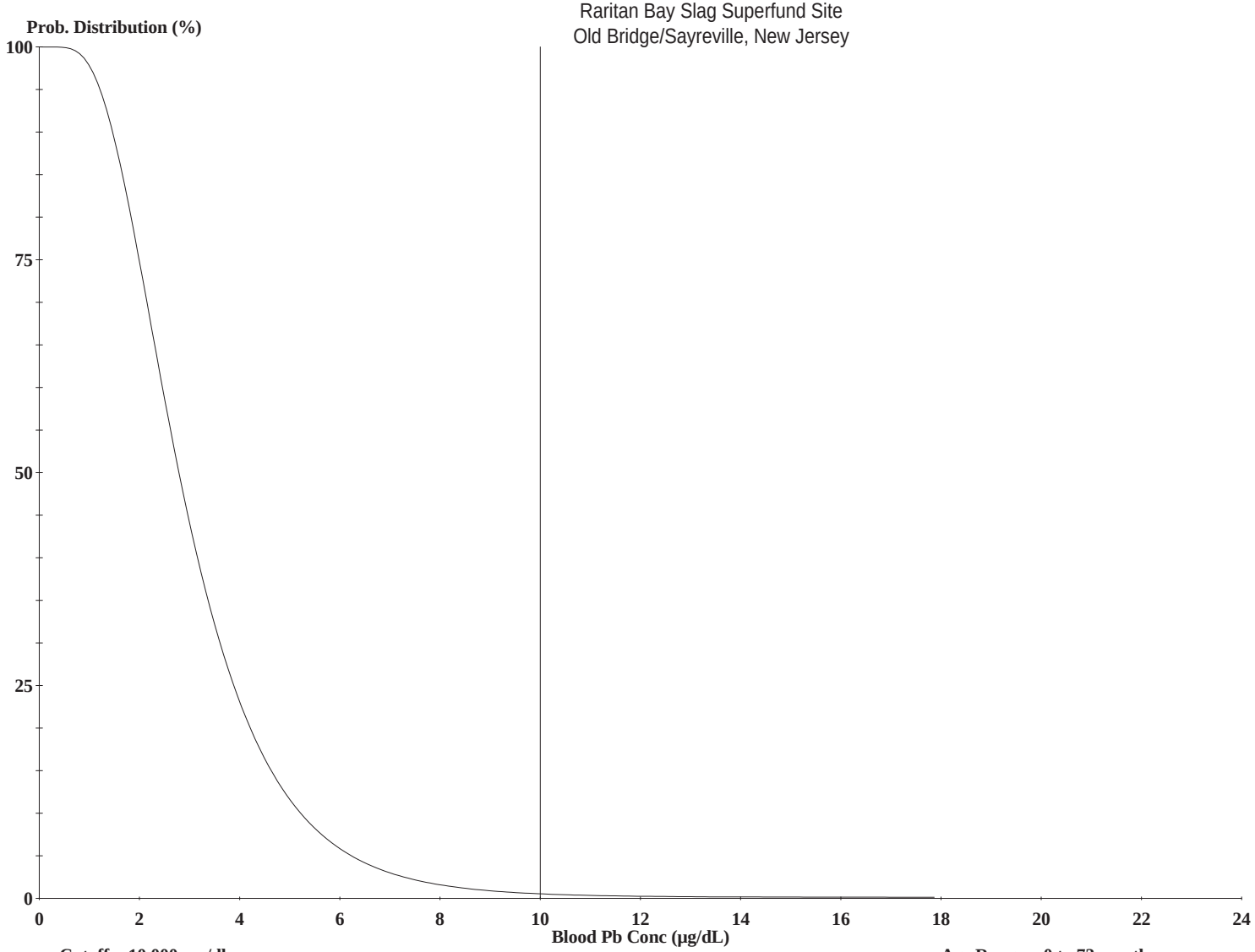
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.114	0.000	0.375
1-2	0.034	1.058	0.000	0.928
2-3	0.062	1.191	0.000	0.975
3-4	0.067	1.172	0.000	1.002
4-5	0.067	1.162	0.000	1.058
5-6	0.093	1.235	0.000	1.122
6-7	0.093	1.360	0.000	1.145

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.126	5.636	3.1
1-2	6.485	8.506	3.5
2-3	6.547	8.775	3.3
3-4	6.607	8.848	3.1
4-5	4.975	7.261	2.6
5-6	4.505	6.955	2.2
6-7	4.268	6.867	2.0

R2-0006402

Figure E-8
Current/Future Children Consuming Blue Crab Muscle and Hepatopancreas
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 2.922
GSD = 1.600
% Above = 0.443

Age Range = 0 to 72 months

Run Mode = Site Risk Assessment
Comment = Blue Crab Plus Hepatopancreas

LEAD MODEL FOR WINDOWS Version 1.1

==========
Model Version: 1.1 Build11
User Name: CDM
Date: 8/11/11
Site Name: Raritan Bay Slag Superfund Site
Operable Unit: All Areas
Run Mode: Site Risk Assessment

 # GSD, Cutoff and Age Type
0.1116 mg/kg
==========

******** 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	2.375
1-2	2.281
2-3	2.544
3-4	2.481
4-5	2.420
5-6	2.556
6-7	2.806

Alternative Dietary Values
Home grown fruits concentration: 0.000 µg/g
Home grown vegetables concentration: 0.000 µg/g
Fish from fishing concentration: 0.112 µg/g
Game animals from hunting concentration: 0.000 µg/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 10.000 %of all meat
Game animals from hunting factor: 0.000 % of all meat

****** 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: 4.000 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

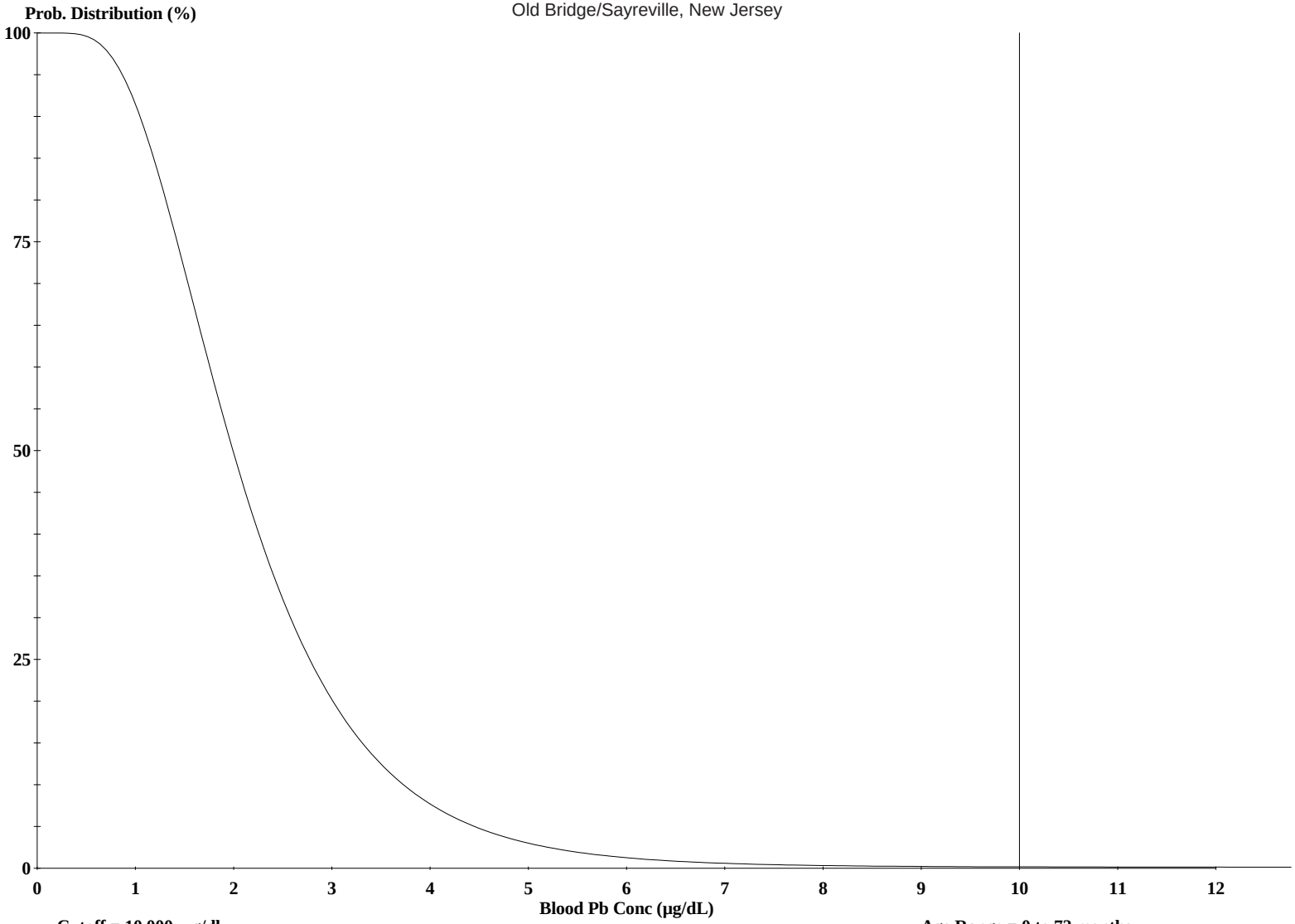
****
CALCULATED BLOOD LEAD AND LEAD UPTAKES:
****

Year	Air (µg/day)	Diet (µg/day)	Alternate (µg/day)	Water (µg/day)
.5-1	0.021	1.114	0.000	0.375
1-2	0.034	1.059	0.000	0.928
2-3	0.062	1.192	0.000	0.975
3-4	0.067	1.173	0.000	1.002
4-5	0.067	1.163	0.000	1.058
5-6	0.093	1.236	0.000	1.122
6-7	0.093	1.361	0.000	1.145

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	4.126	5.636	3.1
1-2	6.485	8.507	3.5
2-3	6.547	8.776	3.3
3-4	6.607	8.849	3.1
4-5	4.975	7.263	2.6
5-6	4.505	6.957	2.2
6-7	4.268	6.868	2.0

R2-0006405

Figure E-9
Additive Effect of Lead Exposure
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey



Cutoff = 10.000 µg/dl
Geo Mean = 2.088
GSD = 1.600
% Above = 0.043

Age Range = 0 to 72 months

Run Mode = Research
Comment = Cumualtive Analysis

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	2.279
1-2	2.013
2-3	2.199
3-4	2.110
4-5	2.023
5-6	2.127
6-7	2.312

Alternative Dietary Values
Home grown fruits concentration: 0.000 µg/g
Home grown vegetables concentration: 0.000 µg/g
Fish from fishing concentration: 1.696 µg/g
Game animals from hunting concentration: 0.000 µg/g
Home grown fruits factor: 0.000 % of all fruits
Home grown vegetables factor: 0.000 % of all vegetables
Fish from fishing factor: 0.100 %of all meat
Game animals from hunting factor: 0.000 % of all meat

******** 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: 10.570 µg Pb/L

R2-0006407

****** Soil & Dust ******

Multiple Source Analysis Used
Average multiple source concentration: 57.572 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	67.960	57.572
1-2	67.960	57.572
2-3	67.960	57.572
3-4	67.960	57.572
4-5	67.960	57.572
5-6	67.960	57.572
6-7	67.960	57.572

****** 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	1.093	0.000	1.014
1-2	0.034	0.956	0.000	2.511
2-3	0.062	1.051	0.000	2.627
3-4	0.067	1.015	0.000	2.694
4-5	0.067	0.981	0.000	2.819
5-6	0.093	1.035	0.000	2.983
6-7	0.093	1.127	0.000	3.040

Year	Soil+Dust (µg/day)	Total (µg/day)	Blood (µg/dL)
.5-1	1.523	3.652	2.0
1-2	2.395	5.896	2.4
2-3	2.410	6.149	2.3
3-4	2.425	6.201	2.2
4-5	1.811	5.678	1.9
5-6	1.635	5.746	1.8
6-7	1.548	5.808	1.7

R2-0006408

TABLE E-1

CURRENT/FUTURE RECREATIONAL USERS - AREA 1

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Area 1	µg/g or ppm	557
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.7**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	4.1
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.08%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-2

FUTURE RECREATIONAL USERS - AREA 2 (TOTAL SOIL)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Area 2	µg/g or ppm	485
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.6**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	3.9
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.06%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-3

FUTURE RECREATIONAL USERS - AREA 2 (FINE FRACTION SOIL)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Area 2	µg/g or ppm	685.4
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.17
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**2.3**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	5.4
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.35%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-4

CURRENT/FUTURE RECREATIONAL USERS - AREAS 5, 6, AND THE BEACH AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Areas 5, 6, and 9	µg/g or ppm	67.96
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.1**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	2.6
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.004%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-5

CURRENT/FUTURE RECREATIONAL USERS - UPLAND AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Area 9	µg/g or ppm	250.6
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.3**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	3.1
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.02%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-6

CURRENT PEDESTRIANS - ALL AREAS (EXCEPT AREAS 2, 8, AND 11)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil All Areas Current	µg/g or ppm	214.7
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	350
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**2.0**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	4.7
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.17%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-7

FUTURE PEDESTRIANS - ALL AREAS (EXCEPT AREAS 8 AND 11)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil All Areas Future	µg/g or ppm	234.3
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	350
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**2.1**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	4.9
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.22%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-8

CURRENT/FUTURE CONSTRUCTION/UTILITY WORKERS - ALL UPLAND AREAS

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface/Subsurface Soil Upland Area	µg/g or ppm	408.1
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.330
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**5.4**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	12.8
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**11.14%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-9

CURRENT/FUTURE ADULT RECREATIONAL USERS - WETLAND AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Sediment Wetland Area 9	µg/g or ppm	117.3
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.2**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	2.7
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.01%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-10

CURRENT/FUTURE ADOLESCENT RECREATIONAL USERS - WETLAND AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Sediment Wetland Area 9	µg/g or ppm	117.3
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.001
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--
K_{SD}	Mass fraction of soil in dust	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.0**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	2.4
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.002%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-11

CURRENT/FUTURE ANGLER (HARD CLAM)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbF	Shellfish lead concentration	µg/g or ppm	1.696
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IRF	Fish ingestion rate	g/day	16.00
$AF_{S, D}$	Absorption fraction	--	0.12
$EF_{S, D}$	Exposure frequency	days/yr	365
$AT_{S, D}$	Averaging time	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**2.3**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	5.4
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.37%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-12

CURRENT/FUTURE ANGLER (RIBBED MUSSEL)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbF	Shellfish lead concentration	µg/g or ppm	0.361
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IRF	Shellfish ingestion rate	g/day	16.00
$AF_{S, D}$	Absorption fraction	--	0.12
$EF_{S, D}$	Exposure frequency	days/yr	365
$AT_{S, D}$	Averaging time	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.3**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	3.0
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.01%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-13

CURRENT/FUTURE ANGLER (BLUE CRAB MUSCLE)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbF	Shellfish lead concentration	µg/g or ppm	0.1114
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IRF	Shellfish ingestion rate	g/day	16.00
$AF_{S, D}$	Absorption fraction	--	0.12
$EF_{S, D}$	Exposure frequency	days/yr	365
$AT_{S, D}$	Averaging time	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.1**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	2.6
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.004%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-14

CURRENT/FUTURE ANGLER (BLUE CRAB MUSCLE PLUS HEPATOPANCREAS)

Raritan Bay Slag Superfund Site

Old Bridge and Sayreville, New Jersey

Calculations of Blood Lead Concentrations (PbBs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004
PbF	Shellfish lead concentration	µg/g or ppm	0.1116
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	1.0
IRF	Shellfish ingestion rate	g/day	16.00
$AF_{S, D}$	Absorption fraction	--	0.12
$EF_{S, D}$	Exposure frequency	days/yr	365
$AT_{S, D}$	Averaging time	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**µg/dL**	**1.1**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses of adult workers	µg/dL	2.6
PbB_t	Target PbB level of concern	µg/dL	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.004%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-15

SENSITIVITY ANALYSIS BASED ON DIFFERENT LEAD ABSORPTION FRACTIONS

CURRENT/FUTURE ADOLESCENT RECREATIONAL USERS - AREA 1

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Area 1	µg/g or ppm	557	557
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.42	0.30
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adolescent, geometric mean**	**µg/dL**	**3.6**	**2.8**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses	µg/dL	8.4	6.7
PbB_t	Target PbB level of concern	µg/dL	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**2.65%**	**1.00%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-16

SENSITIVITY ANALYSIS BASED ON DIFFERENT LEAD ABSORPTION FRACTIONS

CURRENT/FUTURE ADOLESCENT RECREATIONAL USERS - AREAS 5, 6, AND THE BEACH AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Areas 5, 6, and 9	µg/g or ppm	67.96	67.96
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.42	0.30
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adolescent, geometric mean**	**µg/dL**	**1.3**	**1.2**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses	µg/dL	3.1	2.9
PbB_t	Target PbB level of concern	µg/dL	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.014%**	**0.009%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-17

SENSITIVITY ANALYSIS BASED ON DIFFERENT LEAD ABSORPTION FRACTIONS

CURRENT/FUTURE ADOLESCENT RECREATIONAL USERS - UPLAND AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil Area 9	µg/g or ppm	250.6	250.6
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.42	0.30
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adolescent, geometric mean**	**µg/dL**	**2.2**	**1.8**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses	µg/dL	5.1	4.3
PbB_t	Target PbB level of concern	µg/dL	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.26%**	**0.11%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-18

SENSITIVITY ANALYSIS BASED ON DIFFERENT LEAD ABSORPTION FRACTIONS

CURRENT/FUTURE ADOLESCENT RECREATIONAL USERS - WETLAND AREA OF AREA 9

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Sediment Wetland Area 9	µg/g or ppm	117.3	117.3
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.001	0.001
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.42	0.30
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	100	100
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adolescent, geometric mean**	**µg/dL**	**1.0**	**1.0**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses	µg/dL	2.4	2.4
PbB_t	Target PbB level of concern	µg/dL	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**0.002%**	**0.002%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-19

SENSITIVITY ANALYSIS BASED ON DIFFERENT LEAD ABSORPTION FRACTIONS

CURRENT ADOLESCENT PEDESTRIANS - ALL AREAS (EXCEPT AREAS 2, 8, AND 11)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil All Areas Current	µg/g or ppm	214.7	214.7
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.42	0.30
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	350	350
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adolescent, geometric mean**	**µg/dL**	**4.5**	**3.5**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses	µg/dL	10.6	8.2
PbB_t	Target PbB level of concern	µg/dL	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**6.02%**	**2.39%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

TABLE E-20

SENSITIVITY ANALYSIS BASED ON DIFFERENT LEAD ABSORPTION FRACTIONS

FUTURE ADOLESCENT PEDESTRIANS - ALL AREAS (EXCEPT AREAS 8 AND 11)

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES 1999-2004
PbS	Soil lead concentration, Surface Soil All Areas Future	µg/g or ppm	234.3	234.3
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	1.8
PbB_0	Baseline PbB	µg/dL	1.0	1.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100
IR_{S+D}	Total ingestion rate of outdoor soil and indoor dust	g/day	--	--
W_S	Weighting factor; fraction of IR_{S+D} ingested as outdoor soil	--	--	--
K_{SD}	Mass fraction of soil in dust	--	--	--
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.42	0.30
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	350	350
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PbB_{adult}	**PbB of adolescent, geometric mean**	**µg/dL**	**4.8**	**3.7**
$PbB_{fetal, 0.95}$	95th percentile PbB among fetuses	µg/dL	11.3	8.7
PbB_t	Target PbB level of concern	µg/dL	**10.0**	**10.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distribution**	**%**	**7.54%**	**3.06%**

Source: EPA 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

Appendix F
Shower Model – Input Assumptions and Estimated Air Concentrations

Appendix F Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

F-1 Values Used for Shower Model - Future Groundwater Resident Adult
F-2 Values Used for Shower Model - Future Groundwater Resident Child (0-6 years)
F-3 Medium-Specific Exposure Point Concentration Summary - Future Groundwater Resident Adult
F-4 Medium-Specific Exposure Point Concentration Summary - Future Groundwater Resident Child (0-6 years)

TABLE F-1
VALUES USED FOR SHOWER MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Adult

Exposure Route	Parameter Code	Parameter Definition	Unit	RME Value	RME Reference	CTE Value	CTE Reference	Intake Equation/ Model Name
Inhalation	CW	Chemical Concentration in Water	µg/L	See Table B-3.3b	See Table B-3.3b	See Table B-3.3b	See Table B-3.3b	Maximum air concentration in bathroom
	f	Fraction volatilized	--	chem-specific	Schaum et al. [(1)]	chem-specific	Schaum et al. [(1)]	(C_{aMax}) (µg/m^3) =
	F_w	Flow Rate	L/hr	1000	Schaum et al.	500	Schaum et al.	CW x f x Fw x t_1 x 1/Va
	t_1	Time of shower	hr	0.25	EPA 2001	0.10	EPA 2001	
	V_a	Bathroom volume	m^3	6	Schaum et al.	16	Schaum et al.	EPC (µg/m^3) =
	t_2	Time after shower in bathroom	hr	0.33	EPA 2001	0.15	EPA 2001	$(((C_{aMax}2) \times t_1) + (C_{aMax} \times t_2)) / (t_1 + t_2)$

RME = Reasonable Maximum Exposure

CTE = Central Tendency Exposure

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower

hr = hour

L = liter

m^3 = cubic meter

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

[(1)] applies only to volatile chemicals

Sources:

EPA 2001: Personal communication with M. Olsen of EPA Region 2, July 13, 2001. Based on EPA Region 2 and the Andelman model as modified by Schaum et al.

Schaum et al. 1994. *Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water*. Water Contamination and Health, edited by Rhoda G.M. Wang. New York: Marcel Dekker, Inc.

TABLE F-2
VALUES USED FOR SHOWER MODEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Child (0-6 years)

Exposure Route	Parameter Code	Parameter Definition	Unit	RME Value	RME Reference	CTE Value	CTE Reference	Intake Equation/ Model Name
Inhalation	CW	Chemical Concentration in Water	µg/L	See Table B-3.3b	See Table B-3.3b	See Table B-3.3b	See Table B-3.3b	Maximum air concentration in bathroom
	f	Fraction volatilized	--	chem-specific	Schaum et al. [(1)]	chem-specific	Schaum et al. [(1)]	(C_{aMax}) (µg/m^3) =
	F_w	Flow Rate	L/hr	1000	Schaum et al.	500	Schaum et al.	CW x f x Fw x t_1 x 1/Va
	t_1	Time of shower	hr	0.45	EPA 2001	0.14	EPA 2001	
	V_a	Bathroom volume	m^3	6	Schaum et al.	16	Schaum et al.	EPC (µg/m^3) =
	t_2	Time after shower in bathroom	hr	0.55	EPA 2001	0.19	EPA 2001	$(((C_{aMax}/2) \times t_1) + (C_{aMax} \times t_2)) / (t_1 + t_2)$

RME = Reasonable Maximum Exposure

CTE = Central Tendency Exposure

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower

hr = hour

L = liter

m^3 = cubic meter

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

[(1)] applies only to volatile chemicals

Sources:

EPA 2001: Personal communication with M. Olsen of EPA Region 2, July 13, 2001. Based on EPA Region 2 and the Andelman model as modified by Schaum et al.

Schaum et al. 1994. *Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water*. Water Contamination and Health, edited by Rhoda G.M. Wang. New York: Marcel Dekker, Inc.

TABLE F-3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Adult

Exposure Point	CAS No.	Chemical of Potential Concern	Groundwater Exposure Point Concentration (EPC) (µg/L)	Fraction Volatilized	Reasonable Maximum Exposure		Central Tendency Exposure	
					C_{aMax} (µg/m^3)	Air EPC (µg/m^3)	C_{aMax} (µg/m^3)	Air EPC (µg/m^3)
Water Vapor at Showerhead		**Volatile Organic Compounds**						
	127-18-4	Tetrachloroethene	2.0E+00	5.0E-01	4.1E+01	3.2E+01	3.1E+00	2.5E+00

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

TABLE F-4

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Raritan Bay Slag Superfund Site

Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Medium:	Groundwater
Exposure Medium:	Air
Receptor Population:	Resident
Receptor Age:	Child (0-6 years)

Exposure Point	CAS No.	Chemical of Potential Concern	Groundwater Exposure Point Concentration (EPC) (µg/L)	Fraction Volatilized	Reasonable Maximum Exposure		Central Tendency Exposure	
					C_{aMax} (µg/m^3)	Air EPC (µg/m^3)	C_{aMax} (µg/m^3)	Air EPC (µg/m^3)
Water Vapor at Showerhead		**Volatile Organic Compounds**						
	127-18-4	Tetrachloroethene	2.0E+00	5.0E-01	7.4E+01	5.7E+01	4.3E+00	3.4E+00

EPC = Exposure Point Concentration, the average air concentration in the bathroom during and after shower

µg/L = microgram per liter

µg/m^3 = microgram per cubic meter

Appendix G
RAGS D Tables for CTE Scenario

Appendix G Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

G-1 Calculation of Chemical Cancer Risks and Noncancer Hazards - Central Tendency Exposure
- G-1.1a Current/Future Angler - Fish (Adult)
- G-1.1b Current/Future Angler - Fish (Child)
- G-1.2a Current/Future Angler - Hard Clam (Adult)
- G-1.2b Current/Future Angler - Hard Clam (Child)
- G-1.3 Future Resident - All Areas

G-2 Summary of Receptor Risks and Hazards for Chemical of Potential Concern - Central Tendency Exposure
- G-2.1a Current/Future Angler - Fish (Adult)
- G-2.1b Current/Future Angler - Fish (Child)
- G-2.2a Current/Future Angler - Hard Clam (Adult)
- G-2.2b Current/Future Angler - Hard Clam (Child)
- G-2.3 Future Resident - All Areas

G-3 Risk Assessment Summary - Central Tendency Exposure
- G-3.1a Current/Future Angler - Fish (Adult)
- G-3.1b Current/Future Angler - Fish (Child)
- G-3.2a Current/Future Angler - Hard Clam (Adult)
- G-3.2b Current/Future Angler - Hard Clam (Child)
- G-3.3 Future Resident - All Areas

TABLE G-1.1a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Fish

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Fish	Fish	Ingestion	**Inorganics**												
			Arsenic	6.80E-01	mg/kg wet wt.	2.63E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	3.95E-05	2.05E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	6.83E-01
			Mercury	5.30E-02	mg/kg wet wt.	2.05E-06	mg/kg-day	NA	NA	NA	1.60E-05	mg/kg-day	1.00E-04	$(mg/kg\text{-}day)^{-1}$	1.60E-01
		Exp. Route Total								3.95E-05					8.43E-01
	Exposure Point Total									3.95E-05					8.43E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE G-2.1a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	4E-05	NA	NA	4E-05	Skin	7E-01	NA	NA	7E-01
			Mercury	NA	NA	NA	NA	Immune System	2E-01	NA	NA	2E-01
			Chemical Total	4E-05	--	--	4E-05	Chemical Total	8E-01	--	--	8E-01
		Exposure Point Total					4E-05					8E-01
	Exposure Medium Total						4E-05					8E-01
Medium Total							4E-05					8E-01
Receptor Total							4E-05					8E-01

Total Excess Cancer Risk Across All Media: 4E-05

Total Hazard Index Across All Media: 0.8

NA = not applicable

CNS = central nervous system

TABLE G-3.1a
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	4E-05	NA	NA	4E-05	Skin	7E-01	NA	NA	7E-01
			Chemical Total	4E-05	--	--	4E-05	Chemical Total	8E-01	--	--	8E-01
		Exposure Point Total					4E-05					8E-01
	Exposure Medium Total						4E-05					8E-01
Medium Total							4E-05					8E-01
Receptor Total							4E-05					8E-01

Total Excess Cancer Risk Across All Media: 4E-05

Total Hazard Index Across All Media: 0.8

NA = not applicable

CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1×10^{-6} or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE G-1.1b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Fish

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Fish	Fish	Ingestion	**Inorganics**												
			Arsenic	6.80E-01	mg/kg wet wt.	1.17E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.76E-05	1.37E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.55E-01
			Mercury	5.30E-02	mg/kg wet wt.	9.13E-07	mg/kg-day	NA	NA	NA	1.06E-05	mg/kg-day	1.00E-04	$(mg/kg\text{-}day)^{-1}$	1.06E-01
		Exp. Route Total								1.76E-05					5.62E-01
	Exposure Point Total									1.76E-05					5.62E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE G-2.1b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	2E-05	NA	NA	2E-05	Skin	5E-01	NA	NA	5E-01
			Mercury	NA	NA	NA	NA	Immune System	1E-01	NA	NA	1E-01
			Chemical Total	2E-05	--	--	2E-05	Chemical Total	6E-01	--	--	6E-01
		Exposure Point Total					2E-05					6E-01
	Exposure Medium Total						2E-05					6E-01
Medium Total							2E-05					6E-01
Receptor Total							2E-05					6E-01

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 0.6

NA = not applicable

CNS = central nervous system

TABLE G-3.1b
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Fish	Fish	Fish	**Inorganics**									
			Arsenic	2E-05	NA	NA	2E-05	Skin	5E-01	NA	NA	5E-01
			Chemical Total	2E-05	--	--	2E-05	Chemical Total	6E-01	--	--	6E-01
		Exposure Point Total					2E-05					6E-01
	Exposure Medium Total						2E-05					6E-01
Medium Total							2E-05					6E-01
Receptor Total							2E-05					6E-01

Total Excess Cancer Risk Across All Media: 2E-05

Total Hazard Index Across All Media: 0.6

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1×10^{6} or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE G-1.2a
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Adult
Exposure Medium:	Hard Clam

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Hard Clam	Hard Clam	Ingestion	**Inorganics**												
			Arsenic	1.60E+00	mg/kg wet wt.	1.86E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.79E-05	1.45E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	4.82E-01
			Cadmium	1.70E-01	mg/kg wet wt.	1.98E-06	mg/kg-day	NA	NA	NA	1.54E-05	mg/kg-day	1.00E-03	$(mg/kg\text{-}day)^{-1}$	1.54E-02
			Cobalt	1.30E-01	mg/kg wet wt.	1.51E-06	mg/kg-day	NA	NA	NA	1.18E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	3.92E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.40E+01	mg/kg wet wt.	3.95E-04	mg/kg-day	NA	NA	NA	3.07E-03	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	2.20E-02
		Exp. Route Total								2.79E-05					5.59E-01
	Exposure Point Total									2.79E-05					5.59E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE G-2.2a
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

nario Timeframe:	Current/Future
eptor Population:	Angler
eceptor Age:	Adult
xposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	3E-05	NA	NA	3E-05	Skin	5E-01	NA	NA	5E-01
			Cadmium	NA	NA	NA	NA	Kidney	2E-02	NA	NA	2E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	4E-02	NA	NA	4E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-02	NA	NA	2E-02
			Chemical Total	3E-05	--	--	3E-05	Chemical Total	6E-01	--	--	6E-01
		Exposure Point Total					3E-05					6E-01
	Exposure Medium Total						3E-05					6E-01
Medium Total							3E-05					6E-01
Receptor Total							3E-05					6E-01

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 0.6

TABLE G-3.2a
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

nario Timeframe:	Current/Future
eptor Population:	Angler
eceptor Age:	Adult
xposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	3E-05	NA	NA	3E-05	Skin	5E-01	NA	NA	5E-01
			Chemical Total	3E-05	--	--	3E-05	Chemical Total	6E-01	--	--	6E-01
		Exposure Point Total					3E-05					6E-01
	Exposure Medium Total						3E-05					6E-01
Medium Total							3E-05					6E-01
Receptor Total							3E-05					6E-01

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 0.6

TABLE G-1.2b
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Medium:	Hard Clam

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation					Noncancer Hazard Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Risk	Value	Unit	Value	Unit	Quotient
Hard Clam	Hard Clam	Ingestion	**Inorganics**												
			Arsenic	1.60E+00	mg/kg wet wt.	1.93E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	2.89E-05	2.25E-04	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	7.50E-01
			Cadmium	1.70E-01	mg/kg wet wt.	2.05E-06	mg/kg-day	NA	NA	NA	2.39E-05	mg/kg-day	1.00E-03	$(mg/kg\text{-}day)^{-1}$	2.39E-02
			Cobalt	1.30E-01	mg/kg wet wt.	1.57E-06	mg/kg-day	NA	NA	NA	1.83E-05	mg/kg-day	3.00E-04	$(mg/kg\text{-}day)^{-1}$	6.09E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	3.40E+01	mg/kg wet wt.	4.10E-04	mg/kg-day	NA	NA	NA	4.78E-03	mg/kg-day	1.40E-01	$(mg/kg\text{-}day)^{-1}$	3.42E-02
		Exp. Route Total								2.89E-05					8.69E-01
	Exposure Point Total									2.89E-05					8.69E-01

NA = not applicable
RfD = reference dose
RfC = reference concentration
mg/kg wet wt. = milligram per kilogram wet weight
mg/kg-day = milligram per kilogram per day

TABLE G-2.2b
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	3E-05	NA	NA	3E-05	Skin	8E-01	NA	NA	8E-01
			Cadmium	NA	NA	NA	NA	Kidney	2E-02	NA	NA	2E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland	6E-02	NA	NA	6E-02
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	3E-02	NA	NA	3E-02
			Chemical Total	3E-05	--	--	3E-05	Chemical Total	9E-01	--	--	9E-01
		Exposure Point Total					3E-05					9E-01
	Exposure Medium Total						3E-05					9E-01
Medium Total							3E-05					9E-01
Receptor Total							3E-05					9E-01

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 0.9

NA = not applicable

CNS = central nervous system

TABLE G-3.2b
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Current/Future
Receptor Population:	Angler
Receptor Age:	Child (0-6 years)
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Hard Clam	Hard Clam	Hard Clam	**Inorganics**									
			Arsenic	3E-05	NA	NA	3E-05	Skin	8E-01	NA	NA	8E-01
			Chemical Total	3E-05	--	--	3E-05	Chemical Total	9E-01	--	--	9E-01
		Exposure Point Total					3E-05					9E-01
	Exposure Medium Total						3E-05					9E-01
Medium Total							3E-05					9E-01
Receptor Total							3E-05					9E-01

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 0.9

NA = not applicable CNS = central nervous system

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1×10^{6} or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

TABLE G-1.3
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Medium:	Groundwater (All Wells)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Cancer Risk Calculation				
						Intake/ Exposure Concentration		Slope Factor/Unit Risk		Cancer
				Value	Unit	Value	Unit	Value	Unit	Risk
Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**							
			Tetrachloroethene	1.96E+00	µg/L	8.47E-06	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	4.57E-06
			Inorganics							
			Aluminum	8.17E+03	µg/L	3.54E-02	mg/kg-day	NA	NA	NA
			Antimony	1.52E+00	µg/L	6.58E-06	mg/kg-day	NA	NA	NA
			Arsenic	2.76E+00	µg/L	1.19E-05	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	1.79E-05
			Cadmium	1.90E+00	µg/L	8.22E-06	mg/kg-day	NA	NA	NA
			Cobalt	2.27E+01	µg/L	9.84E-05	mg/kg-day	NA	NA	NA
			Copper	8.09E+01	µg/L	3.50E-04	mg/kg-day	NA	NA	NA
			Iron	7.99E+04	µg/L	3.46E-01	mg/kg-day	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	5.66E-03	mg/kg-day	NA	NA	NA
		Exp. Route Total								2.25E-05
Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**							
			Tetrachloroethene	1.96E+00	µg/L	1.44E-05	mg/kg-day	5.40E-01	$(mg/kg\text{-}day)^{-1}$	7.79E-06
			Inorganics							
			Aluminum	8.17E+03	µg/L	1.83E-03	mg/kg-day	NA	NA	NA
			Antimony	1.52E+00	µg/L	3.40E-07	mg/kg-day	NA	NA	NA
			Arsenic	2.76E+00	µg/L	6.16E-07	mg/kg-day	1.50E+00	$(mg/kg\text{-}day)^{-1}$	9.24E-07
			Cadmium	1.90E+00	µg/L	4.24E-07	mg/kg-day	NA	NA	NA
			Cobalt	2.27E+01	µg/L	2.03E-06	mg/kg-day	NA	NA	NA
			Copper	8.09E+01	µg/L	1.81E-05	mg/kg-day	NA	NA	NA
			Iron	7.99E+04	µg/L	1.79E-02	mg/kg-day	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	2.92E-04	mg/kg-day	NA	NA	NA
		Exp. Route Total								8.72E-06
Groundwater	Tap Water	Inhalation at Showerhead	**Volatile Organic Compounds**							
			Tetrachloroethene	1.96E+00	µg/L	1.06E-01	$\mu g/m^3$	5.90E-06	$(\mu g/m^3)^{-1}$	6.23E-07
			Inorganics							
			Aluminum	8.17E+03	µg/L	NA	NA	NA	NA	NA
			Antimony	1.52E+00	µg/L	NA	NA	NA	NA	NA
			Arsenic	2.76E+00	µg/L	NA	NA	4.30E-03	$(\mu g/m^3)^{-1}$	NA
			Cadmium	1.90E+00	µg/L	NA	NA	1.80E-03	$(\mu g/m^3)^{-1}$	NA
			Cobalt	2.27E+01	µg/L	NA	NA	9.00E-03	$(\mu g/m^3)^{-1}$	NA
			Copper	8.09E+01	µg/L	NA	NA	NA	NA	NA
			Iron	7.99E+04	µg/L	NA	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	NA	NA	NA	NA	NA
		Exp. Route Total								6.23E-07
	Exposure Point Total									3.18E-05

NA = not applicable

RfD = reference dose
RfC = reference concentration

$\mu g/m^3$ = microgram per cubic meter
mg/kg-day = milligram per kilogram per day
µg/L = microgram per liter

TABLE G-1.3
CALCULATION OF CHEMICAL CANCER RISKS AND NONCANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Medium:	Groundwater (All Wells)

Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Exposure Point Concentration		Noncancer Hazard Calculation (Adult)					Noncancer Hazard Calculation (Child)				
						Intake/ Exposure Concentration		RfD/RfC		Hazard	Intake/ Exposure Concentration		RfD/RfC		Hazard
				Value	Unit	Value	Unit	Value	Unit	Quotient	Value	Unit	Value	Unit	Quotient
Groundwater	Tap Water	Ingestion	**Volatile Organic Compounds**												
			Tetrachloroethene	1.96E+00	µg/L	3.75E-05	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	3.75E-03	4.25E-05	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	4.25E-03
			Inorganics												
			Aluminum	8.17E+03	µg/L	1.57E-01	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.57E-01	1.78E-01	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	1.78E-01
			Antimony	1.52E+00	µg/L	2.92E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	7.29E-02	3.31E-05	mg/kg-day	4.00E-04	(mg/kg-day)$^{-1}$	8.26E-02
			Arsenic	2.76E+00	µg/L	5.29E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.76E-01	5.99E-05	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	2.00E-01
			Cadmium	1.90E+00	µg/L	3.64E-05	mg/kg-day	5.00E-04	(mg/kg-day)$^{-1}$	7.28E-02	4.13E-05	mg/kg-day	5.00E-04	(mg/kg-day)$^{-1}$	8.25E-02
			Cobalt	2.27E+01	µg/L	4.36E-04	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.45E+00	4.94E-04	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.65E+00
			Copper	8.09E+01	µg/L	1.55E-03	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	3.88E-02	1.76E-03	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	4.40E-02
			Iron	7.99E+04	µg/L	1.53E+00	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.19E+00	1.74E+00	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	2.48E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	2.51E-02	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	1.79E-01	2.84E-02	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	2.03E-01
		Exp. Route Total								4.34E+00					4.92E+00
Groundwater	Tap Water	Dermal Contact	**Volatile Organic Compounds**												
			Tetrachloroethene	1.96E+00	µg/L	3.81E-06	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	3.81E-04	3.81E-06	mg/kg-day	1.00E-02	(mg/kg-day)$^{-1}$	3.81E-04
			Inorganics												
			Aluminum	8.17E+03	µg/L	4.83E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	4.83E-04	4.83E-04	mg/kg-day	1.00E+00	(mg/kg-day)$^{-1}$	4.83E-04
			Antimony	1.52E+00	µg/L	8.98E-08	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	1.50E-03	8.98E-08	mg/kg-day	6.00E-05	(mg/kg-day)$^{-1}$	1.50E-03
			Arsenic	2.76E+00	µg/L	1.63E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.43E-04	1.63E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	5.43E-04
			Cadmium	1.90E+00	µg/L	1.12E-07	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	4.48E-03	1.12E-07	mg/kg-day	2.50E-05	(mg/kg-day)$^{-1}$	4.48E-03
			Cobalt	2.27E+01	µg/L	5.37E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.79E-03	5.37E-07	mg/kg-day	3.00E-04	(mg/kg-day)$^{-1}$	1.79E-03
			Copper	8.09E+01	µg/L	4.78E-06	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.19E-04	4.78E-06	mg/kg-day	4.00E-02	(mg/kg-day)$^{-1}$	1.19E-04
			Iron	7.99E+04	µg/L	4.72E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	6.74E-03	4.72E-03	mg/kg-day	7.00E-01	(mg/kg-day)$^{-1}$	6.74E-03
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	7.73E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	5.52E-04	7.73E-05	mg/kg-day	1.40E-01	(mg/kg-day)$^{-1}$	5.52E-04
		Exp. Route Total								1.66E-02					1.66E-02
Groundwater	Tap Water	Inhalation at Showerhead	**Volatile Organic Compounds**												
			Tetrachloroethene	1.96E+00	µg/L	3.20E-04	mg/m^3	2.70E-01	mg/m^3	1.19E-03	5.01E-04	mg/m^3	2.70E-01	mg/m^3	1.86E-03
			Inorganics												
			Aluminum	8.17E+03	µg/L	NA	NA	5.00E-03	mg/m^3	NA	NA	NA	5.00E-03	mg/m^3	NA
			Antimony	1.52E+00	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Arsenic	2.76E+00	µg/L	NA	NA	1.50E-05	mg/m^3	NA	NA	NA	1.50E-05	mg/m^3	NA
			Cadmium	1.90E+00	µg/L	NA	NA	1.00E-05	mg/m^3	NA	NA	NA	1.00E-05	mg/m^3	NA
			Cobalt	2.27E+01	µg/L	NA	NA	6.00E-06	mg/m^3	NA	NA	NA	6.00E-06	mg/m^3	NA
			Copper	8.09E+01	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Iron	7.99E+04	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	1.31E+03	µg/L	NA	NA	5.00E-05	mg/m^3	NA	NA	NA	5.00E-05	mg/m^3	NA
		Exp. Route Total								1.19E-03					1.86E-03
	Exposure Point Total									4.36E+00					4.94E+00

NA = not applicable
RfD = reference dose
RfC = reference concentration
µg/L = microgram per liter
mg/kg-day = milligram per kilogram per day
mg/m^3 = milligram per cubic meter

TABLE G-2.3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR CHEMICALS OF POTENTIAL CONCERN
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater (All Areas)	Tap Water	**Volatile Organic Compounds**									
			Tetrachloroethene	5E-06	8E-06	6E-07	1E-05	Liver/CNS	4E-03	4E-04	2E-03	6E-03
			Inorganics									
			Aluminum	NA	NA	NA	NA	Neurological	2E-01	5E-04	NA	2E-01
			Antimony	NA	NA	NA	NA	Longevity/Blood	8E-02	1E-03	NA	8E-02
			Arsenic	2E-05	9E-07	NA	2E-05	Skin/Developmental/Cardiovascular System/CNS	2E-01	5E-04	NA	2E-01
			Cadmium	NA	NA	NA	NA	Kidney	8E-02	4E-03	NA	9E-02
			Cobalt	NA	NA	NA	NA	Thyroid Gland/Respiratory System	2E+00	2E-03	NA	2E+00
			Copper	NA	NA	NA	NA	GI Tract	4E-02	1E-04	NA	4E-02
			Iron	NA	NA	NA	NA	GI Tract	2E+00	7E-03	NA	2E+00
			Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	CNS	2E-01	6E-04	NA	2E-01
			Chemical Total	2E-05	9E-06	6E-07	3E-05	Chemical Total	5E+00	2E-02	2E-03	5E+00
		Exposure Point Total					3E-05					5E+00
	Exposure Medium Total						3E-05					5E+00
Medium Total							3E-05					5E+00
Receptor Total							3E-05					5E+00

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 5

Respiratory HI Across All Media = 2
Thyroid Gland HI Across All Media = 2
GI Tract HI Across All Media = 3

TABLE G-3.3
RISK ASSESSMENT SUMMARY
CENTRAL TENDENCY EXPOSURE
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Scenario Timeframe:	Future
Receptor Population:	Resident
Receptor Age:	Adult/Child
Exposure Area:	All Areas

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Cancer Risk				Noncancer Hazard Quotient				
				Ingestion	Dermal Contact	Inhalation	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Dermal Contact	Inhalation	Exposure Routes Total
Groundwater	Groundwater (All Wells)	Tap Water	**Volatile Organic Compounds**									
			Tetrachloroethene	5E-06	8E-06	6E-07	1E-05	Liver/CNS	4E-03	4E-04	2E-03	6E-03
			Inorganics									
			Arsenic	2E-05	9E-07	NA	2E-05	Skin/Developmental/Cardiovascular System/CNS	2E-01	5E-04	NA	2E-01
			Cobalt	NA	NA	NA	NA	Thyroid Gland/Respiratory System	2E+00	2E-03	NA	2E+00
			Iron	NA	NA	NA	NA	GI Tract	2E+00	7E-03	NA	2E+00
			Chemical Total	2E-05	9E-06	6E-07	3E-05	Chemical Total	5E+00	2E-02	2E-03	5E+00
		Exposure Point Total					3E-05					5E+00
	Exposure Medium Total						3E-05					5E+00
Medium Total							3E-05					5E+00
Receptor Total							3E-05					5E+00

Total Excess Cancer Risk Across All Media: 3E-05

Total Hazard Index Across All Media: 5

Respiratory HI Across All Media = 2
Thyroid Gland HI Across All Media = 2
GI Tract HI Across All Media = 3

Note:
The table only shows chemical of potential concern (COPC) with a cancer risk above 1E-6 or a noncancer hazard quotient above 1. However, the total numbers represent the total for all COPC and not just the COPC listed.

Appendix H
Comparison of Reporting Limits to Screening Levels

Appendix H Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Comparison of Reporting Limits for Non-Detected Chemicals to Screening Levels

H-1a Area 1 Surface Soil
H-1b Area 2 Surface Soil
H-1c Areas 3 and 4 Surface Soil
H-1d Areas 5, 6, and Beach Area of Area 9 Surface Soil
H-1e Upland Area of Area 9 Surface Soil
H-1f All Areas (except Areas 2, 8, and 11) Surface Soil
H-1g All Areas (except Areas 8 and 11) Surface Soil
H-1h Areas 8 and 11 Surface Soil
H-1i All Areas Surface Soil
H-2 All Upland Areas Surface/Subsurface Soil
H-3a Groundwater (<10 Feet Bgs)
H-3b Groundwater (All Wells)
H-4a All Areas (except Wetland Area of Area 9) Surface Water
H-4b Wetland Area of Area 9 Surface Water
H-5a Area 1 Sediment
H-5b Area 2 Sediment
H-5c Areas 5, 6, and Beach Area of Area 9 Sediment
H-5d Wetland Area of Area 9 Sediment
H-5e All Areas (except Wetland Area of Area 9) Sediment
H-6a Fish
H-6b Hard Clam
H-6c Ribbed Mussel
H-6d Blue Crab (Muscle)
H-6e Blue Crab (Hepatopancreas)

Screening Levels for Surface Water

H-7a Inputs for Development of Site-Specific Recreator Risk-Based Surface Water Screening Levels
H-7b Site-Specific Recreator Risk-Based Surface Water Screening Levels

TABLE H-1a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 1 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.6	24	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.6	24	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.6	24	270 c	No	No
75-25-2	Bromoform	µg/kg	4.6	24	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.6	24	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.6	24	610 c	No	No
75-00-3	Chloroethane	µg/kg	4.6	24	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.6	24	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.6	24	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.6	24	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.6	24	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.6	24	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.6	24	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.6	24	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.6	24	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.6	24	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.6	24	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	4.6	24	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.6	24	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.6	24	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.6	24	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.6	24	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.6	24	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.6	24	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	4.6	24	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	92	490	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	4.6	24	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	9.2	49	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.6	24	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.6	24	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.6	24	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	9.2	49	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.6	24	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.6	24	11000 c	No	No
100-42-5	Styrene	µg/kg	4.6	24	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	4.6	24	560 c	No	No
108-88-3	Toluene	µg/kg	4.6	24	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.6	24	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.6	24	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.6	24	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.6	24	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	4.6	24	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	4.6	24	2800 c	No	No
75-01-4	Vinyl Chloride	µg/kg	4.6	24	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.6	24	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.6	24	420000 ns	No	No

TABLE H-1a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 1 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	180	910	2100 c	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	180	910	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	180	910	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	180	910	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	180	910	NA	No	No
105-60-2	Caprolactam	µg/kg	180	910	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	180	910	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	180	910	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	92	910	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	180	910	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	180	910	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	180	910	NA	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	180	910	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	180	910	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	92	910	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	180	910	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	92	1800	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	92	1800	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	180	910	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	92	910	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	180	910	NA	No	No
118-74-1	Hexachlorobenzene	µg/kg	180	910	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	92	910	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	180	910	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	180	910	6100 n	No	No
78-59-1	Isophorone	µg/kg	180	910	510000 c	No	No
95-48-7	Methylphenol, 2-	µg/kg	180	910	310000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	340	1800	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	340	1800	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	340	1800	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	180	910	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	180	910	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	340	1800	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	92	910	69 c	**Yes**	**Yes**
87-86-5	Pentachlorophenol	µg/kg	7.2	1800	890 c	No	**Yes**
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	180	910	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	180	910	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	180	910	6100 n	No	No

TABLE H-1a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 1 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.93	5.4	29 c	No	No
319-84-6	Alpha-BHC	µg/kg	0.93	5.4	77 c	No	No
12674-11-2	Aroclor 1016	µg/kg	35	100	390 n	No	No
11104-28-2	Aroclor 1221	µg/kg	35	100	140 c	No	No
11141-16-5	Aroclor 1232	µg/kg	35	100	140 c	No	No
53469-21-9	Aroclor 1242	µg/kg	35	100	220 c	No	No
12672-29-6	Aroclor 1248	µg/kg	35	100	220 c	No	No
11096-82-5	Aroclor 1260	µg/kg	35	100	220 c	No	No
37324-23-5	Aroclor 1262	µg/kg	35	100	110 n [4]	No	No
11100-14-4	Aroclor 1268	µg/kg	35	100	110 n [4]	No	No
8001-35-2	Chlorinated camphene	µg/kg	65	540	440 c	No	**Yes**
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.93	5.4	520 c	No	No

NA = not available
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration

[2] screening level for 1,3-dichloropropene is used

[3] screening level for m-xylene is used

[4] screening level for Aroclor 1254 is used

TABLE H-1b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 2 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.3	6.3	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.3	6.3	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.3	6.3	270 c	No	No
75-25-2	Bromoform	µg/kg	4.3	6.3	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.3	6.3	730 n	No	No
78-93-3	Butanone, 2-	µg/kg	8.5	13	2800000 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.3	6.3	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	4.3	6.3	29000 n	No	No
75-00-3	Chloroethane	µg/kg	4.3	6.3	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.3	6.3	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.3	6.3	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.3	6.3	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.3	6.3	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.3	6.3	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.3	6.3	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.3	6.3	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.3	6.3	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.3	6.3	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.3	6.3	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	5.9	21	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.3	6.3	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.3	6.3	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.3	6.3	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.3	6.3	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.3	6.3	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.3	6.3	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	5.9	21	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	120	130	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	4.3	6.3	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	8.5	13	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.3	6.3	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.3	6.3	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.3	6.3	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	8.5	13	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.3	6.3	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.3	6.3	11000 c	No	No
100-42-5	Styrene	µg/kg	4.3	6.3	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	4.3	6.3	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	4.3	6.3	550 c	No	No
108-88-3	Toluene	µg/kg	4.3	6.3	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.3	6.3	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.3	6.3	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.3	6.3	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.3	6.3	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	4.3	6.3	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	4.3	6.3	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	4.3	6.3	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	4.3	6.3	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.3	6.3	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.3	6.3	420000 ns	No	No

TABLE H-1b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 2 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	µg/kg	120	220	340000 n	No	No
208-96-8	Acenaphthylene	µg/kg	120	220	340000 n [4]	No	No
120-12-7	Anthracene	µg/kg	120	220	1700000 n	No	No
1912-24-9	Atrazine	µg/kg	120	220	2100 c	No	No
191-24-2	Benzo(g,h,i)perylene	µg/kg	120	220	170000 n [5]	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	120	220	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	120	220	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	120	220	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	120	220	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	120	220	NA	No	No
85-68-7	Butylbenzylphthalate	µg/kg	120	220	260000 c	No	No
105-60-2	Caprolactam	µg/kg	120	220	3100000 n	No	No
86-74-8	Carbazole	µg/kg	120	220	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	120	220	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	120	220	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	120	220	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	120	220	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	220	430	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	120	220	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/kg	120	220	15 c	**Yes**	**Yes**
132-64-9	Dibenzofuran	µg/kg	120	220	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	120	220	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	120	220	18000 n	No	No
84-66-2	Diethylphthalate	µg/kg	120	620	4900000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	120	220	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	120	220	NA	No	No
84-74-2	Di-N-Butylphthalate	µg/kg	220	2300	610000 n	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	400	430	490 n	No	No
51-28-5	Dinitrophenol, 2,4-	µg/kg	420	1300	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	120	220	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	120	220	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	120	220	NA	No	No
86-73-7	Fluorene	µg/kg	120	220	230000 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	120	220	300 c	No	No
87-68-3	Hexachlorobutadiene	µg/kg	120	220	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	120	220	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	120	220	6100 n	No	No
193-39-5	Indeno(1,2,3-Cd)Pyrene	µg/kg	120	220	150 c	No	**Yes**
78-59-1	Isophorone	µg/kg	120	220	510000 c	No	No
91-57-6	Methylnaphthalene, 2-	µg/kg	120	220	31000 n	No	No
95-48-7	Methylphenol, 2-	µg/kg	120	220	310000 n	No	No
106-44-5	Methylphenol, 4-	µg/kg	120	220	31000 n	No	No
91-20-3	Naphthalene	µg/kg	120	220	3600 c	No	No
88-74-4	Nitroaniline, 2-	µg/kg	120	430	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	120	430	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	120	430	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	120	220	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	120	220	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	400	430	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	120	220	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	120	220	99000 c	No	No

TABLE H-1b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 2 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)						
87-86-5	Pentachlorophenol	µg/kg	420	1300	890 c	No	**Yes**
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	120	220	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	120	220	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	120	220	6100 n	No	No
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	2.2	2.6	29 c	No	No
319-84-6	Alpha-BHC	µg/kg	2.2	2.6	77 c	No	No
5103-71-9	Alpha-Chlordane	µg/kg	2.2	2.6	1600 c [6]	No	No
12674-11-2	Aroclor 1016	µg/kg	31	43	390 n	No	No
11104-28-2	Aroclor 1221	µg/kg	42	66	140 c	No	No
11141-16-5	Aroclor 1232	µg/kg	31	43	140 c	No	No
53469-21-9	Aroclor 1242	µg/kg	31	43	220 c	No	No
12672-29-6	Aroclor 1248	µg/kg	31	43	220 c	No	No
11096-82-5	Aroclor 1260	µg/kg	31	43	220 c	No	No
37324-23-5	Aroclor 1262	µg/kg	31	43	110 n [7]	No	No
11100-14-4	Aroclor 1268	µg/kg	31	43	110 n [7]	No	No
319-85-7	Beta-BHC	µg/kg	2.2	2.6	270 c	No	No
8001-35-2	Chlorinated Camphene	µg/kg	190	220	440 c	No	No
72-54-8	DDD, 4,4'-	µg/kg	4.2	5.3	2000 c	No	No
319-86-8	Delta-BHC	µg/kg	2.2	2.6	270 c [8]	No	No
60-57-1	Dieldrin	µg/kg	4.2	5.3	30 c	No	No
959-98-8	Endosulfan I	µg/kg	2.2	2.6	37000 n [9]	No	No
33213-65-9	Endosulfan II	µg/kg	4.2	5.3	37000 n [9]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	4.2	5.3	37000 n [9]	No	No
72-20-8	Endrin	µg/kg	4.2	5.3	1800 n	No	No
7421-93-4	Endrin Aldehyde	µg/kg	4.2	5.3	1800 n [10]	No	No
53494-70-5	Endrin Ketone	µg/kg	4.2	5.3	1800 n [10]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	2.2	2.6	520 c	No	No
5103-74-2	Gamma-Chlordane	µg/kg	2.2	2.6	1600 c [6]	No	No
76-44-8	Heptachlor	µg/kg	2.2	2.6	110 c	No	No
1024-57-3	Heptachlor Epoxide	µg/kg	2.2	2.6	53 c	No	No
72-43-5	Methoxychlor	µg/kg	22	27	31000 n	No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for acenaphthene is used
[5] screening level for pyrene is used
[6] screening level for chlordane is used
[7] screening level for Aroclor 1254 is used
[8] screening level for hexachlorocyclohexane is used
[9] screening level for endosulfan is used
[10] screening level for endrin is used

TABLE H-1c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 3 AND 4 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.7	46	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.7	46	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.7	46	270 c	No	No
75-25-2	Bromoform	µg/kg	4.7	46	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.7	46	730 n	No	No
78-93-3	Butanone, 2-	µg/kg	9.5	93	2800000 n	No	No
75-15-0	Carbon Disulfide	µg/kg	4.7	46	82000 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.7	46	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	4.7	46	29000 n	No	No
75-00-3	Chloroethane	µg/kg	4.7	46	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.7	46	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.7	46	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.7	46	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.7	46	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.7	46	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.7	46	34 c	No	**Yes**
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.7	46	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.7	46	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.7	46	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.7	46	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	4.7	46	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.7	46	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.7	46	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.7	46	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.7	46	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.7	46	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.7	46	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	4.7	46	1700 c [2]	No	No
100-41-4	Ethylbenzene	µg/kg	4.7	46	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	9.5	93	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.7	46	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.7	46	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.7	46	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	9.5	93	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.7	46	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.7	46	11000 c	No	No
100-42-5	Styrene	µg/kg	4.7	46	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	4.7	46	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	4.7	46	550 c	No	No
108-88-3	Toluene	µg/kg	4.7	46	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.7	46	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.7	46	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.7	46	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.7	46	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	4.7	46	1100 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	4.7	46	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	4.7	46	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.7	46	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.7	46	420000 ns	No	No

TABLE H-1c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 3 AND 4 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
208-96-8	Acenaphthylene	µg/kg	170	890	340000 n [4]	No	No
98-86-2	Acetophenone	µg/kg	170	890	780000 n	No	No
1912-24-9	Atrazine	µg/kg	170	890	2100 c	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	170	890	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	170	890	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	170	890	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	170	890	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	170	890	NA	No	No
105-60-2	Caprolactam	µg/kg	170	890	3100000 n	No	No
86-74-8	Carbazole	µg/kg	170	890	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	170	890	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	170	890	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	91	890	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	170	890	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	170	890	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	170	890	NA	No	No
132-64-9	Dibenzofuran	µg/kg	170	890	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	170	890	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	170	890	18000 n	No	No
84-66-2	Diethylphthalate	µg/kg	170	890	4900000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	91	890	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	170	890	NA	No	No
84-74-2	Di-N-Butylphthalate	µg/kg	170	890	610000 n	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	91	1700	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	91	1700	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	170	890	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	91	890	6100 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	170	890	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	91	890	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	170	890	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	170	890	6100 n	No	No
78-59-1	Isophorone	µg/kg	170	890	510000 c	No	No
91-57-6	Methylnaphthalene, 2-	µg/kg	170	890	31000 n	No	No
95-48-7	Methylphenol, 2-	µg/kg	170	890	310000 n	No	No
106-44-5	Methylphenol, 4-	µg/kg	170	890	31000 n	No	No
91-20-3	Naphthalene	µg/kg	170	890	3600 c	No	No
88-74-4	Nitroaniline, 2-	µg/kg	330	1700	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	330	1700	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	330	1700	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	170	890	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	170	890	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	330	1700	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	91	890	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	170	890	99000 c	No	No
108-95-2	Phenol	µg/kg	170	890	1800000 n	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	170	890	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	170	890	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	170	890	6100 n	No	No

TABLE H-1c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 3 AND 4 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.91	8.9	29 c	No	No
12674-11-2	Aroclor 1016	µg/kg	33	170	390 n	No	No
11104-28-2	Aroclor 1221	µg/kg	33	170	140 c	No	**Yes**
11141-16-5	Aroclor 1232	µg/kg	33	170	140 c	No	**Yes**
53469-21-9	Aroclor 1242	µg/kg	33	170	220 c	No	No
12672-29-6	Aroclor 1248	µg/kg	33	170	220 c	No	No
11096-82-5	Aroclor 1260	µg/kg	33	170	220 c	No	No
37324-23-5	Aroclor 1262	µg/kg	33	170	110 n [5]	No	**Yes**
11100-14-4	Aroclor 1268	µg/kg	33	170	110 n [5]	No	**Yes**
319-85-7	Beta-BHC	µg/kg	0.91	8.9	270 c	No	No
8001-35-2	Chlorinated Camphene	µg/kg	64	890	440 c	No	**Yes**
72-54-8	DDD, 4,4'-	µg/kg	1.8	17	2000 c	No	No
319-86-8	Delta-BHC	µg/kg	0.91	8.9	270 c [6]	No	No
959-98-8	Endosulfan I	µg/kg	0.91	8.9	37000 n [7]	No	No
33213-65-9	Endosulfan II	µg/kg	1.8	17	37000 n [7]	No	No
72-20-8	Endrin	µg/kg	1.8	17	1800 n	No	No
7421-93-4	Endrin Aldehyde	µg/kg	1.8	17	1800 n [8]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.91	8.9	520 c	No	No
1024-57-3	Heptachlor Epoxide	µg/kg	0.91	8.9	53 c	No	No
	Inorganics						
7440-31-5	Tin	mg/kg	10	10	4700 n	No	No

NA = not available
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration

[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for acenaphthene is used
[5] screening level for Aroclor 1254 is used
[6] screening level for hexachlorocyclohexane is used
[7] screening level for endosulfan is used
[8] screening level for endrin is used

TABLE H-1d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 5, 6, AND BEACH AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	5	7.1	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	5	7.1	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	5	7.1	270 c	No	No
75-25-2	Bromoform	µg/kg	5	7.1	61000 c	No	No
74-83-9	Bromomethane	µg/kg	5	7.1	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	5	7.1	610 c	No	No
75-00-3	Chloroethane	µg/kg	5	7.1	1500000 n	No	No
67-66-3	Chloroform	µg/kg	5	7.1	290 c	No	No
74-87-3	Chloromethane	µg/kg	5	7.1	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	5	7.1	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	5	7.1	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	5	7.1	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	5	7.1	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	5	7.1	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	5	7.1	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	5	7.1	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	5	7.1	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	5	7.1	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	5	7.1	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	5	7.1	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	5	7.1	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	5	7.1	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	5	7.1	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	5	7.1	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	5	7.1	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	100	140	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	5	7.1	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	10	14	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	5	7.1	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	5	7.1	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	5	7.1	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	10	14	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	5	7.1	NA	No	No
75-09-2	Methylene chloride	µg/kg	5	7.1	11000 c	No	No
100-42-5	Styrene	µg/kg	5	7.1	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	5	7.1	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	5	7.1	550 c	No	No
108-88-3	Toluene	µg/kg	5	7.1	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	5	7.1	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	5	7.1	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	5	7.1	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	5	7.1	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	5	7.1	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	5	7.1	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	5	7.1	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	5	7.1	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	5	7.1	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	5	7.1	420000 ns	No	No

TABLE H-1d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 5, 6, AND BEACH AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	µg/kg	180	240	340000 n	No	No
208-96-8	Acenaphthylene	µg/kg	180	240	340000 n [4]	No	No
120-12-7	Anthracene	µg/kg	180	240	1700000 n	No	No
1912-24-9	Atrazine	µg/kg	180	240	2100 c	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	180	240	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	180	240	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	180	240	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	180	240	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	180	240	NA	No	No
85-68-7	Butylbenzylphthalate	µg/kg	180	240	260000 c	No	No
105-60-2	Caprolactam	µg/kg	180	240	3100000 n	No	No
86-74-8	Carbazole	µg/kg	180	240	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	180	240	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	180	240	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	88	240	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	180	240	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	180	240	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	180	240	NA	No	No
132-64-9	Dibenzofuran	µg/kg	180	240	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	180	240	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	180	240	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	88	240	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	180	240	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	88	460	490 n	No	No
51-28-5	Dinitrophenol, 2,4-	µg/kg	88	460	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	180	240	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	88	240	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	180	240	NA	No	No
86-73-7	Fluorene	µg/kg	180	240	230000 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	180	240	300 c	No	No
87-68-3	Hexachlorobutadiene	µg/kg	88	240	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	180	240	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	180	240	6100 n	No	No
78-59-1	Isophorone	µg/kg	180	240	510000 c	No	No
91-57-6	Methylnaphthalene, 2-	µg/kg	180	240	31000 n	No	No
95-48-7	Methylphenol, 2-	µg/kg	180	240	310000 n	No	No
106-44-5	Methylphenol, 4-	µg/kg	180	240	31000 n	No	No
91-20-3	Naphthalene	µg/kg	180	240	3600 c	No	No
88-74-4	Nitroaniline, 2-	µg/kg	340	460	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	340	460	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	340	460	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	180	240	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	180	240	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	340	460	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	88	240	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	180	240	99000 c	No	No
87-86-5	Pentachlorophenol	µg/kg	6.9	460	890 c	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	180	240	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	180	240	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	180	240	6100 n	No	No

TABLE H-1d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 5, 6, AND BEACH AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.89	2.4	29 c	No	No
319-84-6	Alpha-BHC	µg/kg	0.89	2.4	77 c	No	No
5103-71-9	Alpha-Chlordane	µg/kg	0.89	2.4	1600 c [5]	No	No
12674-11-2	Aroclor 1016	µg/kg	34	46	390 n	No	No
11104-28-2	Aroclor 1221	µg/kg	34	46	140 c	No	No
11141-16-5	Aroclor 1232	µg/kg	34	46	140 c	No	No
53469-21-9	Aroclor 1242	µg/kg	34	46	220 c	No	No
12672-29-6	Aroclor 1248	µg/kg	34	46	220 c	No	No
11096-82-5	Aroclor 1260	µg/kg	34	46	220 c	No	No
37324-23-5	Aroclor 1262	µg/kg	34	46	110 n [6]	No	No
11100-14-4	Aroclor 1268	µg/kg	34	46	110 n [6]	No	No
8001-35-2	Chlorinated Camphene	µg/kg	62	240	440 c	No	No
72-54-8	DDD, 4,4'-	µg/kg	1.7	4.6	2000 c	No	No
319-86-8	Delta-BHC	µg/kg	0.89	2.4	270 c [7]	No	No
60-57-1	Dieldrin	µg/kg	1.7	4.6	30 c	No	No
959-98-8	Endosulfan I	µg/kg	0.89	2.4	37000 n [8]	No	No
33213-65-9	Endosulfan II	µg/kg	1.7	4.6	37000 n [8]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	1.7	4.6	37000 n [8]	No	No
7421-93-4	Endrin Aldehyde	µg/kg	1.7	4.6	1800 n [9]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.89	2.4	520 c	No	No
5103-74-2	Gamma-Chlordane	µg/kg	0.89	2.4	1600 c [5]	No	No
76-44-8	Heptachlor	µg/kg	0.89	2.4	110 c	No	No
1024-57-3	Heptachlor Epoxide	µg/kg	0.89	2.4	53 c	No	No
72-43-5	Methoxychlor	µg/kg	8.9	24	31000 n	No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for acenaphthene is used
[5] screening level for chlordane is used
[6] screening level for Aroclor 1254 is used
[7] screening level for hexachlorocyclohexane is used
[8] screening level for endosulfan is used
[9] screening level for endrin is used

TABLE H-1e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
UPLAND AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	2.3	8.2	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	2.3	8.2	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	2.3	8.2	270 c	No	No
75-25-2	Bromoform	µg/kg	2.3	8.2	61000 c	No	No
74-83-9	Bromomethane	µg/kg	2.3	8.2	730 n	No	No
78-93-3	Butanone, 2-	µg/kg	4.6	16	2800000 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	2.3	8.2	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	2.3	8.2	29000 n	No	No
75-00-3	Chloroethane	µg/kg	2.3	8.2	1500000 n	No	No
74-87-3	Chloromethane	µg/kg	2.3	8.2	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	2.3	8.2	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	2.3	8.2	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	2.3	8.2	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	2.3	8.2	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	2.3	8.2	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	2.3	8.2	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	2.3	8.2	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	2.3	8.2	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	2.3	8.2	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	2.3	8.2	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	2.3	8.2	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	2.3	8.2	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	2.3	8.2	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	2.3	8.2	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	2.3	8.2	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	2.3	8.2	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	46	160	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	2.3	8.2	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	4.6	16	21000 n	No	No
79-20-9	Methyl Acetate	µg/kg	2.3	8.2	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	2.3	8.2	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	4.6	16	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	2.3	8.2	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	2.3	8.2	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	2.3	8.2	550 c	No	No
108-88-3	Toluene	µg/kg	2.3	8.2	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	2.3	8.2	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	2.3	8.2	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	2.3	8.2	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	2.3	8.2	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	2.3	8.2	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	2.3	8.2	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	2.3	8.2	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	2.3	8.2	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	2.3	8.2	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	2.3	8.2	420000 ns	No	No

TABLE H-1e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
UPLAND AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	180	260	2100 c	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	180	260	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	180	260	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	180	260	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	180	260	NA	No	No
105-60-2	Caprolactam	µg/kg	180	260	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	180	260	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	180	260	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	88	130	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	180	260	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	180	260	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	180	260	NA	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	180	260	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	180	260	18000 n	No	No
84-66-2	Diethylphthalate	µg/kg	180	260	4900000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	88	130	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	180	260	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	88	130	490 n	No	No
51-28-5	Dinitrophenol, 2,4-	µg/kg	88	130	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	180	260	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	88	130	6100 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	180	260	300 c	No	No
87-68-3	Hexachlorobutadiene	µg/kg	88	130	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	180	260	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	180	260	6100 n	No	No
78-59-1	Isophorone	µg/kg	180	260	510000 c	No	No
106-44-5	Methylphenol, 4-	µg/kg	180	260	31000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	340	510	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	340	510	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	340	510	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	180	260	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	180	260	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	340	510	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	88	130	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	180	260	99000 c	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	180	260	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	180	260	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	180	260	6100 n	No	No
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.87	13	29 c	No	No
319-84-6	Alpha-BHC	µg/kg	0.87	13	77 c	No	No
12674-11-2	Aroclor 1016	µg/kg	34	410	390 n	No	**Yes**
11104-28-2	Aroclor 1221	µg/kg	34	410	140 c	No	**Yes**
11141-16-5	Aroclor 1232	µg/kg	34	410	140 c	No	**Yes**
53469-21-9	Aroclor 1242	µg/kg	34	410	220 c	No	**Yes**
12672-29-6	Aroclor 1248	µg/kg	34	410	220 c	No	**Yes**
37324-23-5	Aroclor 1262	µg/kg	34	410	110 n [4]	No	**Yes**
11100-14-4	Aroclor 1268	µg/kg	34	410	110 n [4]	No	**Yes**
319-85-7	Beta-BHC	µg/kg	0.87	13	270 c	No	No

TABLE H-1e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
UPLAND AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]		RL > SL	
			Minimum	Maximum			Minimum	Maximum
	PCBs/Pesticides (continued)							
8001-35-2	Chlorinated Camphene	µg/kg	61	910	440 c		No	**Yes**
319-86-8	Delta-BHC	µg/kg	0.87	13	270 c	[5]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	1.7	25	37000 n	[6]	No	No
7421-93-4	Endrin Aldehyde	µg/kg	1.7	25	1800 n	[7]	No	No
53494-70-5	Endrin Ketone	µg/kg	1.7	25	1800 n	[7]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.87	13	520 c		No	No
76-44-8	Heptachlor	µg/kg	0.87	13	110 c		No	No
1024-57-3	Heptachlor Epoxide	µg/kg	0.87	13	53 c		No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for Aroclor 1254 is used
[5] screening level for hexachlorocyclohexane is used
[6] screening level for endosulfan is used
[7] screening level for endrin is used

TABLE H-1f
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT AREAS 2, 8, AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	2.3	46	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	2.3	46	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	2.3	46	270 c	No	No
75-25-2	Bromoform	µg/kg	2.3	46	61000 c	No	No
74-83-9	Bromomethane	µg/kg	2.3	46	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	2.3	46	610 c	No	No
75-00-3	Chloroethane	µg/kg	2.3	46	1500000 n	No	No
74-87-3	Chloromethane	µg/kg	2.3	46	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	2.3	46	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	2.3	46	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	2.3	46	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	2.3	46	34 c	No	**Yes**
95-50-1	Dichlorobenzene, 1,2-	µg/kg	2.3	46	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	2.3	46	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	2.3	46	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	2.3	46	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.55	46	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	2.3	46	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	2.3	46	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	2.3	46	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	2.3	46	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	2.3	46	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	2.3	46	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	2.3	46	1700 c [2]	No	No
100-41-4	Ethylbenzene	µg/kg	2.3	46	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	4.6	93	21000 n	No	No
79-20-9	Methyl Acetate	µg/kg	2.3	46	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	2.3	46	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	4.6	93	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	2.3	46	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	1.1	46	560 c	No	No
108-88-3	Toluene	µg/kg	2.3	46	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	2.3	46	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	2.3	46	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	2.3	46	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	2.3	46	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	1.1	46	1100 c	No	No
75-01-4	Vinyl Chloride	µg/kg	2.3	46	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	2.3	46	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	2.3	46	420000 ns	No	No
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	98	910	2100 c	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	170	910	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	170	910	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	170	910	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	170	910	NA	No	No
105-60-2	Caprolactam	µg/kg	170	910	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	170	910	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	98	910	2400 c	No	No

TABLE H-1f
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT AREAS 2, 8, AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)						
91-58-7	Chloronaphthalene, 2-	µg/kg	88	910	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	98	910	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	170	910	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	170	910	NA	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	98	910	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	98	910	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	88	910	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	170	910	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	88	1800	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	88	1800	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	98	910	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	88	910	6100 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	98	910	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	88	910	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	170	910	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	170	910	6100 n	No	No
78-59-1	Isophorone	µg/kg	170	910	510000 c	No	No
88-74-4	Nitroaniline, 2-	µg/kg	330	1800	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	330	1800	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	330	1800	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	170	910	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	170	910	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	330	1800	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	88	910	69 c	**Yes**	**Yes**
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	170	910	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	170	910	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	170	910	6100 n	No	No
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.39	13	29 c	No	No
12674-11-2	Aroclor 1016	µg/kg	7.5	410	390 n	No	**Yes**
11104-28-2	Aroclor 1221	µg/kg	7.5	410	140 c	No	**Yes**
11141-16-5	Aroclor 1232	µg/kg	7.5	410	140 c	No	**Yes**
53469-21-9	Aroclor 1242	µg/kg	7.5	410	220 c	No	**Yes**
12672-29-6	Aroclor 1248	µg/kg	7.5	410	220 c	No	**Yes**
37324-23-5	Aroclor 1262	µg/kg	7.5	410	110 n [4]	No	**Yes**
11100-14-4	Aroclor 1268	µg/kg	7.5	410	110 n [4]	No	**Yes**
8001-35-2	Chlorinated Camphene	µg/kg	39	910	440 c	No	**Yes**
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.39	13	520 c	No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for Aroclor 1254 is used

TABLE H-1g
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT AREAS 8 AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	2.3	46	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	2.3	46	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	2.3	46	270 c	No	No
75-25-2	Bromoform	µg/kg	2.3	46	61000 c	No	No
74-83-9	Bromomethane	µg/kg	2.3	46	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	2.3	46	610 c	No	No
75-00-3	Chloroethane	µg/kg	2.3	46	1500000 n	No	No
74-87-3	Chloromethane	µg/kg	2.3	46	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	2.3	46	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	2.3	46	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	2.3	46	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	2.3	46	34 c	No	**Yes**
95-50-1	Dichlorobenzene, 1,2-	µg/kg	2.3	46	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	2.3	46	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	2.3	46	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	2.3	46	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.55	46	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	2.3	46	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	2.3	46	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	2.3	46	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	2.3	46	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	2.3	46	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	2.3	46	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	2.3	46	1700 c [2]	No	No
100-41-4	Ethylbenzene	µg/kg	2.3	46	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	4.6	93	21000 n	No	No
79-20-9	Methyl Acetate	µg/kg	2.3	46	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	2.3	46	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	4.6	93	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	2.3	46	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	1.1	46	560 c	No	No
108-88-3	Toluene	µg/kg	2.3	46	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	2.3	46	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	2.3	46	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	2.3	46	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	2.3	46	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	1.1	46	1100 c	No	No
75-01-4	Vinyl Chloride	µg/kg	2.3	46	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	2.3	46	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	2.3	46	420000 ns	No	No
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	98	910	2100 c	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	120	910	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	120	910	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	120	910	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	120	910	NA	No	No
105-60-2	Caprolactam	µg/kg	120	910	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	120	910	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	98	910	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	88	910	630000 n	No	No

TABLE H-1g
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT AREAS 8 AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)						
95-57-8	Chlorophenol, 2-	µg/kg	98	910	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	170	910	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	120	910	NA	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	98	910	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	98	910	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	88	910	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	120	910	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	88	1800	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	88	1800	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	98	910	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	88	910	6100 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	98	910	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	88	910	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	120	910	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	120	910	6100 n	No	No
78-59-1	Isophorone	µg/kg	120	910	510000 c	No	No
88-74-4	Nitroaniline, 2-	µg/kg	120	1800	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	120	1800	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	120	1800	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	120	910	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	120	910	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	330	1800	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	88	910	69 c	**Yes**	**Yes**
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	120	910	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	120	910	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	120	910	6100 n	No	No
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.39	13	29 c	No	No
12674-11-2	Aroclor 1016	µg/kg	7.5	410	390 n	No	**Yes**
11104-28-2	Aroclor 1221	µg/kg	7.5	410	140 c	No	**Yes**
11141-16-5	Aroclor 1232	µg/kg	7.5	410	140 c	No	**Yes**
53469-21-9	Aroclor 1242	µg/kg	7.5	410	220 c	No	**Yes**
12672-29-6	Aroclor 1248	µg/kg	7.5	410	220 c	No	**Yes**
37324-23-5	Aroclor 1262	µg/kg	7.5	410	110 n [4]	No	**Yes**
11100-14-4	Aroclor 1268	µg/kg	7.5	410	110 n [4]	No	**Yes**
8001-35-2	Chlorinated Camphene	µg/kg	39	910	440 c	No	**Yes**
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.39	13	520 c	No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride

[1] Regional Screening Levels, November 2010 (RSL), for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for Aroclor 1254 is used

TABLE H-1h
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 8 AND 11 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	1	4.2	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	1.8	4.2	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	1.2	4.2	270 c	No	No
75-25-2	Bromoform	µg/kg	1.5	4.2	61000 c	No	No
74-83-9	Bromomethane	µg/kg	2.3	4.2	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	1.6	4.2	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	0.75	4.2	29000 n	No	No
75-00-3	Chloroethane	µg/kg	2	4.2	1500000 n	No	No
67-66-3	Chloroform	µg/kg	2	4.2	290 c	No	No
74-87-3	Chloromethane	µg/kg	1	4.2	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	0.75	4.2	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	2.4	4.2	5.4 c	No	No
124-48-1	Dibromochloromethane	µg/kg	1.8	4.2	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	2	4.2	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	1.9	4.2	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	0.86	4.2	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	1.9	4.2	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	1.4	4.2	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.72	0.46	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	1.1	4.2	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	2.4	4.2	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	1.8	4.2	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	1.5	4.2	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	1.8	4.2	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	1.5	4.2	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	2.2	4.2	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	44	84	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	0.44	4.2	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	5.2	8.4	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	0.77	4.2	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	1.9	4.2	7800000 n	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	2.2	8.4	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	0.89	4.2	NA	No	No
75-09-2	Methylene chloride	µg/kg	1.3	4.2	11000 c	No	No
100-42-5	Styrene	µg/kg	1.2	4.2	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	1.4	0.92	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	1.9	4.2	550 c	No	No
108-88-3	Toluene	µg/kg	0.72	4.2	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	2.4	4.2	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	1.8	4.2	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	1.6	4.2	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	1.3	4.2	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	1.7	0.92	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	2	4.2	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	1.9	4.2	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	1.4	4.2	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	1.9	4.2	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	0.92	4.2	420000 ns	No	No

TABLE H-1h
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 8 AND 11 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	91	330	2100 c	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	180	330	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	180	330	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	180	330	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	180	330	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	180	330	NA	No	No
105-60-2	Caprolactam	µg/kg	180	330	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	180	330	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	91	330	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	93	330	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	91	330	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	180	330	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	180	330	NA	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	91	330	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	91	330	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	180	330	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	93	630	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	91	630	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	91	330	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	91	330	6100 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	91	330	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	93	330	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	180	330	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	180	330	6100 n	No	No
78-59-1	Isophorone	µg/kg	180	330	510000 c	No	No
95-48-7	Methylphenol, 2-	µg/kg	91	330	310000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	350	630	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	350	630	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	350	630	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	180	330	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	180	330	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	350	630	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	93	330	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	180	330	99000 c	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	180	330	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	180	330	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	180	330	6100 n	No	No
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.36	3.3	29 c	No	No
319-84-6	Alpha-BHC	µg/kg	0.36	3.3	77 c	No	No
12674-11-2	Aroclor 1016	µg/kg	7	63	390 n	No	No
11104-28-2	Aroclor 1221	µg/kg	7	63	140 c	No	No
11141-16-5	Aroclor 1232	µg/kg	7	63	140 c	No	No
53469-21-9	Aroclor 1242	µg/kg	7	63	220 c	No	No
12672-29-6	Aroclor 1248	µg/kg	7	63	220 c	No	No
11096-82-5	Aroclor 1260	µg/kg	7	63	220 c	No	No
37324-23-5	Aroclor 1262	µg/kg	7	63	110 n [4]	No	No
11100-14-4	Aroclor 1268	µg/kg	7	63	110 n [4]	No	No
319-85-7	Beta-BHC	µg/kg	0.36	3.3	270 c	No	No
8001-35-2	Chlorinated Camphene	µg/kg	36	330	440 c	No	No

TABLE H-1h
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 8 AND 11 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides (continued)						
72-54-8	DDD, 4,4'-	µg/kg	0.7	6.3	2000 c	No	No
319-86-8	Delta-BHC	µg/kg	0.36	3.3	270 c [5]	No	No
60-57-1	Dieldrin	µg/kg	0.7	6.3	30 c	No	No
959-98-8	Endosulfan I	µg/kg	0.36	3.3	37000 n [6]	No	No
7421-93-4	Endrin Aldehyde	µg/kg	0.7	6.3	1800 n [7]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.36	3.3	520 c	No	No
1024-57-3	Heptachlor Epoxide	µg/kg	0.36	3.3	53 c	No	No
72-43-5	Methoxychlor	µg/kg	3.6	33	31000 n	No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane

[1] Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for Aroclor 1254 is used
[5] screening level for hexachlorocyclohexane is used
[6] screening level for endosulfan is used
[7] screening level for endrin is used

TABLE H-1i
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	1	46	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	1.8	46	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	1.2	46	270 c	No	No
75-25-2	Bromoform	µg/kg	1.5	46	61000 c	No	No
74-83-9	Bromomethane	µg/kg	2.3	46	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	1.6	46	610 c	No	No
75-00-3	Chloroethane	µg/kg	2	46	1500000 n	No	No
74-87-3	Chloromethane	µg/kg	1	46	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	0.75	46	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	2.3	46	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	1.8	46	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	2	46	34 c	No	**Yes**
95-50-1	Dichlorobenzene, 1,2-	µg/kg	1.9	46	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	0.86	46	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	1.9	46	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	1.4	46	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.55	46	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	1.1	46	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	2.3	46	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	1.8	46	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	1.5	46	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	1.8	46	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	1.5	46	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	2.2	46	1700 c [2]	No	No
100-41-4	Ethylbenzene	µg/kg	0.44	46	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	4.6	93	21000 n	No	No
79-20-9	Methyl Acetate	µg/kg	1.9	46	7800000 n	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	2.2	93	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	0.89	46	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	1.1	46	560 c	No	No
108-88-3	Toluene	µg/kg	0.72	46	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	2.3	46	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	1.8	46	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	1.6	46	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	1.3	46	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	1.1	46	1100 c	No	No
75-01-4	Vinyl Chloride	µg/kg	1.4	46	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	1.9	46	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	0.92	46	420000 ns	No	No
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	91	910	2100 c	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	120	910	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	120	910	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	120	910	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	120	910	NA	No	No
105-60-2	Caprolactam	µg/kg	120	910	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	120	910	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	91	910	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	88	910	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	91	910	39000 n	No	No

TABLE H-1i
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]		RL > SL	
			Minimum	Maximum			Minimum	Maximum
	Semi-volatile Organic Compounds (continued)							
58-90-2	Chlorophenols	µg/kg	170	910	180000 n		No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	120	910	NA		No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	91	910	18000 n		No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	88	910	120000 n		No	No
131-11-3	Dimethylphthalate	µg/kg	120	910	NA		No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	88	1800	490 n		No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	88	1800	12000 n		No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	91	910	1600 c		No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	88	910	6100 n		No	No
118-74-1	Hexachlorobenzene	µg/kg	91	910	300 c		No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	88	910	6100 n		No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	120	910	37000 n		No	No
67-72-1	Hexachloroethane	µg/kg	120	910	6100 n		No	No
78-59-1	Isophorone	µg/kg	120	910	510000 c		No	No
88-74-4	Nitroaniline, 2-	µg/kg	120	1800	61000 n		No	No
99-09-2	Nitroaniline, 3-	µg/kg	120	1800	NA		No	No
100-01-6	Nitroaniline, 4-	µg/kg	120	1800	24000 c		No	No
98-95-3	Nitrobenzene	µg/kg	120	910	4800 c		No	No
88-75-5	Nitrophenol, 2-	µg/kg	120	910	NA		No	No
100-02-7	Nitrophenol, 4-	µg/kg	330	1800	NA		No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	88	910	69 c		**Yes**	**Yes**
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	120	910	1800 n		No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	120	910	610000 n		No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	120	910	6100 n		No	No
	PCBs/Pesticides							
309-00-2	Aldrin	µg/kg	0.36	13	29 c		No	No
12674-11-2	Aroclor 1016	µg/kg	7	410	390 n		No	**Yes**
11104-28-2	Aroclor 1221	µg/kg	7	410	140 c		No	**Yes**
11141-16-5	Aroclor 1232	µg/kg	7	410	140 c		No	**Yes**
53469-21-9	Aroclor 1242	µg/kg	7	410	220 c		No	**Yes**
12672-29-6	Aroclor 1248	µg/kg	7	410	220 c		No	**Yes**
37324-23-5	Aroclor 1262	µg/kg	7	410	110 n	(4)	No	**Yes**
11100-14-4	Aroclor 1268	µg/kg	7	410	110 n	(4)	No	**Yes**
8001-35-2	Chlorinated Camphene	µg/kg	36	910	440 c		No	**Yes**
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.36	13	520 c		No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride

(1) Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration

(2) screening level for 1,3-dichloropropene is used

(3) screening level for m-xylene is used

(4) screening level for Aroclor 1254 is used

TABLE H-2
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL UPLAND AREAS SURFACE/SUBSURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	2.3	46	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	2.3	46	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	2.3	46	270 c	No	No
75-25-2	Bromoform	µg/kg	2.3	46	61000 c	No	No
74-83-9	Bromomethane	µg/kg	2.3	46	730 n	No	No
78-93-3	Butanone, 2-	µg/kg	4.6	93	2800000 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	2.3	46	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	2.3	46	29000 n	No	No
75-00-3	Chloroethane	µg/kg	2.3	46	1500000 n	No	No
74-87-3	Chloromethane	µg/kg	2.3	46	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	2.3	46	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	2.3	46	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	2.3	46	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	2.3	46	34 c	No	**Yes**
95-50-1	Dichlorobenzene, 1,2-	µg/kg	2.3	46	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	2.3	46	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	2.3	46	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	2.3	46	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.55	46	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	2.3	46	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	2.3	46	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	2.3	46	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	2.3	46	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	2.3	46	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	2.3	46	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	2.3	46	1700 c [2]	No	No
100-41-4	Ethylbenzene	µg/kg	2.3	46	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	4.6	93	21000 n	No	No
79-20-9	Methyl Acetate	µg/kg	2.3	46	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	2.3	46	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	4.6	93	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	2.3	46	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	1.1	46	560 c	No	No
108-88-3	Toluene	µg/kg	2.3	46	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	2.3	46	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	2.3	46	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	2.3	46	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	2.3	46	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	1.1	46	1100 c	No	No
75-01-4	Vinyl Chloride	µg/kg	2.3	46	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	2.3	46	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	2.3	46	420000 ns	No	No
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	110	990	2100 c	No	No
108-60-1	Bis-Chloroisopropyl ether	µg/kg	120	990	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	120	990	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	120	990	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	110	990	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	88	990	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	110	990	39000 n	No	No

TABLE H-2
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL UPLAND AREAS SURFACE/SUBSURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)						
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	120	990	NA	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	110	990	18000 n	No	No
84-66-2	Diethylphthalate	µg/kg	120	990	4900000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	88	990	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	120	990	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	88	1900	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	88	1900	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	110	990	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	88	990	6100 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	110	990	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	88	990	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	120	990	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	120	990	6100 n	No	No
78-59-1	Isophorone	µg/kg	120	990	510000 c	No	No
106-44-5	Methylphenol, 4-	µg/kg	120	990	31000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	120	1900	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	120	1900	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	120	1900	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	120	990	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	120	990	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	330	1900	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	88	990	69 c	**Yes**	**Yes**
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	120	990	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	120	990	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	120	990	6100 n	No	No
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.42	13	29 c	No	No
12674-11-2	Aroclor 1016	µg/kg	8.2	410	390 n	No	**Yes**
11104-28-2	Aroclor 1221	µg/kg	8.2	410	140 c	No	**Yes**
11141-16-5	Aroclor 1232	µg/kg	8.2	410	140 c	No	**Yes**
53469-21-9	Aroclor 1242	µg/kg	8.2	410	220 c	No	**Yes**
12672-29-6	Aroclor 1248	µg/kg	8.2	410	220 c	No	**Yes**
37324-23-5	Aroclor 1262	µg/kg	8.2	410	110 n [4]	No	**Yes**
11100-14-4	Aroclor 1268	µg/kg	8.2	410	110 n [4]	No	**Yes**
8001-35-2	Chlorinated Camphene	µg/kg	42	910	440 c	No	**Yes**

NA = not available
PCB = polychlorinated biphenyl
µg/kg = micrograms per kilogram
[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for Aroclor 1254 is used

TABLE H-3a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
GROUNDWATER (<10 FEET BGS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL		Maximum Contaminant Level (MCL) [2]	RL > MCL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds									
67-64-1	Acetone	µg/L	5	5	2200 n	No	No	NA	No	No
71-43-2	Benzene	µg/L	0.2	0.2	0.41 c	No	No	5	No	No
74-97-5	Bromochloromethane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-27-4	Bromodichloromethane	µg/L	0.5	0.5	0.12 c	Yes	Yes	80	No	No
75-25-2	Bromoform	µg/L	0.5	0.5	8.5 c	No	No	80	No	No
74-83-9	Bromomethane	µg/L	0.5	0.5	0.87 n	No	No	NA	No	No
78-93-3	Butanone, 2-	µg/L	5	5	710 n	No	No	NA	No	No
75-15-0	Carbon Disulfide	µg/L	0.5	0.5	100 n	No	No	NA	No	No
56-23-5	Carbon tetrachloride	µg/L	0.4	0.4	0.44 c	No	No	5	No	No
108-90-7	Chlorobenzene	µg/L	0.5	0.5	9.1 n	No	No	100	No	No
75-00-3	Chloroethane	µg/L	0.5	0.5	2100 n	No	No	NA	No	No
67-66-3	Chloroform	µg/L	0.5	0.5	0.19 c	Yes	Yes	80	No	No
74-87-3	Chloromethane	µg/L	0.5	0.5	19 n	No	No	NA	No	No
110-82-7	Cyclohexane	µg/L	0.5	0.5	1300 n	No	No	NA	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/L	0.2	0.2	0.00032 c	Yes	Yes	0.2	No	No
124-48-1	Dibromochloromethane	µg/L	0.4	0.4	0.15 c	Yes	Yes	80	No	No
106-93-4	Dibromoethane, 1,2-	µg/L	0.2	0.2	0.0065 c	Yes	Yes	0.05	Yes	Yes
95-50-1	Dichlorobenzene, 1,2-	µg/L	0.5	0.5	37 n	No	No	600	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/L	0.5	0.5	NA	No	No	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/L	0.5	0.5	0.43 c	Yes	Yes	75	No	No
75-71-8	Dichlorodifluoromethane	µg/L	0.5	0.5	39 n	No	No	NA	No	No
75-34-3	Dichloroethane, 1,1-	µg/L	0.5	0.5	2.4 c	No	No	NA	No	No
107-06-2	Dichloroethane, 1,2-	µg/L	0.3	0.3	0.15 c	Yes	Yes	5	No	No
75-35-4	Dichloroethene, 1,1-	µg/L	0.5	0.5	34 n	No	No	7	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/L	0.5	0.5	7.3 n	No	No	70	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/L	0.5	0.5	11 n	No	No	100	No	No
78-87-5	Dichloropropane, 1,2-	µg/L	0.5	0.5	0.39 c	Yes	Yes	5	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/L	0.4	0.4	0.43 c [3]	No	No	NA	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/L	0.4	0.4	0.43 c [3]	No	No	NA	No	No
100-41-4	Ethylbenzene	µg/L	0.5	0.5	1.5 c	No	No	700	No	No
591-78-6	Hexanone, 2-	µg/L	5	5	4.7 n	Yes	Yes	NA	No	No
98-82-8	Isopropylbenzene	µg/L	0.5	0.5	68 n	No	No	NA	No	No
79-20-9	Methyl Acetate	µg/L	0.5	0.5	3700 n	No	No	NA	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/L	0.5	0.5	12 c	No	No	NA	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/L	5	5	200 n	No	No	NA	No	No
108-87-2	Methylcyclohexane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-09-2	Methylene chloride	µg/L	0.5	0.5	4.8 c	No	No	5	No	No
100-42-5	Styrene	µg/L	0.5	0.5	160 n	No	No	100	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/L	0.5	0.5	0.067 c	Yes	Yes	NA	No	No
127-18-4	Tetrachloroethene	µg/L	0.4	0.4	0.11 c	Yes	Yes	5	No	No
108-88-3	Toluene	µg/L	0.5	0.5	230 n	No	No	1000	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/L	0.5	0.5	5900 n	No	No	NA	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/L	0.5	0.5	2.9 n	No	No	NA	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/L	0.5	0.5	0.41 n	Yes	Yes	70	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/L	0.5	0.5	910 n	No	No	200	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/L	0.5	0.5	0.24 c	Yes	Yes	5	No	No
79-01-6	Trichloroethene	µg/L	0.5	0.5	2 c	No	No	5	No	No
75-69-4	Trichlorofluoromethane	µg/L	0.5	0.5	130 n	No	No	NA	No	No
75-01-4	Vinyl Chloride	µg/L	0.2	0.2	0.016 c	Yes	Yes	2	No	No
179601-23-1	Xylene, m,p-	µg/L	0.5	0.5	120 n [4]	No	No	NA	No	No
95-47-6	Xylene, o-	µg/L	0.5	0.5	120 n	No	No	NA	No	No
	Semi-volatile Organic Compounds									
208-96-8	Acenaphthylene	µg/L	5	5	220 n [5]	No	No	NA	No	No
98-86-2	Acetophenone	µg/L	5	5	370 n	No	No	NA	No	No
120-12-7	Anthracene	µg/L	5	5	1100 n	No	No	NA	No	No
1912-24-9	Atrazine	µg/L	3	3	0.29 c	Yes	Yes	3	No	No
100-52-7	Benzaldehyde	µg/L	5	5	370 n	No	No	NA	No	No
50-32-8	Benzo(a)pyrene	µg/L	0.1	0.1	0.0029 c	Yes	Yes	0.2	No	No
205-99-2	Benzo(b)fluoranthene	µg/L	0.1	0.1	0.029 c	Yes	Yes	NA	No	No
191-24-2	Benzo(g,h,i)perylene	µg/L	5	5	110 n [6]	No	No	NA	No	No
207-08-9	Benzo(k)fluoranthene	µg/L	5	5	0.29 c	Yes	Yes	NA	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/L	5	5	11 n	No	No	NA	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/L	0.2	0.2	0.012 c	Yes	Yes	NA	No	No

TABLE H-3a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
GROUNDWATER (<10 FEET BGS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL		Maximum Contaminant Level (MCL) [2]	RL > MCL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)									
108-60-1	Bis-Chloroisopropyl ether	µg/L	5	5	0.32 c	Yes	Yes	NA	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/L	5	5	NA	No	No	NA	No	No
85-68-7	Butylbenzylphthalate	µg/L	5	5	35 c	No	No	NA	No	No
105-60-2	Caprolactam	µg/L	5	5	1800 n	No	No	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/L	5	5	370 n	No	No	NA	No	No
106-47-8	Chloroaniline, 4-	µg/L	5	5	0.34 c	Yes	Yes	NA	No	No
91-58-7	Chloronaphthalene, 2-	µg/L	5	5	290 n	No	No	NA	No	No
95-57-8	Chlorophenol, 2-	µg/L	5	5	18 n	No	No	NA	No	No
58-90-2	Chlorophenols	µg/L	5	5	110 n	No	No	NA	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/L	5	5	NA	No	No	NA	No	No
218-01-9	Chrysene	µg/L	5	5	2.9 c	Yes	Yes	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/L	0.1	0.1	0.0029 c	Yes	Yes	NA	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/L	0.1	0.1	0.15 c	No	No	NA	No	No
120-83-2	Dichlorophenol, 2,4-	µg/L	5	5	11 n	No	No	NA	No	No
84-66-2	Diethylphthalate	µg/L	5	5	2900 n	No	No	NA	No	No
131-11-3	Dimethylphthalate	µg/L	5	5	NA	No	No	NA	No	No
84-74-2	Di-N-Butylphthalate	µg/L	5	5	370 n	No	No	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/L	10	10	0.29 n	Yes	Yes	NA	No	No
51-28-5	Dinitrophenol, 2,4-	µg/L	10	10	7.3 n	Yes	Yes	NA	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/L	0.1	0.1	0.22 c	No	No	NA	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/L	5	5	3.7 n	Yes	Yes	NA	No	No
117-84-0	Di-N-Octyl Phthalate	µg/L	5	5	NA	No	No	NA	No	No
118-74-1	Hexachlorobenzene	µg/L	0.1	0.1	0.042 c	Yes	Yes	1	No	No
87-68-3	Hexachlorobutadiene	µg/L	0.4	0.4	0.86 c	No	No	NA	No	No
77-47-4	Hexachlorocyclopentadiene	µg/L	5	5	22 n	No	No	50	No	No
67-72-1	Hexachloroethane	µg/L	2	2	3.7 n	No	No	NA	No	No
193-39-5	Indeno(1,2,3-Cd)Pyrene	µg/L	5	5	0.029 c	Yes	Yes	NA	No	No
78-59-1	Isophorone	µg/L	5	5	71 c	No	No	NA	No	No
88-74-4	Nitroaniline, 2-	µg/L	10	10	37 n	No	No	NA	No	No
99-09-2	Nitroaniline, 3-	µg/L	10	10	NA	No	No	NA	No	No
100-01-6	Nitroaniline, 4-	µg/L	10	10	3.4 c	Yes	Yes	NA	No	No
98-95-3	Nitrobenzene	µg/L	4	4	0.12 c	Yes	Yes	NA	No	No
88-75-5	Nitrophenol, 2-	µg/L	5	5	NA	No	No	NA	No	No
100-02-7	Nitrophenol, 4-	µg/L	10	10	NA	No	No	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/L	0.1	0.1	0.0096 c	Yes	Yes	NA	No	No
86-30-6	Nitrosodiphenylamine, N-	µg/L	5	5	14 c	No	No	NA	No	No
87-86-5	Pentachlorophenol	µg/L	10	10	0.17 c	Yes	Yes	1	Yes	Yes
108-95-2	Phenol	µg/L	5	5	1100 n	No	No	NA	No	No
129-00-0	Pyrene	µg/L	5	5	110 n	No	No	NA	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/L	5	5	1.1 n	Yes	Yes	NA	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/L	5	5	370 n	No	No	NA	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/L	1	1	3.7 n	No	No	NA	No	No
	PCBs/Pesticides									
309-00-2	Aldrin	µg/L	0.005	0.005	0.004 c	Yes	Yes	NA	No	No
319-84-6	Alpha-BHC	µg/L	0.005	0.005	0.011 c	No	No	NA	No	No
12674-11-2	Aroclor 1016	µg/L	0.05	0.05	0.26 n	No	No	NA	No	No
11104-28-2	Aroclor 1221	µg/L	0.05	0.05	0.0068 c	Yes	Yes	NA	No	No
11141-16-5	Aroclor 1232	µg/L	0.05	0.05	0.0068 c	Yes	Yes	NA	No	No
53469-21-9	Aroclor 1242	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
12672-29-6	Aroclor 1248	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
11097-69-1	Aroclor 1254	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
11096-82-5	Aroclor 1260	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
37324-23-5	Aroclor 1262	µg/L	0.05	0.05	0.034 c [7]	Yes	Yes	NA	No	No
11100-14-4	Aroclor 1268	µg/L	0.05	0.05	0.034 c [7]	Yes	Yes	NA	No	No
319-85-7	Beta-BHC	µg/L	0.02	0.02	0.037 c	No	No	NA	No	No
8001-35-2	Chlorinated Camphene	µg/L	0.5	0.5	0.061 c	Yes	Yes	3	No	No
60-57-1	Dieldrin	µg/L	0.01	0.01	0.0042 c	Yes	Yes	NA	No	No
5103-74-2	Gamma-Chlordane	µg/L	0.01	0.01	0.19 c [8]	No	No	NA	No	No
76-44-8	Heptachlor	µg/L	0.008	0.008	0.015 c	No	No	0.4	No	No
1024-57-3	Heptachlor Epoxide	µg/L	0.005	0.005	0.0074 c	No	No	0.2	No	No

TABLE H-3a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
GROUNDWATER (<10 FEET BGS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL		Maximum Contaminant Level (MCL) [2]	RL > MCL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Inorganics									
18540-29-9	Chromium VI	µg/L	10	10	0.043 c	Yes	Yes	NA	No	No
7439-97-6	Mercury	µg/L	0.2	0.2	1.1 n [9]	No	No	2	No	No

NA = not available
µg/L = micrograms per liter
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
bgs = below ground surface

[1] Regional Screening Levels (RSL), November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.
http://www.epa.gov/region09/waste/sfund/prg/index.htm
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
[2] Maximum Contaminant Level from Regional Screening Levels, November 2010
[3] screening level for 1,3-dichloropropene is used
[4] screening level for m-xylene is used
[5] screening level for acenaphthene is used
[6] screening level for pyrene is used
[7] screening level for Aroclor 1254 is used
[8] screening level for chlordane is used
[9] screening level for mercuric chloride is used

TABLE H-3b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
GROUNDWATER (ALL WELLS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL		Maximum Contaminant Level (MCL) [2]	RL > MCL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds									
67-64-1	Acetone	µg/L	5	5	2200 n	No	No	NA	No	No
71-43-2	Benzene	µg/L	0.2	0.2	0.41 c	No	No	5	No	No
74-97-5	Bromochloromethane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-27-4	Bromodichloromethane	µg/L	0.5	0.5	0.12 c	Yes	Yes	80	No	No
75-25-2	Bromoform	µg/L	0.5	0.5	8.5 c	No	No	80	No	No
74-83-9	Bromomethane	µg/L	0.5	0.5	0.87 n	No	No	NA	No	No
78-93-3	Butanone, 2-	µg/L	5	5	710 n	No	No	NA	No	No
75-15-0	Carbon Disulfide	µg/L	0.5	0.5	100 n	No	No	NA	No	No
56-23-5	Carbon tetrachloride	µg/L	0.4	0.4	0.44 c	No	No	5	No	No
108-90-7	Chlorobenzene	µg/L	0.5	0.5	9.1 n	No	No	100	No	No
75-00-3	Chloroethane	µg/L	0.5	0.5	2100 n	No	No	NA	No	No
67-66-3	Chloroform	µg/L	0.5	0.5	0.19 c	Yes	Yes	80	No	No
74-87-3	Chloromethane	µg/L	0.5	0.5	19 n	No	No	NA	No	No
110-82-7	Cyclohexane	µg/L	0.5	0.5	1300 n	No	No	NA	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/L	0.2	0.2	0.00032 c	Yes	Yes	0.2	No	No
124-48-1	Dibromochloromethane	µg/L	0.4	0.4	0.15 c	Yes	Yes	80	No	No
106-93-4	Dibromoethane, 1,2-	µg/L	0.2	0.2	0.0065 c	Yes	Yes	0.05	Yes	Yes
95-50-1	Dichlorobenzene, 1,2-	µg/L	0.5	0.5	37 n	No	No	600	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/L	0.5	0.5	NA	No	No	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/L	0.5	0.5	0.43 c	Yes	Yes	75	No	No
75-71-8	Dichlorodifluoromethane	µg/L	0.5	0.5	39 n	No	No	NA	No	No
75-34-3	Dichloroethane, 1,1-	µg/L	0.5	0.5	2.4 c	No	No	NA	No	No
107-06-2	Dichloroethane, 1,2-	µg/L	0.3	0.3	0.15 c	Yes	Yes	5	No	No
75-35-4	Dichloroethene, 1,1-	µg/L	0.5	0.5	34 n	No	No	7	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/L	0.5	0.5	7.3 n	No	No	70	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/L	0.5	0.5	11 n	No	No	100	No	No
78-87-5	Dichloropropane, 1,2-	µg/L	0.5	0.5	0.39 c	Yes	Yes	5	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/L	0.4	0.4	0.43 c [3]	No	No	NA	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/L	0.4	0.4	0.43 c [3]	No	No	NA	No	No
100-41-4	Ethylbenzene	µg/L	0.5	0.5	1.5 c	No	No	700	No	No
591-78-6	Hexanone, 2-	µg/L	5	5	4.7 n	Yes	Yes	NA	No	No
98-82-8	Isopropylbenzene	µg/L	0.5	0.5	68 n	No	No	NA	No	No
79-20-9	Methyl Acetate	µg/L	0.5	0.5	3700 n	No	No	NA	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/L	5	5	200 n	No	No	NA	No	No
108-87-2	Methylcyclohexane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-09-2	Methylene chloride	µg/L	0.5	0.5	4.8 c	No	No	5	No	No
100-42-5	Styrene	µg/L	0.5	0.5	160 n	No	No	100	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/L	0.5	0.5	0.067 c	Yes	Yes	NA	No	No
108-88-3	Toluene	µg/L	0.5	0.5	230 n	No	No	1000	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/L	0.5	0.5	5900 n	No	No	NA	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/L	0.5	0.5	2.9 n	No	No	NA	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/L	0.5	0.5	0.41 n	Yes	Yes	70	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/L	0.5	0.5	910 n	No	No	200	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/L	0.5	0.5	0.24 c	Yes	Yes	5	No	No
79-01-6	Trichloroethene	µg/L	0.5	0.5	2 c	No	No	5	No	No
75-69-4	Trichlorofluoromethane	µg/L	0.5	0.5	130 n	No	No	NA	No	No
75-01-4	Vinyl Chloride	µg/L	0.2	0.2	0.016 c	Yes	Yes	2	No	No
179601-23-1	Xylene, m,p-	µg/L	0.5	0.5	120 n [4]	No	No	NA	No	No
95-47-6	Xylene, o-	µg/L	0.5	0.5	120 n	No	No	NA	No	No
	Semi-volatile Organic Compounds									
208-96-8	Acenaphthylene	µg/L	5	5	220 n [5]	No	No	NA	No	No
98-86-2	Acetophenone	µg/L	5	5	370 n	No	No	NA	No	No
120-12-7	Anthracene	µg/L	5	5	1100 n	No	No	NA	No	No
1912-24-9	Atrazine	µg/L	3	3	0.29 c	Yes	Yes	3	No	No
100-52-7	Benzaldehyde	µg/L	5	5	370 n	No	No	NA	No	No
50-32-8	Benzo(a)pyrene	µg/L	0.1	0.1	0.0029 c	Yes	Yes	0.2	No	No
205-99-2	Benzo(b)fluoranthene	µg/L	0.1	0.1	0.029 c	Yes	Yes	NA	No	No
191-24-2	Benzo(g,h,i)perylene	µg/L	5	5	110 n [6]	No	No	NA	No	No
207-08-9	Benzo(k)fluoranthene	µg/L	5	5	0.29 c	Yes	Yes	NA	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/L	5	5	11 n	No	No	NA	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/L	0.2	0.2	0.012 c	Yes	Yes	NA	No	No

TABLE H-3b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
GROUNDWATER (ALL WELLS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL		Maximum Contaminant Level (MCL) [2]	RL > MCL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)									
108-60-1	Bis-Chloroisopropyl ether	µg/L	5	5	0.32 c	Yes	Yes	NA	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/L	5	5	NA	No	No	NA	No	No
85-68-7	Butylbenzylphthalate	µg/L	5	5	35 c	No	No	NA	No	No
105-60-2	Caprolactam	µg/L	5	5	1800 n	No	No	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/L	5	5	370 n	No	No	NA	No	No
106-47-8	Chloroaniline, 4-	µg/L	5	5	0.34 c	Yes	Yes	NA	No	No
91-58-7	Chloronaphthalene, 2-	µg/L	5	5	290 n	No	No	NA	No	No
95-57-8	Chlorophenol, 2-	µg/L	5	5	18 n	No	No	NA	No	No
58-90-2	Chlorophenols	µg/L	5	5	110 n	No	No	NA	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/L	5	5	NA	No	No	NA	No	No
218-01-9	Chrysene	µg/L	5	5	2.9 c	Yes	Yes	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/L	0.1	0.1	0.0029 c	Yes	Yes	NA	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/L	0.1	0.1	0.15 c	No	No	NA	No	No
120-83-2	Dichlorophenol, 2,4-	µg/L	5	5	11 n	No	No	NA	No	No
84-66-2	Diethylphthalate	µg/L	5	5	2900 n	No	No	NA	No	No
131-11-3	Dimethylphthalate	µg/L	5	5	NA	No	No	NA	No	No
84-74-2	Di-N-Butylphthalate	µg/L	5	5	370 n	No	No	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/L	10	10	0.29 n	Yes	Yes	NA	No	No
51-28-5	Dinitrophenol, 2,4-	µg/L	10	10	7.3 n	Yes	Yes	NA	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/L	0.1	0.1	0.22 c	No	No	NA	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/L	5	5	3.7 n	Yes	Yes	NA	No	No
117-84-0	Di-N-Octyl Phthalate	µg/L	5	5	NA	No	No	NA	No	No
118-74-1	Hexachlorobenzene	µg/L	0.1	0.1	0.042 c	Yes	Yes	1	No	No
87-68-3	Hexachlorobutadiene	µg/L	0.4	0.4	0.86 c	No	No	NA	No	No
77-47-4	Hexachlorocyclopentadiene	µg/L	5	5	22 n	No	No	50	No	No
67-72-1	Hexachloroethane	µg/L	2	2	3.7 n	No	No	NA	No	No
193-39-5	Indeno(1,2,3-Cd)Pyrene	µg/L	5	5	0.029 c	Yes	Yes	NA	No	No
78-59-1	Isophorone	µg/L	5	5	71 c	No	No	NA	No	No
88-74-4	Nitroaniline, 2-	µg/L	10	10	37 n	No	No	NA	No	No
99-09-2	Nitroaniline, 3-	µg/L	10	10	NA	No	No	NA	No	No
100-01-6	Nitroaniline, 4-	µg/L	10	10	3.4 c	Yes	Yes	NA	No	No
98-95-3	Nitrobenzene	µg/L	4	4	0.12 c	Yes	Yes	NA	No	No
88-75-5	Nitrophenol, 2-	µg/L	5	5	NA	No	No	NA	No	No
100-02-7	Nitrophenol, 4-	µg/L	10	10	NA	No	No	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/L	0.1	0.1	0.0096 c	Yes	Yes	NA	No	No
86-30-6	Nitrosodiphenylamine, N-	µg/L	5	5	14 c	No	No	NA	No	No
87-86-5	Pentachlorophenol	µg/L	10	10	0.17 c	Yes	Yes	1	Yes	Yes
108-95-2	Phenol	µg/L	5	5	1100 n	No	No	NA	No	No
129-00-0	Pyrene	µg/L	5	5	110 n	No	No	NA	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/L	5	5	1.1 n	Yes	Yes	NA	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/L	5	5	370 n	No	No	NA	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/L	1	1	3.7 n	No	No	NA	No	No
	PCBs/Pesticides									
309-00-2	Aldrin	µg/L	0.005	0.005	0.004 c	Yes	Yes	NA	No	No
319-84-6	Alpha-BHC	µg/L	0.005	0.005	0.011 c	No	No	NA	No	No
12674-11-2	Aroclor 1016	µg/L	0.05	0.05	0.26 n	No	No	NA	No	No
11104-28-2	Aroclor 1221	µg/L	0.05	0.05	0.0068 c	Yes	Yes	NA	No	No
11141-16-5	Aroclor 1232	µg/L	0.05	0.05	0.0068 c	Yes	Yes	NA	No	No
53469-21-9	Aroclor 1242	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
12672-29-6	Aroclor 1248	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
11097-69-1	Aroclor 1254	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
11096-82-5	Aroclor 1260	µg/L	0.05	0.05	0.034 c	Yes	Yes	NA	No	No
37324-23-5	Aroclor 1262	µg/L	0.05	0.05	0.034 c [7]	Yes	Yes	NA	No	No
11100-14-4	Aroclor 1268	µg/L	0.05	0.05	0.034 c [7]	Yes	Yes	NA	No	No
319-85-7	Beta-BHC	µg/L	0.02	0.02	0.037 c	No	No	NA	No	No
8001-35-2	Chlorinated Camphene	µg/L	0.5	0.5	0.061 c	Yes	Yes	3	No	No
60-57-1	Dieldrin	µg/L	0.01	0.01	0.0042 c	Yes	Yes	NA	No	No
76-44-8	Heptachlor	µg/L	0.008	0.008	0.015 c	No	No	0.4	No	No

TABLE H-3b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
GROUNDWATER (ALL WELLS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL		Maximum Contaminant Level (MCL) [2]	RL > MCL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Inorganics									
18540-29-9	Chromium VI	µg/L	10	10	0.043 c	Yes	Yes	NA	No	No
7439-97-6	Mercury	µg/L	0.2	0.2	1.1 n [8]	No	No	2	No	No

NA = not available
µg/L = micrograms per liter
PCB = polychlorinated biphenyl
BHC = benzene hexachloride

(1) Regional Screening Levels (RSL), November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.
http://www.epa.gov/region09/waste/sfund/prg/index.htm
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects

(2) Maximum Contaminant Level from Regional Screening Levels, November 2010

(3) screening level for 1,3-dichloropropene is used

(4) screening level for m-xylene is used

(5) screening level for acenaphthene is used

(6) screening level for pyrene is used

(7) screening level for Aroclor 1254 is used

(8) screening level for mercuric chloride is used

TABLE H-4a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Nov 2010 Screening Level (SL) [1]	RL > 2010 SL		June 2011 Screening Level (SL) [2]	RL > 2011 SL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds									
67-64-1	Acetone	µg/L	5	5	2200 n	No	No	NA	No	No
71-43-2	Benzene	µg/L	0.5	0.5	0.41 c	Yes	Yes	57.7 c	No	No
74-97-5	Bromochloromethane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-27-4	Bromodichloromethane	µg/L	0.5	0.5	0.12 c	Yes	Yes	87.1 c	No	No
75-25-2	Bromoform	µg/L	0.5	0.5	8.5 c	No	No	NA	No	No
74-83-9	Bromomethane	µg/L	0.5	0.5	0.87 n	No	No	NA	No	No
78-93-3	Butanone, 2-	µg/L	5	5	710 n	No	No	NA	No	No
75-15-0	Carbon Disulfide	µg/L	0.5	0.5	100 n	No	No	NA	No	No
56-23-5	Carbon tetrachloride	µg/L	0.5	0.5	0.44 c	Yes	Yes	29.8 c	No	No
108-90-7	Chlorobenzene	µg/L	0.5	0.5	9.1 n	No	No	NA	No	No
75-00-3	Chloroethane	µg/L	0.5	0.5	2100 n	No	No	NA	No	No
67-66-3	Chloroform	µg/L	0.5	0.5	0.19 c	Yes	Yes	151 c	No	No
74-87-3	Chloromethane	µg/L	0.5	0.5	19 n	No	No	NA	No	No
110-82-7	Cyclohexane	µg/L	0.5	0.5	1300 n	No	No	NA	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/L	0.5	0.5	0.00032 c	Yes	Yes	0.594 c	No	No
124-48-1	Dibromochloromethane	µg/L	0.5	0.5	0.15 c	Yes	Yes	65.9 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/L	0.5	0.5	0.0065 c	Yes	Yes	3.03 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/L	0.5	0.5	37 n	No	No	NA	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/L	0.5	0.5	NA	No	No	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/L	0.5	0.5	0.43 c	Yes	Yes	162 c	No	No
75-71-8	Dichlorodifluoromethane	µg/L	0.5	0.5	39 n	No	No	NA	No	No
75-34-3	Dichloroethane, 1,1-	µg/L	0.5	0.5	2.4 c	No	No	NA	No	No
107-06-2	Dichloroethane, 1,2-	µg/L	0.5	0.5	0.15 c	Yes	Yes	71.1 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/L	0.5	0.5	34 n	No	No	NA	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/L	0.5	0.5	7.3 n	No	No	NA	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/L	0.5	0.5	11 n	No	No	NA	No	No
78-87-5	Dichloropropane, 1,2-	µg/L	0.5	0.5	0.39 c	Yes	Yes	125 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/L	0.5	0.5	0.43 c [3]	Yes	Yes	42.5 c [3]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/L	0.5	0.5	0.43 c [3]	Yes	Yes	42.5 c [3]	No	No
591-78-6	Hexanone, 2-	µg/L	5	5	4.7 n	Yes	Yes	299 n	No	No
98-82-8	Isopropylbenzene	µg/L	0.5	0.5	68 n	No	No	NA	No	No
79-20-9	Methyl Acetate	µg/L	0.5	0.5	3700 n	No	No	NA	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/L	0.5	0.5	12 c	No	No	NA	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/L	5	5	200 n	No	No	NA	No	No
108-87-2	Methylcyclohexane	µg/L	0.5	0.5	NA	No	No	NA	No	No
100-42-5	Styrene	µg/L	0.5	0.5	160 n	No	No	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/L	0.5	0.5	0.067 c	Yes	Yes	18.8 c	No	No
127-18-4	Tetrachloroethene	µg/L	0.5	0.5	0.11 c	Yes	Yes	1.92 c	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/L	0.5	0.5	5900 n	No	No	NA	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/L	0.5	0.5	2.9 n	No	No	NA	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/L	0.5	0.5	0.41 n	Yes	Yes	16.1 c	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/L	0.5	0.5	910 n	No	No	NA	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/L	0.5	0.5	0.24 c	Yes	Yes	93.2 c	No	No
79-01-6	Trichloroethene	µg/L	0.5	0.5	2 c	No	No	NA	No	No
75-69-4	Trichlorofluoromethane	µg/L	0.5	0.5	130 n	No	No	NA	No	No
75-01-4	Vinyl Chloride	µg/L	0.5	0.5	0.016 c	Yes	Yes	0.156 c	Yes	Yes
	Semi-volatile Organic Compounds									
83-32-9	Acenaphthene	µg/L	5	5	220 n	No	No	NA	No	No
208-96-8	Acenaphthylene	µg/L	5	5	220 n [4]	No	No	NA	No	No
98-86-2	Acetophenone	µg/L	5	5	370 n	No	No	NA	No	No
120-12-7	Anthracene	µg/L	5	5	1100 n	No	No	NA	No	No
1912-24-9	Atrazine	µg/L	5	5	0.29 c	Yes	Yes	16 c	No	No
100-52-7	Benzaldehyde	µg/L	5	5	370 n	No	No	NA	No	No
50-32-8	Benzo(a)pyrene	µg/L	0.05	0.05	0.0029 c	Yes	Yes	0.259 c	No	No
191-24-2	Benzo(g,h,i)perylene	µg/L	5	5	110 n [5]	No	No	NA	No	No
207-08-9	Benzo(k)fluoranthene	µg/L	0.1	0.1	0.29 c	No	No	NA	No	No
92-52-4	Biphenyl, 1,1'-	µg/L	5	5	180 n	No	No	NA	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/L	5	5	11 n	No	No	NA	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/L	0.05	0.05	0.012 c	Yes	Yes	7.53 c	No	No
117-81-7	Bis(2-Ethylhexyl)phthalate	µg/L	1	1	4.8 c	No	No	NA	No	No
108-60-1	Bis-Chloroisopropyl ether	µg/L	5	5	0.32 c	Yes	Yes	49.4 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/L	5	5	NA	No	No	NA	No	No
85-68-7	Butylbenzylphthalate	µg/L	5	5	35 c	No	No	NA	No	No
105-60-2	Caprolactam	µg/L	5	5	1800 n	No	No	NA	No	No

TABLE H-4a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Nov 2010 Screening Level (SL) [1]	RL > 2010 SL		June 2011 Screening Level (SL) [2]	RL > 2011 SL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)									
86-74-8	Carbazole	µg/L	5	5	NA	No	No	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/L	5	5	370 n	No	No	NA	No	No
106-47-8	Chloroaniline, 4-	µg/L	5	5	0.34 c	Yes	Yes	27.4 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/L	5	5	290 n	No	No	NA	No	No
95-57-8	Chlorophenol, 2-	µg/L	5	5	18 n	No	No	NA	No	No
58-90-2	Chlorophenols	µg/L	5	5	110 n	No	No	NA	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/L	5	5	NA	No	No	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/L	0.05	0.05	0.0029 c	Yes	Yes	0.259 c	No	No
132-64-9	Dibenzofuran	µg/L	5	5	3.7 n	Yes	Yes	3.17 n	Yes	Yes
91-94-1	Dichlorobenzidine, 3,3`-	µg/L	0.05	0.05	0.15 c	No	No	NA	No	No
120-83-2	Dichlorophenol, 2,4-	µg/L	5	5	11 n	No	No	NA	No	No
84-66-2	Diethylphthalate	µg/L	5	5	2900 n	No	No	NA	No	No
105-67-9	Dimethylphenol, 2,4-	µg/L	5	5	73 n	No	No	NA	No	No
131-11-3	Dimethylphthalate	µg/L	5	5	NA	No	No	NA	No	No
84-74-2	Di-N-Butylphthalate	µg/L	5	5	370 n	No	No	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/L	10	10	0.29 n	Yes	Yes	3.75 n	Yes	Yes
51-28-5	Dinitrophenol, 2,4-	µg/L	10	10	7.3 n	Yes	Yes	126 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/L	0.11	0.11	0.22 c	No	No	NA	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/L	5	5	3.7 n	Yes	Yes	45.4 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/L	5	5	NA	No	No	NA	No	No
206-44-0	Fluoranthene	µg/L	5	5	150 n	No	No	NA	No	No
86-73-7	Fluorene	µg/L	5	5	150 n	No	No	NA	No	No
118-74-1	Hexachlorobenzene	µg/L	0.05	0.05	0.042 c	Yes	Yes	7.81 c	No	No
87-68-3	Hexachlorobutadiene	µg/L	0.44	0.44	0.86 c	No	No	NA	No	No
77-47-4	Hexachlorocyclopentadiene	µg/L	5	5	22 n	No	No	NA	No	No
67-72-1	Hexachloroethane	µg/L	1.4	1.4	3.7 n	No	No	NA	No	No
193-39-5	Indeno(1,2,3-cd)pyrene	µg/L	0.05	0.05	0.029 c	Yes	Yes	2.59 c	No	No
78-59-1	Isophorone	µg/L	5	5	71 c	No	No	NA	No	No
91-57-6	Methylnaphthalene, 2-	µg/L	5	5	15 n	No	No	NA	No	No
95-48-7	Methylphenol, 2-	µg/L	5	5	180 n	No	No	NA	No	No
106-44-5	Methylphenol, 4-	µg/L	5	5	18 n	No	No	NA	No	No
91-20-3	Naphthalene	µg/L	5	5	0.14 c	Yes	Yes	164 n	No	No
88-74-4	Nitroaniline, 2-	µg/L	10	10	37 n	No	No	NA	No	No
99-09-2	Nitroaniline, 3-	µg/L	10	10	NA	No	No	NA	No	No
100-01-6	Nitroaniline, 4-	µg/L	10	10	3.4 c	Yes	Yes	266 n	No	No
98-95-3	Nitrobenzene	µg/L	5	5	0.12 c	Yes	Yes	90.8 n	No	No
88-75-5	Nitrophenol, 2-	µg/L	5	5	NA	No	No	NA	No	No
100-02-7	Nitrophenol, 4-	µg/L	10	10	NA	No	No	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/L	0.05	0.05	0.0096 c	Yes	Yes	1.11 c	No	No
86-30-6	Nitrosodiphenylamine, N-	µg/L	3.3	3.3	14 c	No	No	NA	No	No
87-86-5	Pentachlorophenol	µg/L	0.2	0.2	0.17 c	Yes	Yes	0.426 c	No	No
85-01-8	Phenanthrene	µg/L	5	5	1100 n [6]	No	No	NA	No	No
108-95-2	Phenol	µg/L	5	5	1100 n	No	No	NA	No	No
129-00-0	Pyrene	µg/L	5	5	110 n	No	No	NA	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/L	0.97	0.97	1.1 n	No	No	NA	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/L	5	5	370 n	No	No	NA	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/L	0.58	0.58	3.7 n	No	No	NA	No	No
	PCBs/Pesticides									
309-00-2	Aldrin	µg/L	0.05	0.05	0.004 c	Yes	Yes	0.735 c	No	No
319-84-6	Alpha-BHC	µg/L	0.05	0.05	0.011 c	Yes	Yes	0.135 c	No	No
5103-71-9	Alpha-Chlordane	µg/L	0.05	0.05	0.19 c [7]	No	No	NA	No	No
12674-11-2	Aroclor 1016	µg/L	1	1	0.26 n	Yes	Yes	7.49 n	No	No
11104-28-2	Aroclor 1221	µg/L	1	1	0.0068 c	Yes	Yes	0.114 c	Yes	Yes
11141-16-5	Aroclor 1232	µg/L	1	1	0.0068 c	Yes	Yes	0.114 c	Yes	Yes
53469-21-9	Aroclor 1242	µg/L	1	1	0.034 c	Yes	Yes	6.25 c	No	No
12672-29-6	Aroclor 1248	µg/L	1	1	0.034 c	Yes	Yes	6.25 c	No	No
11097-69-1	Aroclor 1254	µg/L	1	1	0.034 c	Yes	Yes	2.14 n	No	No
11096-82-5	Aroclor 1260	µg/L	1	1	0.034 c	Yes	Yes	6.25 c	No	No
37324-23-5	Aroclor 1262	µg/L	1	1	0.034 c [8]	Yes	Yes	2.14 n	No	No
11100-14-4	Aroclor 1268	µg/L	1	1	0.034 c [8]	Yes	Yes	2.14 n	No	No
319-85-7	Beta-BHC	µg/L	0.05	0.05	0.037 c	Yes	Yes	0.471 c	No	No
8001-35-2	Chlorinated Camphene	µg/L	5	5	0.061 c	Yes	Yes	0.165 c	Yes	Yes
72-54-8	DDD, 4,4'-	µg/L	0.1	0.1	0.28 c	No	No	NA	No	No
72-55-9	DDE, 4,4'-	µg/L	0.1	0.1	0.2 c	No	No	NA	No	No

TABLE H-4a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Nov 2010 Screening Level (SL) [1]	RL > 2010 SL		June 2011 Screening Level (SL) [2]	RL > 2011 SL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides (continued)									
50-29-3	DDT, 4,4'-	µg/L	0.1	0.1	0.2 c	No	No	NA	No	No
319-86-8	Delta-BHC	µg/L	0.05	0.05	0.037 c [9]	Yes	Yes	0.471 c [9]	No	No
60-57-1	Dieldrin	µg/L	0.1	0.1	0.0042 c	Yes	Yes	0.022 c	Yes	Yes
959-98-8	Endosulfan I	µg/L	0.05	0.05	22 n [10]	No	No	NA	No	No
33213-65-9	Endosulfan II	µg/L	0.1	0.1	22 n [10]	No	No	NA	No	No
1031-07-8	Endosulfan Sulfate	µg/L	0.1	0.1	22 n [10]	No	No	NA	No	No
72-20-8	Endrin	µg/L	0.1	0.1	1.1 n	No	No	NA	No	No
7421-93-4	Endrin Aldehyde	µg/L	0.1	0.1	1.1 n [11]	No	No	NA	No	No
53494-70-5	Endrin Ketone	µg/L	0.1	0.1	1.1 n [11]	No	No	NA	No	No
58-89-9	Gamma-BHC (Lindane)	µg/L	0.05	0.05	0.061 c	No	No	NA	No	No
5103-74-2	Gamma-Chlordane	µg/L	0.05	0.05	0.19 c [7]	No	No	NA	No	No
76-44-8	Heptachlor	µg/L	0.05	0.05	0.015 c	Yes	Yes	0.0191 c	Yes	Yes
1024-57-3	Heptachlor Epoxide	µg/L	0.05	0.05	0.0074 c	Yes	Yes	0.0564 c	No	No
72-43-5	Methoxychlor	µg/L	0.5	0.5	18 n	No	No	NA	No	No
	Inorganics									
18540-29-9	Chromium VI	µg/L	10	10	0.043 c	Yes	Yes	0.4 c	Yes	Yes
7439-97-6	Mercury	µg/L	0.1	0.1	1.1 n [12]	No	No	NA	No	No
7440-28-0	Thallium	µg/L	0.075	250	NA	No	No	NA	No	No

NA = not available
µg/L = micrograms per liter
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

[1] Regional Screening Levels (RSL), November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.
http://www.epa.gov/region09/waste/sfund/prg/index.html
[2] Regional Screening Levels, June 2011, using site-specific parameter for recreational surface water based on a cancer risk of 1E-6 and hazard quotient of 0.1.
http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
[3] screening level for 1,3-dichloropropene is used
[4] screening level for acenaphthene is used
[5] screening level for pyrene is used
[6] screening level for anthracene is used
[7] screening level for chlordane is used
[8] screening level for Aroclor 1254 is used
[9] screening level for hexachlorocyclohexane is used
[10] screening level for endosulfan is used
[11] screening level for endrin is used
[12] screening level for mercuric chloride is used

TABLE H-4b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
WETLAND AREA OF AREA 9 SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Nov 2010 Screening Level (SL) [1]	RL > 2010 SL		June 2011 Screening Level (SL) [2]	RL > 2011 SL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds									
67-64-1	Acetone	µg/L	5	5	2200 n	No	No	NA	No	No
71-43-2	Benzene	µg/L	0.15	0.15	0.41 c	No	No	NA	No	No
74-97-5	Bromochloromethane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-27-4	Bromodichloromethane	µg/L	0.5	0.5	0.12 c	Yes	Yes	87.1 c	No	No
75-25-2	Bromoform	µg/L	0.5	0.5	8.5 c	No	No	NA	No	No
74-83-9	Bromomethane	µg/L	0.5	0.5	0.87 n	No	No	NA	No	No
78-93-3	Butanone, 2-	µg/L	5	5	710 n	No	No	NA	No	No
75-15-0	Carbon Disulfide	µg/L	0.5	0.5	100 n	No	No	NA	No	No
56-23-5	Carbon tetrachloride	µg/L	0.3	0.3	0.44 c	No	No	NA	No	No
108-90-7	Chlorobenzene	µg/L	0.5	0.5	9.1 n	No	No	NA	No	No
75-00-3	Chloroethane	µg/L	0.5	0.5	2100 n	No	No	NA	No	No
74-87-3	Chloromethane	µg/L	0.5	0.5	19 n	No	No	NA	No	No
110-82-7	Cyclohexane	µg/L	0.5	0.5	1300 n	No	No	NA	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/L	0.5	0.5	0.00032 c	Yes	Yes	0.594 c	No	No
124-48-1	Dibromochloromethane	µg/L	0.4	0.4	0.15 c	Yes	Yes	65.9 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/L	0.5	0.5	0.0065 c	Yes	Yes	3.03 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/L	0.5	0.5	37 n	No	No	NA	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/L	0.5	0.5	NA	No	No	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/L	0.5	0.5	0.43 c	Yes	Yes	162 c	No	No
75-71-8	Dichlorodifluoromethane	µg/L	0.5	0.5	39 n	No	No	NA	No	No
75-34-3	Dichloroethane, 1,1-	µg/L	0.5	0.5	2.4 c	No	No	NA	No	No
107-06-2	Dichloroethane, 1,2-	µg/L	0.29	0.29	0.15 c	Yes	Yes	71.1 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/L	0.5	0.5	34 n	No	No	NA	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/L	0.5	0.5	7.3 n	No	No	NA	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/L	0.5	0.5	11 n	No	No	NA	No	No
78-87-5	Dichloropropane, 1,2-	µg/L	0.5	0.5	0.39 c	Yes	Yes	125 c	No	No
542-75-6	Dichloropropylene, 1,3-	µg/L	0.34	0.34	0.43 c	No	No	NA	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/L	0.5	0.5	0.43 c [3]	Yes	Yes	42.5 c [3]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/L	0.5	0.5	0.43 c [3]	Yes	Yes	42.5 c [3]	No	No
100-41-4	Ethylbenzene	µg/L	0.5	0.5	1.5 c	No	No	NA	No	No
591-78-6	Hexanone, 2-	µg/L	5	5	4.7 n	Yes	Yes	299 n	No	No
98-82-8	Isopropylbenzene	µg/L	0.5	0.5	68 n	No	No	NA	No	No
79-20-9	Methyl Acetate	µg/L	0.5	0.5	3700 n	No	No	NA	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/L	0.5	0.5	12 c	No	No	NA	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/L	5	5	200 n	No	No	NA	No	No
108-87-2	Methylcyclohexane	µg/L	0.5	0.5	NA	No	No	NA	No	No
75-09-2	Methylene chloride	µg/L	0.5	0.5	4.8 c	No	No	NA	No	No
100-42-5	Styrene	µg/L	0.5	0.5	160 n	No	No	NA	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/L	0.5	0.5	0.067 c	Yes	Yes	18.8 c	No	No
127-18-4	Tetrachloroethene	µg/L	0.34	0.34	0.11 c	Yes	Yes	1.92 c	No	No
108-88-3	Toluene	µg/L	0.5	0.5	230 n	No	No	NA	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/L	0.5	0.5	5900 n	No	No	NA	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/L	0.5	0.5	2.9 n	No	No	NA	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/L	0.5	0.5	0.41 n	Yes	Yes	16.1 c	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/L	0.5	0.5	910 n	No	No	NA	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/L	0.5	0.5	0.24 c	Yes	Yes	93.2 c	No	No
79-01-6	Trichloroethene	µg/L	0.5	0.5	2 c	No	No	NA	No	No
75-69-4	Trichlorofluoromethane	µg/L	0.5	0.5	130 n	No	No	NA	No	No
75-01-4	Vinyl Chloride	µg/L	0.5	0.5	0.016 c	Yes	Yes	0.156 c	Yes	Yes
179601-23-1	Xylene, m,p-	µg/L	0.5	0.5	120 n [5]	No	No	NA	No	No
95-47-6	Xylene, o-	µg/L	0.5	0.5	120 n	No	No	NA	No	No
	Semi-volatile Organic Compounds									
83-32-9	Acenaphthene	µg/L	5	5	220 n	No	No	NA	No	No
208-96-8	Acenaphthylene	µg/L	5	5	220 n [5]	No	No	NA	No	No
98-86-2	Acetophenone	µg/L	5	5	370 n	No	No	NA	No	No
120-12-7	Anthracene	µg/L	5	5	1100 n	No	No	NA	No	No
1912-24-9	Atrazine	µg/L	5	5	0.29 c	Yes	Yes	16 c	No	No
100-52-7	Benzaldehyde	µg/L	5	5	370 n	No	No	NA	No	No
50-32-8	Benzo(a)pyrene	µg/L	0.05	0.05	0.0029 c	Yes	Yes	0.259 c	No	No
205-99-2	Benzo(b)fluoranthene	µg/L	0.05	0.05	0.029 c	Yes	Yes	2.59 c	No	No
191-24-2	Benzo(g,h,i)perylene	µg/L	5	5	110 n [6]	No	No	NA	No	No
207-08-9	Benzo(k)fluoranthene	µg/L	0.1	0.1	0.29 c	No	No	NA	No	No
92-52-4	Biphenyl, 1,1'-	µg/L	5	5	180 n	No	No	NA	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/L	5	5	11 n	No	No	NA	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/L	0.05	0.05	0.012 c	Yes	Yes	7.53 c	No	No

TABLE H-4b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
WETLAND AREA OF AREA 9 SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Nov 2010 Screening Level (SL) [1]	RL > 2010 SL		June 2011 Screening Level (SL) [2]	RL > 2011 SL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds (continued)									
108-60-1	Bis-Chloroisopropyl ether	µg/L	5	5	0.32 c	Yes	Yes	49.4 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/L	5	5	NA	No	No	NA	No	No
85-68-7	Butylbenzylphthalate	µg/L	5	5	35 c	No	No	NA	No	No
105-60-2	Caprolactam	µg/L	5	5	1800 n	No	No	NA	No	No
86-74-8	Carbazole	µg/L	5	5	NA	No	No	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/L	5	5	370 n	No	No	NA	No	No
106-47-8	Chloroaniline, 4-	µg/L	5	5	0.34 c	Yes	Yes	27.4 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/L	5	5	290 n	No	No	NA	No	No
95-57-8	Chlorophenol, 2-	µg/L	5	5	18 n	No	No	NA	No	No
58-90-2	Chlorophenols	µg/L	5	5	110 n	No	No	NA	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/L	5	5	NA	No	No	NA	No	No
218-01-9	Chrysene	µg/L	0.1	0.1	2.9 c	No	No	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/L	0.05	0.05	0.0029 c	Yes	Yes	0.259 c	No	No
132-64-9	Dibenzofuran	µg/L	5	5	3.7 n	Yes	Yes	3.17 n	Yes	Yes
120-83-2	Dichlorophenol, 2,4-	µg/L	5	5	11 n	No	No	NA	No	No
84-66-2	Diethylphthalate	µg/L	5	5	2900 n	No	No	NA	No	No
105-67-9	Dimethylphenol, 2,4-	µg/L	5	5	73 n	No	No	NA	No	No
131-11-3	Dimethylphthalate	µg/L	5	5	NA	No	No	NA	No	No
84-74-2	Di-N-Butylphthalate	µg/L	5	5	370 n	No	No	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/L	10	10	0.29 n	Yes	Yes	3.75 n	Yes	Yes
51-28-5	Dinitrophenol, 2,4-	µg/L	10	10	7.3 n	Yes	Yes	126 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/L	0.11	0.11	0.22 c	No	No	NA	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/L	5	5	3.7 n	Yes	Yes	45.4 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/L	5	5	NA	No	No	NA	No	No
206-44-0	Fluoranthene	µg/L	5	5	150 n	No	No	NA	No	No
86-73-7	Fluorene	µg/L	5	5	150 n	No	No	NA	No	No
118-74-1	Hexachlorobenzene	µg/L	0.05	0.05	0.042 c	Yes	Yes	7.81 c	No	No
87-68-3	Hexachlorobutadiene	µg/L	0.44	0.44	0.86 c	No	No	NA	No	No
77-47-4	Hexachlorocyclopentadiene	µg/L	5	5	22 n	No	No	NA	No	No
67-72-1	Hexachloroethane	µg/L	1.4	1.4	3.7 n	No	No	NA	No	No
193-39-5	Indeno(1,2,3-Cd)Pyrene	µg/L	0.05	0.05	0.029 c	Yes	Yes	2.59 c	No	No
78-59-1	Isophorone	µg/L	5	5	71 c	No	No	NA	No	No
91-57-6	Methylnaphthalene, 2-	µg/L	5	5	15 n	No	No	NA	No	No
95-48-7	Methylphenol, 2-	µg/L	5	5	180 n	No	No	NA	No	No
106-44-5	Methylphenol, 4-	µg/L	5	5	18 n	No	No	NA	No	No
91-20-3	Naphthalene	µg/L	5	5	0.14 c	Yes	Yes	164 n	No	No
88-74-4	Nitroaniline, 2-	µg/L	10	10	37 n	No	No	NA	No	No
99-09-2	Nitroaniline, 3-	µg/L	10	10	NA	No	No	NA	No	No
100-01-6	Nitroaniline, 4-	µg/L	10	10	3.4 c	Yes	Yes	266 n	No	No
98-95-3	Nitrobenzene	µg/L	5	5	0.12 c	Yes	Yes	90.8 n	No	No
88-75-5	Nitrophenol, 2-	µg/L	5	5	NA	No	No	NA	No	No
100-02-7	Nitrophenol, 4-	µg/L	10	10	NA	No	No	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/L	0.05	0.05	0.0096 c	Yes	Yes	1.11 c	No	No
86-30-6	Nitrosodiphenylamine, N-	µg/L	3.3	3.3	14 c	No	No	NA	No	No
85-01-8	Phenanthrene	µg/L	5	5	1100 n [7]	No	No	NA	No	No
108-95-2	Phenol	µg/L	5	5	1100 n	No	No	NA	No	No
129-00-0	Pyrene	µg/L	5	5	110 n	No	No	NA	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/L	0.97	0.97	1.1 n	No	No	NA	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/L	5	5	370 n	No	No	NA	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/L	0.58	0.58	3.7 n	No	No	NA	No	No
	PCBs/Pesticides									
309-00-2	Aldrin	µg/L	0.05	0.05	0.004 c	Yes	Yes	0.735 c	No	No
319-84-6	Alpha-BHC	µg/L	0.05	0.05	0.011 c	Yes	Yes	0.135 c	No	No
5103-71-9	Alpha-Chlordane	µg/L	0.05	0.05	0.19 c [8]	No	No	NA	No	No
12674-11-2	Aroclor 1016	µg/L	1	1	0.26 n	Yes	Yes	7.49 n	No	No
11104-28-2	Aroclor 1221	µg/L	1	1	0.0068 c	Yes	Yes	0.114 c	Yes	Yes
11141-16-5	Aroclor 1232	µg/L	1	1	0.0068 c	Yes	Yes	0.114 c	Yes	Yes
53469-21-9	Aroclor 1242	µg/L	1	1	0.034 c	Yes	Yes	6.25 c	No	No
12672-29-6	Aroclor 1248	µg/L	1	1	0.034 c	Yes	Yes	6.25 c	No	No
11097-69-1	Aroclor 1254	µg/L	1	1	0.034 c	Yes	Yes	2.14 n	No	No
11096-82-5	Aroclor 1260	µg/L	1	1	0.034 c	Yes	Yes	6.25 c	No	No
37324-23-5	Aroclor 1262	µg/L	1	1	0.034 c [9]	Yes	Yes	2.14 n	No	No
11100-14-4	Aroclor 1268	µg/L	1	1	0.034 c [9]	Yes	Yes	2.14 n	No	No
319-85-7	Beta-BHC	µg/L	0.05	0.05	0.037 c	Yes	Yes	0.471 c	No	No
8001-35-2	Chlorinated Camphene	µg/L	5	5	0.061 c	Yes	Yes	0.165 c	Yes	Yes

TABLE H-4b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
WETLAND AREA OF AREA 9 SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Nov 2010 Screening Level (SL) [1]	RL > 2010 SL		June 2011 Screening Level (SL) [2]	RL > 2011 SL	
			Minimum	Maximum		Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides (continued)									
72-54-8	DDD, 4,4'-	µg/L	0.1	0.1	0.28 c	No	No	NA	No	No
72-55-9	DDE, 4,4'-	µg/L	0.1	0.1	0.2 c	No	No	NA	No	No
50-29-3	DDT, 4,4'-	µg/L	0.1	0.1	0.2 c	No	No	NA	No	No
319-86-8	Delta-BHC	µg/L	0.05	0.05	0.037 c [10]	Yes	Yes	0.471 c [10]	No	No
60-57-1	Dieldrin	µg/L	0.1	0.1	0.0042 c	Yes	Yes	0.022 c	Yes	Yes
959-98-8	Endosulfan I	µg/L	0.05	0.05	22 n [11]	No	No	NA	No	No
33213-65-9	Endosulfan II	µg/L	0.1	0.1	22 n [11]	No	No	NA	No	No
1031-07-8	Endosulfan Sulfate	µg/L	0.1	0.1	22 n [11]	No	No	NA	No	No
72-20-8	Endrin	µg/L	0.1	0.1	1.1 n	No	No	NA	No	No
7421-93-4	Endrin Aldehyde	µg/L	0.1	0.1	1.1 n [12]	No	No	NA	No	No
53494-70-5	Endrin Ketone	µg/L	0.1	0.1	1.1 n [12]	No	No	NA	No	No
58-89-9	Gamma-BHC (Lindane)	µg/L	0.05	0.05	0.061 c	No	No	NA	No	No
5103-74-2	Gamma-Chlordane	µg/L	0.05	0.05	0.19 c [8]	No	No	NA	No	No
76-44-8	Heptachlor	µg/L	0.05	0.05	0.015 c	Yes	Yes	0.0191 c	Yes	Yes
1024-57-3	Heptachlor Epoxide	µg/L	0.05	0.05	0.0074 c	Yes	Yes	0.0564 c	No	No
72-43-5	Methoxychlor	µg/L	0.5	0.5	18 n	No	No	NA	No	No
	Inorganics									
7440-36-0	Antimony	µg/L	0.68	600	1.5 n	No	Yes	23.2 n	No	Yes
18540-29-9	Chromium VI	µg/L	10	10	0.043 c	Yes	Yes	0.4 c	Yes	Yes
7782-49-2	Selenium	µg/L	1.5	350	18 n	No	Yes	475 n	No	No
7440-22-4	Silver	µg/L	0.35	100	18 n	No	Yes	185 n	No	No
7440-28-0	Thallium	µg/L	0.075	250	NA	No	No	NA	No	No

NA = not available
µg/L = micrograms per liter
PCB = polychlorinated biphenyl

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

[1] Regional Screening Levels (RSL), November 2010, for tap water, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1.
http://www.epa.gov/region09/waste/sfund/prg/index.html
[2] Regional Screening Levels, June 2011, using site-specific parameter for recreational surface water based on a cancer risk of 1E-6 and hazard quotient of 0.1.
http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
[3] screening level for 1,3-dichloropropene is used
[5] screening level for m-xylene is used
[5] screening level for acenaphthene is used
[6] screening level for pyrene is used
[7] screening level for anthracene is used
[8] screening level for chlordane is used
[9] screening level for Aroclor 1254 is used
[10] screening level for hexachlorocyclohexane is used
[11] screening level for endosulfan is used
[12] screening level for endrin is used

TABLE H-5a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 1 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.9	11	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.9	11	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.9	11	270 c	No	No
75-25-2	Bromoform	µg/kg	4.9	11	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.9	11	730 n	No	No
78-93-3	Butanone, 2-	µg/kg	9.9	21	2800000 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.9	11	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	4.9	11	29000 n	No	No
75-00-3	Chloroethane	µg/kg	4.9	11	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.9	11	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.9	11	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.9	11	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.9	11	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.9	11	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.9	11	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.9	11	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.9	11	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.9	11	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.9	11	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.49	11	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.9	11	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.9	11	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.9	11	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.9	11	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.9	11	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.9	11	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	4.9	11	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	99	210	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	4.9	11	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	9.9	21	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.9	11	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.9	11	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.9	11	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	9.9	21	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.9	11	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.9	11	11000 c	No	No
100-42-5	Styrene	µg/kg	4.9	11	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	0.99	11	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	4.9	11	550 c	No	No
108-88-3	Toluene	µg/kg	4.9	11	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.9	11	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.9	11	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.9	11	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.9	11	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	0.99	11	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	4.9	11	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	4.9	11	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	4.9	11	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.9	11	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.9	11	420000 ns	No	No

TABLE H-5a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 1 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
208-96-8	Acenaphthylene	µg/kg	4.2	260	340000 n [4]	No	No
120-12-7	Anthracene	µg/kg	110	260	1700000 n	No	No
1912-24-9	Atrazine	µg/kg	110	260	2100 c	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	210	260	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	210	260	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	210	260	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	210	260	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	210	260	NA	No	No
85-68-7	Butylbenzylphthalate	µg/kg	210	260	260000 c	No	No
105-60-2	Caprolactam	µg/kg	210	260	3100000 n	No	No
86-74-8	Carbazole	µg/kg	210	260	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	210	260	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	110	260	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	210	260	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	110	260	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	210	260	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	210	260	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/kg	4.2	260	15 c	No	**Yes**
132-64-9	Dibenzofuran	µg/kg	210	260	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	110	260	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	110	260	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	110	260	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	210	260	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	410	500	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	110	500	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	110	260	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	110	260	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	210	260	NA	No	No
118-74-1	Hexachlorobenzene	µg/kg	110	260	300 c	No	No
87-68-3	Hexachlorobutadiene	µg/kg	210	260	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	210	260	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	210	260	6100 n	No	No
193-39-5	Indeno(1,2,3-Cd)Pyrene	µg/kg	210	260	150 c	**Yes**	**Yes**
78-59-1	Isophorone	µg/kg	210	260	510000 c	No	No
95-48-7	Methylphenol, 2-	µg/kg	110	260	310000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	410	500	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	410	500	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	410	500	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	210	260	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	210	260	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	410	500	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	210	260	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	210	260	99000 c	No	No
87-86-5	Pentachlorophenol	µg/kg	410	500	890 c	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	210	260	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	210	260	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	210	260	6100 n	No	No

TABLE H-5a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 1 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]		RL > SL	
			Minimum	Maximum			Minimum	Maximum
	PCBs/Pesticides							
309-00-2	Aldrin	µg/kg	0.43	2.6	29 c		No	No
319-84-6	Alpha-BHC	µg/kg	0.43	2.6	77 c		No	No
5103-71-9	Alpha-Chlordane	µg/kg	0.43	2.6	1600 c	[5]	No	No
12674-11-2	Aroclor 1016	µg/kg	8.3	50	390 n		No	No
11104-28-2	Aroclor 1221	µg/kg	8.3	50	140 c		No	No
11141-16-5	Aroclor 1232	µg/kg	8.3	50	140 c		No	No
53469-21-9	Aroclor 1242	µg/kg	8.3	50	220 c		No	No
12672-29-6	Aroclor 1248	µg/kg	8.3	50	220 c		No	No
11097-69-1	Aroclor 1254	µg/kg	8.3	50	110 n		No	No
11096-82-5	Aroclor 1260	µg/kg	8.3	50	220 c		No	No
37324-23-5	Aroclor 1262	µg/kg	8.3	50	110 n	[6]	No	No
11100-14-4	Aroclor 1268	µg/kg	8.3	50	110 n	[6]	No	No
319-85-7	Beta-BHC	µg/kg	0.43	2.6	270 c		No	No
8001-35-2	Chlorinated Camphene	µg/kg	43	260	440 c		No	No
72-54-8	DDD, 4,4'-	µg/kg	0.83	5	2000 c		No	No
319-86-8	Delta-BHC	µg/kg	0.43	2.6	270 c	[7]	No	No
60-57-1	Dieldrin	µg/kg	0.83	5	30 c		No	No
959-98-8	Endosulfan I	µg/kg	0.43	2.6	37000 n	[8]	No	No
33213-65-9	Endosulfan II	µg/kg	0.83	5	37000 n	[8]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	0.83	5	37000 n	[8]	No	No
72-20-8	Endrin	µg/kg	0.83	5	1800 n		No	No
7421-93-4	Endrin Aldehyde	µg/kg	0.83	5	1800 n	[9]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.43	2.6	520 c		No	No
76-44-8	Heptachlor	µg/kg	0.43	2.6	110 c		No	No
72-43-5	Methoxychlor	µg/kg	4.3	26	31000 n		No	No

NA = not available
µg/kg = micrograms per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for acenaphthene is used
[5] screening level for chlordane is used
[6] screening level for Aroclor 1254 is used
[7] screening level for hexachlorocyclohexane is used
[8] screening level for endosulfan is used
[9] screening level for endrin is used

TABLE H-5b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREA 2 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Inorganics						
7440-36-0	Antimony	mg/kg	2	2	3.1 n	No	No
7440-39-3	Barium	mg/kg	10	10	1500 n	No	No
7440-43-9	Cadmium	mg/kg	1	1	7 n	No	No
7440-22-4	Silver	mg/kg	1	1	39 n	No	No
7440-28-0	Thallium	mg/kg	1	1	NA	No	No

NA = not available
mg/kg = milligrams per kilogram
[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects

TABLE H-5c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 5, 6, AND BEACH AREA OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.2	6.8	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.2	6.8	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.2	6.8	270 c	No	No
75-25-2	Bromoform	µg/kg	4.2	6.8	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.2	6.8	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.2	6.8	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	4.2	6.8	29000 n	No	No
75-00-3	Chloroethane	µg/kg	4.2	6.8	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.2	6.8	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.2	6.8	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.2	6.8	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.2	6.8	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.2	6.8	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.2	6.8	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.2	6.8	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.2	6.8	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.2	6.8	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.2	6.8	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.42	6	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.2	6.8	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.2	6.8	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.2	6.8	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.2	6.8	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.2	6.8	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.2	6.8	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	4.2	6.8	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	83	140	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	4.2	6.8	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	8.3	14	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.2	6.8	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.2	6.8	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.2	6.8	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	8.3	14	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.2	6.8	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.2	6.8	11000 c	No	No
100-42-5	Styrene	µg/kg	4.2	6.8	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	0.83	6	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	4.2	6.8	550 c	No	No
108-88-3	Toluene	µg/kg	4.2	6.8	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.2	6.8	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.2	6.8	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.2	6.8	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.2	6.8	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	0.83	6	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	4.2	6.8	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	4.2	6.8	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	4.2	6.8	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.2	6.8	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.2	6.8	420000 ns	No	No

TABLE H-5c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 5, 6, AND BEACH AREA OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	µg/kg	4	230	340000 n	No	No
208-96-8	Acenaphthylene	µg/kg	4	230	340000 n [4]	No	No
120-12-7	Anthracene	µg/kg	100	230	1700000 n	No	No
1912-24-9	Atrazine	µg/kg	100	230	2100 c	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	210	230	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	210	230	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	210	230	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	210	230	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	210	230	NA	No	No
85-68-7	Butylbenzylphthalate	µg/kg	210	230	260000 c	No	No
105-60-2	Caprolactam	µg/kg	210	230	3100000 n	No	No
86-74-8	Carbazole	µg/kg	210	230	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	210	230	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	100	230	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	210	230	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	100	230	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	210	230	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	210	230	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/kg	4	230	15 c	No	**Yes**
132-64-9	Dibenzofuran	µg/kg	210	230	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	100	230	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	100	230	18000 n	No	No
84-66-2	Diethylphthalate	µg/kg	210	230	4900000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	100	230	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	210	230	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	400	440	490 n	No	No
51-28-5	Dinitrophenol, 2,4-	µg/kg	100	440	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	100	230	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	100	230	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	210	230	NA	No	No
86-73-7	Fluorene	µg/kg	4	230	230000 n	No	No
118-74-1	Hexachlorobenzene	µg/kg	100	230	300 c	No	No
87-68-3	Hexachlorobutadiene	µg/kg	210	230	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	210	230	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	210	230	6100 n	No	No
78-59-1	Isophorone	µg/kg	210	230	510000 c	No	No
91-57-6	Methylnaphthalene, 2-	µg/kg	4	230	31000 n	No	No
95-48-7	Methylphenol, 2-	µg/kg	100	230	310000 n	No	No
106-44-5	Methylphenol, 4-	µg/kg	210	230	31000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	400	440	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	400	440	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	400	440	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	210	230	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	210	230	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	400	440	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	210	230	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	210	230	99000 c	No	No
87-86-5	Pentachlorophenol	µg/kg	400	440	890 c	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	210	230	1800 n	No	No

TABLE H-5c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
AREAS 5, 6, AND BEACH AREA OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]		RL > SL	
			Minimum	Maximum			Minimum	Maximum
	Semi-volatile Organic Compounds (continued)							
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	210	230	610000 n		No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	210	230	6100 n		No	No
	PCBs/Pesticides							
309-00-2	Aldrin	µg/kg	0.42	2.3	29 c		No	No
5103-71-9	Alpha-Chlordane	µg/kg	0.42	2.3	1600 c	[5]	No	No
12674-11-2	Aroclor 1016	µg/kg	8.1	44	390 n		No	No
11104-28-2	Aroclor 1221	µg/kg	8.1	44	140 c		No	No
11141-16-5	Aroclor 1232	µg/kg	8.1	44	140 c		No	No
53469-21-9	Aroclor 1242	µg/kg	8.1	44	220 c		No	No
12672-29-6	Aroclor 1248	µg/kg	8.1	44	220 c		No	No
11096-82-5	Aroclor 1260	µg/kg	8.1	44	220 c		No	No
37324-23-5	Aroclor 1262	µg/kg	8.1	44	110 n	[6]	No	No
11100-14-4	Aroclor 1268	µg/kg	8.1	44	110 n	[6]	No	No
8001-35-2	Chlorinated Camphene	µg/kg	42	230	440 c		No	No
72-54-8	DDD, 4,4'-	µg/kg	0.81	4.4	2000 c		No	No
50-29-3	DDT, 4,4'-	µg/kg	0.81	4.4	1700 c		No	No
319-86-8	Delta-BHC	µg/kg	0.42	2.3	270 c	[7]	No	No
60-57-1	Dieldrin	µg/kg	0.81	4.4	30 c		No	No
959-98-8	Endosulfan I	µg/kg	0.42	2.3	37000 n	[8]	No	No
33213-65-9	Endosulfan II	µg/kg	0.81	4.4	37000 n	[8]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	0.81	4.4	37000 n	[8]	No	No
72-20-8	Endrin	µg/kg	0.81	4.4	1800 n		No	No
7421-93-4	Endrin Aldehyde	µg/kg	0.81	4.4	1800 n	[9]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.42	2.3	520 c		No	No
5103-74-2	Gamma-Chlordane	µg/kg	0.42	2.3	1600 c	[5]	No	No
76-44-8	Heptachlor	µg/kg	0.42	2.3	110 c		No	No
1024-57-3	Heptachlor Epoxide	µg/kg	0.42	2.3	53 c		No	No
72-43-5	Methoxychlor	µg/kg	4.2	23	31000 n		No	No
	Inorganics							
7440-28-0	Thallium	mg/kg	0.5	3.3	NA		No	No
7440-31-5	Tin	mg/kg	10	10	4700 n		No	No

NA = not available
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDT = p,p'-dichlorodiphenyltrichloroethane

[1] Regional Screening Levels, November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for acenaphthene is used
[5] screening level for chlordane is used
[6] screening level for Aroclor 1254 is used
[7] screening level for hexachlorocyclohexane is used
[8] screening level for endosulfan is used
[9] screening level for endrin is used

TABLE H-5d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
WETLAND OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.3	35	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.3	35	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.3	35	270 c	No	No
75-25-2	Bromoform	µg/kg	4.3	35	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.3	35	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.3	35	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	4.3	35	29000 n	No	No
75-00-3	Chloroethane	µg/kg	4.3	35	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.3	35	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.3	35	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.3	35	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.3	35	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.3	35	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.3	35	34 c	No	**Yes**
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.3	35	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.3	35	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.3	35	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.3	35	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.43	3.5	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.3	35	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.3	35	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.3	35	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.3	35	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.3	35	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.3	35	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	4.3	35	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	85	690	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	4.3	35	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	8.5	69	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.3	35	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.3	35	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.3	35	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	8.5	69	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.3	35	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.3	35	11000 c	No	No
100-42-5	Styrene	µg/kg	4.3	35	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	0.85	6.9	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	4.3	35	550 c	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.3	35	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.3	35	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.3	35	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.3	35	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	0.85	6.9	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	4.3	35	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	4.3	35	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	4.3	35	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.3	35	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.3	35	420000 ns	No	No

TABLE H-5d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
WETLAND OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
1912-24-9	Atrazine	µg/kg	97	500	2100 c	No	No
100-52-7	Benzaldehyde	µg/kg	190	1000	780000 n	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	190	1000	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	190	1000	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	190	1000	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	190	1000	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	190	1000	NA	No	No
105-60-2	Caprolactam	µg/kg	190	1000	3100000 n	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	190	1000	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	97	500	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	190	1000	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	97	500	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	190	1000	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	190	1000	NA	No	No
132-64-9	Dibenzofuran	µg/kg	190	1000	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	97	500	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	97	500	18000 n	No	No
84-66-2	Diethylphthalate	µg/kg	190	1000	4900000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	97	500	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	190	1000	NA	No	No
84-74-2	Di-n-butylphthalate	µg/kg	190	1000	610000 n	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	380	1900	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	97	500	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	97	500	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	97	500	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	190	1000	NA	No	No
118-74-1	Hexachlorobenzene	µg/kg	97	500	300 c	No	**Yes**
87-68-3	Hexachlorobutadiene	µg/kg	190	1000	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	190	1000	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	190	1000	6100 n	No	No
78-59-1	Isophorone	µg/kg	190	1000	510000 c	No	No
95-48-7	Methylphenol, 2-	µg/kg	97	500	310000 n	No	No
106-44-5	Methylphenol, 4-	µg/kg	190	1000	31000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	380	1900	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	380	1900	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	380	1900	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	190	1000	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	190	1000	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	380	1900	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	190	1000	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	190	1000	99000 c	No	No
87-86-5	Pentachlorophenol	µg/kg	380	1900	890 c	No	**Yes**
108-95-2	Phenol	µg/kg	190	1000	1800000 n	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	190	1000	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	190	1000	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	190	1000	6100 n	No	No

TABLE H-5d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
WETLAND OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	PCBs/Pesticides						
309-00-2	Aldrin	µg/kg	0.4	1.8	29 c	No	No
319-84-6	Alpha-BHC	µg/kg	0.4	1.8	77 c	No	No
12674-11-2	Aroclor 1016	µg/kg	7.8	34	390 n	No	No
11104-28-2	Aroclor 1221	µg/kg	7.8	34	140 c	No	No
11141-16-5	Aroclor 1232	µg/kg	7.8	34	140 c	No	No
53469-21-9	Aroclor 1242	µg/kg	7.8	34	220 c	No	No
12672-29-6	Aroclor 1248	µg/kg	7.8	34	220 c	No	No
11096-82-5	Aroclor 1260	µg/kg	7.8	34	220 c	No	No
37324-23-5	Aroclor 1262	µg/kg	7.8	34	110 n [4]	No	No
11100-14-4	Aroclor 1268	µg/kg	7.8	34	110 n [4]	No	No
319-85-7	Beta-BHC	µg/kg	0.4	1.8	270 c	No	No
8001-35-2	Chlorinated Camphene	µg/kg	40	180	440 c	No	No
72-54-8	DDD, 4,4'-	µg/kg	0.78	3.4	2000 c	No	No
72-55-9	DDE, 4,4'-	µg/kg	0.78	3.4	1400 c	No	No
50-29-3	DDT, 4,4'-	µg/kg	0.78	3.4	1700 c	No	No
319-86-8	Delta-BHC	µg/kg	0.4	1.8	270 c [5]	No	No
959-98-8	Endosulfan I	µg/kg	0.4	1.8	37000 n [6]	No	No
33213-65-9	Endosulfan II	µg/kg	0.78	3.4	37000 n [6]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	0.78	3.4	37000 n [6]	No	No
72-20-8	Endrin	µg/kg	0.78	3.4	1800 n	No	No
7421-93-4	Endrin Aldehyde	µg/kg	0.78	3.4	1800 n [7]	No	No
53494-70-5	Endrin ketone	µg/kg	0.78	3.4	1800 n [7]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.4	1.8	520 c	No	No
76-44-8	Heptachlor	µg/kg	0.4	1.8	110 c	No	No
1024-57-3	Heptachlor Epoxide	µg/kg	0.4	1.8	53 c	No	No
	Inorganics						
7440-31-5	Tin	mg/kg	10	10	4700 n	No	No

NA = not available
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for Aroclor 1254 is used
[5] screening level for hexachlorocyclohexane is used
[6] screening level for endosulfan is used
[7] screening level for endrin is used

TABLE H-5e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Volatile Organic Compounds						
71-43-2	Benzene	µg/kg	4.2	11	1100 c	No	No
74-97-5	Bromochloromethane	µg/kg	4.2	11	NA	No	No
75-27-4	Bromodichloromethane	µg/kg	4.2	11	270 c	No	No
75-25-2	Bromoform	µg/kg	4.2	11	61000 c	No	No
74-83-9	Bromomethane	µg/kg	4.2	11	730 n	No	No
56-23-5	Carbon tetrachloride	µg/kg	4.2	11	610 c	No	No
108-90-7	Chlorobenzene	µg/kg	4.2	11	29000 n	No	No
75-00-3	Chloroethane	µg/kg	4.2	11	1500000 n	No	No
67-66-3	Chloroform	µg/kg	4.2	11	290 c	No	No
74-87-3	Chloromethane	µg/kg	4.2	11	12000 n	No	No
110-82-7	Cyclohexane	µg/kg	4.2	11	120000 ns	No	No
96-12-8	Dibromo-3-chloropropane, 1,2-	µg/kg	4.2	11	5.4 c	No	**Yes**
124-48-1	Dibromochloromethane	µg/kg	4.2	11	680 c	No	No
106-93-4	Dibromoethane, 1,2-	µg/kg	4.2	11	34 c	No	No
95-50-1	Dichlorobenzene, 1,2-	µg/kg	4.2	11	190000 n	No	No
541-73-1	Dichlorobenzene, 1,3-	µg/kg	4.2	11	NA	No	No
106-46-7	Dichlorobenzene, 1,4-	µg/kg	4.2	11	2400 c	No	No
75-71-8	Dichlorodifluoromethane	µg/kg	4.2	11	18000 n	No	No
75-34-3	Dichloroethane, 1,1-	µg/kg	0.42	11	3300 c	No	No
107-06-2	Dichloroethane, 1,2-	µg/kg	4.2	11	430 c	No	No
75-35-4	Dichloroethene, 1,1-	µg/kg	4.2	11	24000 n	No	No
156-59-2	Dichloroethene, 1,2-cis-	µg/kg	4.2	11	16000 n	No	No
156-60-5	Dichloroethene, 1,2-trans-	µg/kg	4.2	11	15000 n	No	No
78-87-5	Dichloropropane, 1,2-	µg/kg	4.2	11	890 c	No	No
10061-01-5	Dichloropropene, 1,3-cis-	µg/kg	4.2	11	1700 c [2]	No	No
10061-02-6	Dichloropropene, trans-1,3-	µg/kg	4.2	11	1700 c [2]	No	No
123-91-1	Dioxane, 1,4-	µg/kg	83	210	4900 c	No	No
100-41-4	Ethylbenzene	µg/kg	4.2	11	5400 cs	No	No
591-78-6	Hexanone, 2-	µg/kg	8.3	21	21000 n	No	No
98-82-8	Isopropylbenzene	µg/kg	4.2	11	260000 ns	No	No
79-20-9	Methyl Acetate	µg/kg	4.2	11	7800000 n	No	No
1634-04-4	Methyl tert-Butyl Ether	µg/kg	4.2	11	43000 c	No	No
108-10-1	Methyl-2-Pentanone, 4-	µg/kg	8.3	21	2200000 ns	No	No
108-87-2	Methylcyclohexane	µg/kg	4.2	11	NA	No	No
75-09-2	Methylene chloride	µg/kg	4.2	11	11000 c	No	No
100-42-5	Styrene	µg/kg	4.2	11	820000 ns	No	No
79-34-5	Tetrachloroethane, 1,1,2,2-	µg/kg	0.83	11	560 c	No	No
127-18-4	Tetrachloroethene	µg/kg	4.2	11	550 c	No	No
108-88-3	Toluene	µg/kg	4.2	11	720000 ns	No	No
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	µg/kg	4.2	11	910000 ns	No	No
87-61-6	Trichlorobenzene, 1,2,3-	µg/kg	4.2	11	4900 n	No	No
120-82-1	Trichlorobenzene, 1,2,4-	µg/kg	4.2	11	6200 n	No	No
71-55-6	Trichloroethane, 1,1,1-	µg/kg	4.2	11	640000 ns	No	No
79-00-5	Trichloroethane, 1,1,2-	µg/kg	0.83	11	1100 c	No	No
79-01-6	Trichloroethene	µg/kg	4.2	11	2800 c	No	No
75-69-4	Trichlorofluoromethane	µg/kg	4.2	11	79000 n	No	No
75-01-4	Vinyl Chloride	µg/kg	4.2	11	60 c	No	No
179601-23-1	Xylene, m,p-	µg/kg	4.2	11	380000 ns [3]	No	No
95-47-6	Xylene, o-	µg/kg	4.2	11	420000 ns	No	No

TABLE H-5e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Semi-volatile Organic Compounds						
208-96-8	Acenaphthylene	µg/kg	4	260	340000 n [4]	No	No
120-12-7	Anthracene	µg/kg	100	260	1700000 n	No	No
1912-24-9	Atrazine	µg/kg	100	260	2100 c	No	No
92-52-4	Biphenyl, 1,1'-	µg/kg	210	260	390000 n	No	No
111-91-1	Bis(2-Chloroethoxy)methane	µg/kg	210	260	18000 n	No	No
111-44-4	Bis(2-Chloroethyl)ether	µg/kg	210	260	210 c	No	**Yes**
108-60-1	Bis-Chloroisopropyl ether	µg/kg	210	260	4600 c	No	No
101-55-3	Bromophenyl Phenyl Ether, 4-	µg/kg	210	260	NA	No	No
85-68-7	Butylbenzylphthalate	µg/kg	210	260	260000 c	No	No
105-60-2	Caprolactam	µg/kg	210	260	3100000 n	No	No
86-74-8	Carbazole	µg/kg	210	260	NA	No	No
59-50-7	Chloro-3-Methylphenol, 4-	µg/kg	210	260	610000 n	No	No
106-47-8	Chloroaniline, 4-	µg/kg	100	260	2400 c	No	No
91-58-7	Chloronaphthalene, 2-	µg/kg	210	260	630000 n	No	No
95-57-8	Chlorophenol, 2-	µg/kg	100	260	39000 n	No	No
58-90-2	Chlorophenols	µg/kg	210	260	180000 n	No	No
7005-72-3	Chlorophenyl Phenylether, 4-	µg/kg	210	260	NA	No	No
53-70-3	Dibenzo(a,h)anthracene	µg/kg	4	260	15 c	No	**Yes**
132-64-9	Dibenzofuran	µg/kg	210	260	7800 n	No	No
91-94-1	Dichlorobenzidine, 3,3`-	µg/kg	100	260	1100 c	No	No
120-83-2	Dichlorophenol, 2,4-	µg/kg	100	260	18000 n	No	No
105-67-9	Dimethylphenol, 2,4-	µg/kg	100	260	120000 n	No	No
131-11-3	Dimethylphthalate	µg/kg	210	260	NA	No	No
534-52-1	Dinitro-2-Methylphenol, 4,6-	µg/kg	400	500	490 n	No	**Yes**
51-28-5	Dinitrophenol, 2,4-	µg/kg	100	500	12000 n	No	No
121-14-2	Dinitrotoluene, 2,4-	µg/kg	100	260	1600 c	No	No
606-20-2	Dinitrotoluene, 2,6-	µg/kg	100	260	6100 n	No	No
117-84-0	Di-N-Octyl Phthalate	µg/kg	210	260	NA	No	No
118-74-1	Hexachlorobenzene	µg/kg	100	260	300 c	No	No
87-68-3	Hexachlorobutadiene	µg/kg	210	260	6100 n	No	No
77-47-4	Hexachlorocyclopentadiene	µg/kg	210	260	37000 n	No	No
67-72-1	Hexachloroethane	µg/kg	210	260	6100 n	No	No
78-59-1	Isophorone	µg/kg	210	260	510000 c	No	No
95-48-7	Methylphenol, 2-	µg/kg	100	260	310000 n	No	No
88-74-4	Nitroaniline, 2-	µg/kg	400	500	61000 n	No	No
99-09-2	Nitroaniline, 3-	µg/kg	400	500	NA	No	No
100-01-6	Nitroaniline, 4-	µg/kg	400	500	24000 c	No	No
98-95-3	Nitrobenzene	µg/kg	210	260	4800 c	No	No
88-75-5	Nitrophenol, 2-	µg/kg	210	260	NA	No	No
100-02-7	Nitrophenol, 4-	µg/kg	400	500	NA	No	No
621-64-7	Nitroso-Di-N-Propylamine, N-	µg/kg	210	260	69 c	**Yes**	**Yes**
86-30-6	Nitrosodiphenylamine, N-	µg/kg	210	260	99000 c	No	No
87-86-5	Pentachlorophenol	µg/kg	400	500	890 c	No	No
95-94-3	Tetrachlorobenzene, 1,2,4,5-	µg/kg	210	260	1800 n	No	No
95-95-4	Trichlorophenol, 2,4,5-	µg/kg	210	260	610000 n	No	No
88-06-2	Trichlorophenol, 2,4,6-	µg/kg	210	260	6100 n	No	No

TABLE H-5e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL) [1]		RL > SL	
			Minimum	Maximum			Minimum	Maximum
	PCBs/Pesticides							
309-00-2	Aldrin	µg/kg	0.42	2.6	29 c		No	No
5103-71-9	Alpha-Chlordane	µg/kg	0.42	2.6	1600 c	[5]	No	No
12674-11-2	Aroclor 1016	µg/kg	8.1	50	390 n		No	No
11104-28-2	Aroclor 1221	µg/kg	8.1	50	140 c		No	No
11141-16-5	Aroclor 1232	µg/kg	8.1	50	140 c		No	No
53469-21-9	Aroclor 1242	µg/kg	8.1	50	220 c		No	No
12672-29-6	Aroclor 1248	µg/kg	8.1	50	220 c		No	No
11096-82-5	Aroclor 1260	µg/kg	8.1	50	220 c		No	No
37324-23-5	Aroclor 1262	µg/kg	8.1	50	110 n	[6]	No	No
11100-14-4	Aroclor 1268	µg/kg	8.1	50	110 n	[6]	No	No
8001-35-2	Chlorinated Camphene	µg/kg	42	260	440 c		No	No
72-54-8	DDD, 4,4'-	µg/kg	0.81	5	2000 c		No	No
319-86-8	Delta-BHC	µg/kg	0.42	2.6	270 c	[7]	No	No
60-57-1	Dieldrin	µg/kg	0.81	5	30 c		No	No
959-98-8	Endosulfan I	µg/kg	0.42	2.6	37000 n	[8]	No	No
33213-65-9	Endosulfan II	µg/kg	0.81	5	37000 n	[8]	No	No
1031-07-8	Endosulfan Sulfate	µg/kg	0.81	5	37000 n	[8]	No	No
72-20-8	Endrin	µg/kg	0.81	5	1800 n		No	No
7421-93-4	Endrin Aldehyde	µg/kg	0.81	5	1800 n	[9]	No	No
58-89-9	Gamma-BHC (Lindane)	µg/kg	0.42	2.6	520 c		No	No
76-44-8	Heptachlor	µg/kg	0.42	2.6	110 c		No	No
72-43-5	Methoxychlor	µg/kg	4.2	26	31000 n		No	No
	Inorganics							
7440-31-5	Tin	mg/kg	10	10	4700 n		No	No

NA = not available
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
PCB = polychlorinated biphenyl
BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane

[1] Regional Screening Levels (RSL), November 2010, for residential soil, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. http://www.epa.gov/region09/waste/sfund/prg/index.html
Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
c = screening toxicity value is based on cancer effects
s = concentration may exceed saturation concentration
[2] screening level for 1,3-dichloropropene is used
[3] screening level for m-xylene is used
[4] screening level for acenaphthene is used
[5] screening level for chlordane is used
[6] screening level for Aroclor 1254 is used
[7] screening level for hexachlorocyclohexane is used
[8] screening level for endosulfan is used
[9] screening level for endrin is used

TABLE H-6a
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
FISH
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Inorganics						
7440-36-0	Antimony	mg/kg wet wt.	0.97	1.5	0.054 n	Yes	Yes
7440-39-3	Barium	mg/kg wet wt.	3.2	5	27 n	No	No
7440-41-7	Beryllium	mg/kg wet wt.	0.081	0.13	0.27 n	No	No
7440-43-9	Cadmium	mg/kg wet wt.	0.081	0.13	0.14 n	No	No
7440-48-4	Cobalt	mg/kg wet wt.	0.81	1.3	0.041 n	Yes	Yes
7440-50-8	Copper	mg/kg wet wt.	0.41	0.63	5.4 n	No	No
7439-89-6	Iron	mg/kg wet wt.	1.6	2.5	95 n	No	No
7439-95-4	Magnesium	mg/kg wet wt.	81	130	NA	No	No
7440-02-0	Nickel	mg/kg wet wt.	0.65	1	2.7 n [2]	No	No
7440-09-7	Potassium	mg/kg wet wt.	81	130	NA	No	No
7782-49-2	Selenium	mg/kg wet wt.	0.57	0.88	0.68 n	No	Yes
7440-22-4	Silver	mg/kg wet wt.	0.16	0.25	0.68 n	No	No
7440-28-0	Thallium	mg/kg wet wt.	0.41	0.63	NA	No	No
7440-62-2	Vanadium	mg/kg wet wt.	0.81	1.3	0.68 n [3]	Yes	Yes

NA = not available
mg/kg wet wt. = milligrams per kilogram wet weight
[1] Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
[2] screening level for nickel soluble salts is used
[3] screening level for vanadium and compounds is used

TABLE H-6b
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
HARD CLAM
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Inorganics						
7440-36-0	Antimony	mg/kg wet wt.	0.016	1	0.054 n	No	**Yes**
7440-41-7	Beryllium	mg/kg wet wt.	0.016	0.083	0.27 n	No	No
7439-97-6	Mercury	mg/kg wet wt.	0.017	0.017	0.014 n [2]	**Yes**	**Yes**
7440-28-0	Thallium	mg/kg wet wt.	0.034	0.42	NA	No	No
7440-31-5	Tin	mg/kg wet wt.	1.6	1.9	81 n	No	No

NA = not available
mg/kg wet wt. = milligrams per kilogram wet weight
[1] Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
[2] screening level for methylmercury is used

TABLE H-6c
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
RIBBED MUSSEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Inorganics						
7440-41-7	Beryllium	mg/kg wet wt.	0.018	0.049	0.27 n	No	No
7439-97-6	Mercury	mg/kg wet wt.	0.0098	0.0098	0.014 n [2]	No	No
7440-28-0	Thallium	mg/kg wet wt.	0.036	0.24	NA	No	No
7440-31-5	Tin	mg/kg wet wt.	1.8	2	81 n	No	No

NA = not available
mg/kg wet wt. = milligrams per kilogram wet weight
[1] Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
[2] screening level for methylmercury is used

TABLE H-6d
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
BLUE CRAB (MUSCLE)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Inorganics						
7440-36-0	Antimony	mg/kg wet wt.	0.8	1.1	0.054 n	Yes	Yes
7440-39-3	Barium	mg/kg wet wt.	2.7	3.7	27 n	No	No
7440-43-9	Cadmium	mg/kg wet wt.	0.067	0.094	0.14 n	No	No
7440-48-4	Cobalt	mg/kg wet wt.	0.67	0.94	0.041 n	Yes	Yes
7782-49-2	Selenium	mg/kg wet wt.	0.47	0.65	0.68 n	No	No
7440-28-0	Thallium	mg/kg wet wt.	0.34	0.47	NA	No	No
7440-62-2	Vanadium	mg/kg wet wt.	0.67	0.94	0.68 n [2]	No	Yes

NA = not available
mg/kg wet wt. = milligrams per kilogram wet weight
[1] Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects
[2] screening level for vanadium and compounds is used

TABLE H-6e
COMPARISON OF REPORTING LIMITS FOR NON-DETECTED CHEMICALS TO SCREENING LEVELS
BLUE CRAB (HEPATOPANCREAS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Unit	Reporting Limit (RL)		Screening Level (SL)[1]	RL > SL	
			Minimum	Maximum		Minimum	Maximum
	Inorganics						
7440-36-0	Antimony	mg/kg wet wt.	1	1.4	0.054 n	**Yes**	**Yes**
7440-39-3	Barium	mg/kg wet wt.	3.4	4.8	27 n	No	No
7440-41-7	Beryllium	mg/kg wet wt.	0.085	0.12	0.27 n	No	No
7782-49-2	Selenium	mg/kg wet wt.	0.59	0.84	0.68 n	No	**Yes**
7440-28-0	Thallium	mg/kg wet wt.	0.42	0.6	NA	No	No

NA = not available
mg/kg wet wt. = milligrams per kilogram wet weight
(1) Region 3 Risk-based Concentrations, November 2010, for fish consumption, adjusted to a cancer risk of 1E-6 and hazard quotient of 0.1. Although the more recent version of RSL became available while preparing the HHRA, in general, use of a previous version of RSL (November 2010) results in more conservative screening levels.
n = screening toxicity value is based on noncancer effects

TABLE H-7a
INPUTS FOR DEVELOPMENT OF SITE-SPECIFIC RECREATOR RISK-BASED SURFACE WATER SCREENING LEVELS
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Variable	Value
TR (target cancer risk) unitless	$1x10^{-6}$
THQ (target hazard quotient) unitless	0.1
EF_{recwc} (child exposure frequency) day/year	100
EF_{recwa} (adult exposure frequency) day/year	0
EF_{0-2} (mutagenic exposure frequency) day/year	100
EF_{2-6} (mutagenic exposure frequency) day/year	100
EF_{6-16} (mutagenic exposure frequency) day/year	0
EF_{16-30} (mutagenic exposure frequency) day/year	0
ED_{recwc} (exposure duration - child) year	6
ED_{recwa} (exposure duration - adult) year	0
ED_{0-2} (mutagenic exposure duration) year	2
ED_{2-6} (mutagenic exposure duration) year	4
ED_{6-16} (mutagenic exposure duration) year	0
ED_{16-30} (mutagenic exposure duration) year	0
LT (lifetime - recreator) year	70
EV_{recwa} (adult) events/day	0
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	0
EV_{16-30} (mutagenic) events/day	0
ET_{recwa} (adult exposure time) hour/event	0
ET_{recwc} (child exposure time) hour/event	1
$ET_{recw0-2}$ (mutagenic exposure time) hour/event	1
$ET_{recw2-6}$ (mutagenic exposure time) hour/event	1
$ET_{recw6-16}$ (mutagenic exposure time) hour/event	0
$ET_{recw16-30}$ (mutagenic exposure time) hour/event	0
$ET_{recw-adj}$ (age-adjusted exposure time) hour/event	1
$ET_{recw-madj}$ (mutagenic age-adjusted exposure time) hour/event	1
BW_{recwa} (body weight - adult) kg	0
BW_{recwc} (body weight - child) kg	14.667
BW_{0-2} (mutagenic body weight) kg	10
BW_{2-6} (mutagenic body weight) kg	17
BW_{6-16} (mutagenic body weight) kg	0
BW_{16-30} (mutagenic body weight) kg	0
IRW_{recwa} (water intake rate - adult) L/hr	0
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
SA_{recwa} (skin surface area - adult) cm^2	0
SA_{recwc} (skin surface area - child) cm^2	6333.333
SA_{0-2} (mutagenic skin surface area) cm^2	4600
SA_{2-6} (mutagenic skin surface area) cm^2	7200
SA_{6-16} (mutagenic skin surface area) cm^2	0
SA_{16-30} (mutagenic skin surface area) cm^2	0
l_{sc} (apparent thickness of stratum corneum) cm	0.001
$IFW_{rec-adj}$ (age-adjusted water intake rate) L/kg	2.045
$IFWM_{rec-adj}$ (mutagenic age-adjusted water intake rate) L/kg	13.529
$DFW_{rec-adj}$ (age-adjusted dermal factor) cm^2-event/kg	259085.007
$DFWM_{rec-adj}$ (mutagenic age-adjusted dermal factor) cm^2-event/kg	1428235.294

Note:
Site-specific screening levels are calculated using the Online Screening Level Calculator (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)
based on a young child swimming scenario in the beach areas (e.g., Areas 5, 6 and 9).
Exposure assumptions are defined in Appendix B.

TABLE H-7b

SITE-SPECIFIC RECREATOR RISK-BASED SCREENING LEVELS FOR SURFACE WATER

Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical	CAS Number	Screening Level [(1)] (ug/L)
Benzene	71-43-2	5.77E+01 ca*
Bromodichloromethane	75-27-4	8.71E+01 ca
Carbon Tetrachloride	56-23-5	2.98E+01 ca*
Chloroform	67-66-3	1.51E+02 ca*
Dibromo-3-chloropropane, 1,2-	96-12-8	5.94E-01 ca*
Dibromochloromethane	124-48-1	6.59E+01 ca
Dibromoethane, 1,2-	106-93-4	3.03E+00 ca
Dichlorobenzene, 1,4-	106-46-7	1.62E+02 ca*
Dichloroethane, 1,2-	107-06-2	7.11E+01 ca*
Dichloropropane, 1,2-	78-87-5	1.25E+02 ca
Hexanone, 2-	591-78-6	2.99E+02 nc
Tetrachloroethane, 1,1,2,2-	79-34-5	1.88E+01 ca
Tetrachloroethylene	127-18-4	1.92E+00 ca
Trichlorobenzene, 1,2,4-	120-82-1	1.61E+01 ca*
Trichloroethane, 1,1,2-	79-00-5	9.32E+01 ca*
Vinyl Chloride	75-01-4	1.56E-01 ca
Atrazine	1912-24-9	1.60E+01 ca*
Benz[a]anthracene	56-55-3	2.59E+00 ca**
Benzo[a]pyrene	50-32-8	2.59E-01 ca**
Benzo[b]fluoranthene	205-99-2	2.59E+00 ca**
Bis(2-chloro-1-methylethyl) ether	108-60-1	4.94E+01 ca*
Bis(2-chloroethyl)ether	111-44-4	7.53E+00 ca**
Chloroaniline, p-	106-47-8	2.74E+01 ca**
Dibenz[a,h]anthracene	53-70-3	2.59E-01 ca**
Dibenzofuran	132-64-9	3.17E+00 nc
Dichloropropene, 1,3-	542-75-6	4.25E+01 ca*
Dinitro-o-cresol, 4,6-	534-52-1	3.75E+00 nc
Dinitrophenol, 2,4-	51-28-5	1.26E+02 nc
Dinitrotoluene, 2,6-	606-20-2	4.54E+01 nc
Hexachlorobenzene	118-74-1	7.81E+00 ca*
Indeno[1,2,3-cd]pyrene	193-39-5	2.59E+00 ca**
Naphthalene	91-20-3	1.64E+02 nc
Nitroaniline, 4-	100-01-6	2.66E+02 nc
Nitrobenzene	98-95-3	9.08E+01 nc
Nitroso-di-N-propylamine, N-	621-64-7	1.11E+00 ca**
Pentachlorophenol	87-86-5	4.26E-01 ca*

TABLE H-7b

SITE-SPECIFIC RECREATOR RISK-BASED SCREENING LEVELS FOR SURFACE WATER

Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Chemical	CAS Number	Screening Level (1) (ug/L)
Aldrin	309-00-2	7.35E-01 ca**
Aroclor 1016	12674-11-2	7.49E+00 nc
Aroclor 1221	11104-28-2	1.14E-01 ca**
Aroclor 1232	11141-16-5	1.14E-01 ca**
Aroclor 1242	53469-21-9	6.25E+00 ca**
Aroclor 1248	12672-29-6	6.25E+00 ca**
Aroclor 1254	11097-69-1	2.14E+00 nc
Aroclor 1260	11096-82-5	6.25E+00 ca**
Dieldrin	60-57-1	2.20E-02 ca**
Heptachlor	76-44-8	1.91E-02 ca*
Heptachlor Epoxide	1024-57-3	5.64E-02 ca**
Hexachlorocyclohexane, Alpha-	319-84-6	1.35E-01 ca
Hexachlorocyclohexane, Beta-	319-85-7	4.71E-01 ca**
Toxaphene	8001-35-2	1.65E-01 ca**
Hexachlorocyclohexane, Technical	608-73-1	4.71E-01 ca**
Antimony (metallic)	7440-36-0	2.32E+01 nc
Arsenic, Inorganic	7440-38-2	7.39E+00 ca**
Barium	7440-39-3	7.62E+03 nc
Beryllium and compounds	7440-41-7	1.12E+01 nc
Cadmium (Water)	7440-43-9	1.52E+01 nc
Chromium(VI)	18540-29-9	4.00E-01 ca*
Cobalt	7440-48-4	3.06E+01 nc
Copper	7440-50-8	3.80E+03 nc
Manganese (Non-diet)	7439-96-5	6.17E+02 nc
Nickel Soluble Salts	7440-02-0	1.31E+03 nc
Selenium	7782-49-2	4.75E+02 nc
Silver	7440-22-4	1.85E+02 nc
Vanadium Pentoxide	1314-62-1	1.64E+02 nc
Vanadium and Compounds	NA	4.79E+02 nc

(Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's

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Note:
Site-specific screening levels are calculated using the Online Screening Level Calculator.
(http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)

Appendix I
Statistical Summary Tables for All Chemicals

Appendix I Contents
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

Summary of Analytical Results

I-1a	Area 1 Surface Soil
I-1b	Area 2 Surface Soil
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I-1d	Areas 5, 6, and Beach Area of Area 9 Surface Soil
I-1e	Upland Area of Area 9 Surface Soil
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I-1g	All Areas (except Areas 8 and 11) Surface Soil
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I-1i	All Areas Surface Soil
I-2	All Upland Areas Surface/Subsurface Soil
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I-5c	Areas 5, 6, and Beach Area of Area 9 Sediment
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I-6a	Fish
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I-6d	Blue Crab (Muscle)
I-6e	Blue Crab (Hepatopancreas)

TABLE I-1a
SUMMARY OF ANALYTICAL RESULTS - AREA 1 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	13	28	µg/kg	A116	3 / 31	9.2 - 49
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
78-93-3	Butanone, 2-	15	15	µg/kg	A92	1 / 31	9.2 - 49
75-15-0	Carbon disulfide	0.42 J	5 J	µg/kg	A41	7 / 31	4.6 - 24
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	3 / 31	4.6 - 24
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 31	92 - 490
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 31	9.2 - 49
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 31	9.2 - 49
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 31	4.6 - 24
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 31	4.6 - 24
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 31	4.6 - 24
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	12 J	68 J	µg/kg	A1-S14	2 / 31	180 - 910
208-96-8	Acenaphthylene	9.4 J	28 J	µg/kg	A1-S11	3 / 31	180 - 910
98-86-2	Acetophenone	14 J	61 J	µg/kg	A56	12 / 31	180 - 910
120-12-7	Anthracene	6 J	150 J	µg/kg	A1-S14	10 / 31	180 - 910
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 31	180 - 910
100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A56	11 / 31	180 - 910
56-55-3	Benzo(a)anthracene	3.2 J	600	µg/kg	A1-S14	25 / 31	3.6 - 910
50-32-8	Benzo(a)pyrene	6.8 J	530	µg/kg	A1-S14	22 / 31	3.6 - 910

TABLE I-1a
SUMMARY OF ANALYTICAL RESULTS - AREA 1 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	5.9 J	580	µg/kg	A1-S14	24 / 31	3.6 - 910
191-24-2	Benzo(g,h,i)perylene	6.8 J	290	µg/kg	A1-S14	14 / 31	180 - 910
207-08-9	Benzo(k)fluoranthene	6.9 J	450	µg/kg	A1-S14	14 / 31	180 - 910
92-52-4	Biphenyl, 1,1'-	15 J	15 J	µg/kg	A1-S14	1 / 31	180 - 910
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 31	180 - 910
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 31	180 - 910
117-81-7	Bis(2-ethylhexyl)phthalate	15 J	51 J	µg/kg	A1-07	13 / 31	180 - 910
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 31	180 - 910
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 31	180 - 910
85-68-7	Butylbenzylphthalate	7 J	7 J	µg/kg	A80	1 / 31	180 - 910
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 31	180 - 910
86-74-8	Carbazole	5.7 J	53 J	µg/kg	A1-S14	7 / 31	180 - 910
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 31	180 - 910
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 31	180 - 910
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 31	92 - 910
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 31	180 - 910
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 31	180 - 910
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 31	180 - 910
218-01-9	Chrysene	6.6 J	550	µg/kg	A1-S14	20 / 31	180 - 910
53-70-3	Dibenzo(a,h)anthracene	2 J	110 J	µg/kg	A1-S14	16 / 31	3.6 - 910
132-64-9	Dibenzofuran	8.5 J	96 J	µg/kg	A1-S14	2 / 31	180 - 910
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 31	180 - 910
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 31	180 - 910
84-66-2	Diethylphthalate	7.5 J	13 J	µg/kg	A80	4 / 31	180 - 910
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 31	92 - 910
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 31	180 - 910
84-74-2	Di-n-butylphthalate	8.7 J	12 J	µg/kg	A136	5 / 31	180 - 910
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 31	92 - 1800
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 31	92 - 1800
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 31	180 - 910
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 31	92 - 910
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 31	180 - 910
206-44-0	Fluoranthene	13 J	1100	µg/kg	A1-S14	21 / 31	180 - 910
86-73-7	Fluorene	11 J	130 J	µg/kg	A1-S14	2 / 31	180 - 910
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 31	180 - 910
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 31	92 - 910
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 31	180 - 910
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 31	180 - 910
193-39-5	Indeno(1,2,3-cd)pyrene	7.3	290	µg/kg	A1-S14	18 / 31	3.6 - 910
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 31	180 - 910
91-57-6	Methylnaphthalene, 2-	5.7 J	59 J	µg/kg	A1-S14	7 / 31	180 - 910
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 31	180 - 910
106-44-5	Methylphenol, 4-	6.8 J	6.8 J	µg/kg	A80	1 / 31	180 - 910
91-20-3	Naphthalene	5.6 J	58 J	µg/kg	A1-S14	15 / 31	180 - 910
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 31	340 - 1800
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 31	340 - 1800
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 31	340 - 1800
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 31	180 - 910
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 31	180 - 910
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 31	340 - 1800
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 31	92 - 910
86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 31	180 - 910
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 31	7.2 - 1800
85-01-8	Phenanthrene	6.5 J	960	µg/kg	A1-S14	21 / 31	180 - 910
108-95-2	Phenol	13 J	73 J	µg/kg	A56	10 / 31	180 - 910
129-00-0	Pyrene	10 J	990	µg/kg	A1-S14	22 / 31	180 - 910
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 31	180 - 910
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 31	180 - 910
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 31	180 - 910

TABLE I-1a
SUMMARY OF ANALYTICAL RESULTS - AREA 1 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 31	0.93 - 5.4
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 31	0.93 - 5.4
5103-71-9	Alpha-chlordane	1.4 J	52 JN	µg/kg	A1-S05	5 / 31	0.93 - 5.4
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 31	35 - 100
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 31	35 - 100
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 31	35 - 100
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 31	35 - 100
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 31	35 - 100
11097-69-1	Aroclor 1254	51	3100	µg/kg	A1-S15	12 / 31	35 - 100
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 31	35 - 100
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 31	35 - 100
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 31	35 - 100
319-85-7	Beta-BHC	0.72 J	0.72 J	µg/kg	A1-S16	1 / 31	0.93 - 5.4
8001-35-2	Chlorinated camphene	ND	ND	µg/kg	NA	0 / 31	65 - 540
72-54-8	DDD, 4,4'-	4	4	µg/kg	A1-S11	1 / 31	1.8 - 10
72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	7 / 31	1.8 - 10
50-29-3	DDT, 4,4'-	0.56 J	160 JN	µg/kg	A1-10	12 / 31	1.8 - 10
319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 31	0.93 - 5.4
60-57-1	Dieldrin	2.3 JN	4.4 JN	µg/kg	A1-07	2 / 31	1.8 - 10
959-98-8	Endosulfan I	0.047 J	0.087 J	µg/kg	A17	2 / 31	0.93 - 5.4
33213-65-9	Endosulfan II	4.9 J	96	µg/kg	A1-10	3 / 31	1.8 - 10
1031-07-8	Endosulfan sulfate	58 JN	58 JN	µg/kg	A1-10	1 / 31	1.8 - 10
72-20-8	Endrin	0.65 J	24 JN	µg/kg	A1-10	5 / 31	1.8 - 10
7421-93-4	Endrin aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 31	1.8 - 10
53494-70-5	Endrin ketone	0.059 J	1.4 J	µg/kg	A1-S14	6 / 31	1.8 - 10
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 31	0.93 - 5.4
5103-74-2	Gamma-chlordane	3.9	71 JN	µg/kg	A1-10	8 / 31	0.93 - 5.4
76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	2 / 31	0.93 - 5.4
1024-57-3	Heptachlor epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 31	0.93 - 5.4
72-43-5	Methoxychlor	3.3 J	3.3 J	µg/kg	A1-S05	1 / 31	9.3 - 54
	Inorganics						
7429-90-5	Aluminum	271 J	8710 J	mg/kg	A54	220 / 228	14.9 - 85.1
7440-36-0	Antimony	0.22	2390	mg/kg	A19	118 / 244	0.14 - 232
7440-38-2	Arsenic	0.73 J	760 J	mg/kg	A4	227 / 242	0.19 - 157
7440-39-3	Barium	1.7 J	162	mg/kg	A1-03	139 / 230	0.18 - 23.3
7440-41-7	Beryllium	0.15 J	1.2	mg/kg	A26	115 / 230	0.18 - 1.3
7440-43-9	Cadmium	0.035 J	5.9	mg/kg	A14	110 / 230	0.021 - 1
7440-70-2	Calcium	143 J	42900	mg/kg	A93	193 / 228	371 - 2128
7440-47-3	Chromium	2	62.5 J	mg/kg	A13	244 / 244	0.28 - 2
18540-29-9	Chromium VI	0.31 J	8.3 J	mg/kg	A1-10	14 / 18	1.1 - 1.2
7440-48-4	Cobalt	0.29 J	9.2 J	mg/kg	A48	196 / 230	0.24 - 5.8
7440-50-8	Copper	1.5 J	1730	mg/kg	A1-10	232 / 243	0.17 - 248
7439-89-6	Iron	2750	96800	mg/kg	A13	229 / 229	7.4 - 42.6
7439-92-1	Lead	8.2 J	47700 J	mg/kg	A19	222 / 241	0.1 - 12.4
7439-95-4	Magnesium	65.2 J	6960 J	mg/kg	A56	199 / 228	371 - 2128
7439-96-5	Manganese	6.1	355 J	mg/kg	A43	231 / 242	0.2 - 174
7439-97-6	Mercury	0.017 J	0.54	mg/kg	A98	138 / 198	0.032 - 0.17
7440-02-0	Nickel	0.6 J	68.4	mg/kg	A1-10	229 / 244	0.22 - 4.7
7440-09-7	Potassium	41.1 J	2120 J	mg/kg	A54	169 / 223	371 - 2128
7782-49-2	Selenium	0.081 J	2.1	mg/kg	A73	131 / 230	0.062 - 5
7440-22-4	Silver	0.08	2.8	mg/kg	A1-10	33 / 244	0.087 - 1.5
7440-23-5	Sodium	140 J	21600 J	mg/kg	A56	191 / 228	371 - 2128
7440-28-0	Thallium	0.15 J	0.65 J	mg/kg	A103	5 / 230	0.11 - 2.9
7440-31-5	Tin	8 J	1020	mg/kg	SED26	14 / 40	8.7 - 15
7440-62-2	Vanadium	5.5	118 J	mg/kg	A48	229 / 230	0.23 - 5.8
7440-66-6	Zinc	4.7 J	497	mg/kg	A19	241 / 242	0.25 - 7.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1b
SUMMARY OF ANALYTICAL RESULTS - AREA 2 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	8.9	16	µg/kg	A122	2 / 11	8.5 - 13
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
78-93-3	Butanone, 2-	ND	ND	µg/kg	NA	0 / 11	8.5 - 13
75-15-0	Carbon disulfide	0.62 J	0.72 J	µg/kg	A122	2 / 11	4.3 - 6.3
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 11	5.9 - 21
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 11	5.9 - 21
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 2	120 - 130
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 11	8.5 - 13
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 11	8.5 - 13
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 11	4.3 - 6.3
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	ND	ND	µg/kg	NA	0 / 13	120 - 220
208-96-8	Acenaphthylene	ND	ND	µg/kg	NA	0 / 13	120 - 220
98-86-2	Acetophenone	37 J	38 J	µg/kg	A122	2 / 13	120 - 220
120-12-7	Anthracene	ND	ND	µg/kg	NA	0 / 13	120 - 220
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 13	120 - 220
100-52-7	Benzaldehyde	61 J	78 J	µg/kg	A110	2 / 13	120 - 220
56-55-3	Benzo(a)anthracene	14 J	14 J	µg/kg	A122	1 / 13	120 - 220
50-32-8	Benzo(a)pyrene	16 J	16 J	µg/kg	A122	1 / 13	120 - 220

TABLE I-1b
SUMMARY OF ANALYTICAL RESULTS - AREA 2 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	18 J	18 J	µg/kg	A122	1 / 13	120 - 220
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/kg	NA	0 / 13	120 - 220
207-08-9	Benzo(k)fluoranthene	9.5 J	9.5 J	µg/kg	A122	1 / 13	120 - 220
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 13	120 - 220
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 13	120 - 220
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 13	120 - 220
117-81-7	Bis(2-ethylhexyl)phthalate	21 J	3100	µg/kg	A2-07	3 / 13	120 - 380
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 13	120 - 220
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
85-68-7	Butylbenzylphthalate	ND	ND	µg/kg	NA	0 / 13	120 - 220
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 13	120 - 220
86-74-8	Carbazole	ND	ND	µg/kg	NA	0 / 13	120 - 220
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 13	120 - 220
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 13	120 - 220
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 13	220 - 430
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
218-01-9	Chrysene	15 J	15 J	µg/kg	A122	1 / 13	120 - 220
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/kg	NA	0 / 13	120 - 220
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 13	120 - 220
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 13	120 - 220
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
84-66-2	Diethylphthalate	ND	ND	µg/kg	NA	0 / 13	120 - 620
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 13	120 - 220
84-74-2	Di-N-Butylphthalate	ND	ND	µg/kg	NA	0 / 13	220 - 2300
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 13	400 - 430
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 13	420 - 1300
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 13	120 - 220
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 13	120 - 220
206-44-0	Fluoranthene	22 J	22 J	µg/kg	A122	1 / 13	120 - 220
86-73-7	Fluorene	ND	ND	µg/kg	NA	0 / 13	120 - 220
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 13	120 - 220
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 13	120 - 220
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 13	120 - 220
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 13	120 - 220
193-39-5	Indeno(1,2,3-Cd)Pyrene	ND	ND	µg/kg	NA	0 / 13	120 - 220
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 13	120 - 220
91-57-6	Methylnaphthalene, 2-	ND	ND	µg/kg	NA	0 / 13	120 - 220
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 13	120 - 220
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 13	120 - 220
91-20-3	Naphthalene	ND	ND	µg/kg	NA	0 / 13	120 - 220
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 13	120 - 430
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 13	120 - 430
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 13	120 - 430
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 13	120 - 220
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 13	120 - 220
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 13	400 - 430
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 13	120 - 220
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 13	120 - 220
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 13	420 - 1300
85-01-8	Phenanthrene	11 J	11 J	µg/kg	A122	1 / 13	120 - 220
108-95-2	Phenol	12 J	13 J	µg/kg	A110	2 / 13	120 - 220
129-00-0	Pyrene	9.7 J	22 J	µg/kg	A122	2 / 13	120 - 220
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 13	120 - 220
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 13	120 - 220
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 13	120 - 220

TABLE I-1b
SUMMARY OF ANALYTICAL RESULTS - AREA 2 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
5103-71-9	Alpha-Chlordane	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 13	31 - 43
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 13	42 - 66
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 13	31 - 43
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 13	31 - 43
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 13	31 - 43
11097-69-1	Aroclor 1254	42	480	µg/kg	A122	2 / 13	31 - 43
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 13	31 - 43
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 13	31 - 43
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 13	31 - 43
319-85-7	Beta-BHC	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 13	190 - 220
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
72-55-9	DDE, 4,4'-	1.1 J	19	µg/kg	A122	2 / 13	4.2 - 5.3
50-29-3	DDT, 4,4'-	3.2 J	60	µg/kg	A122	2 / 13	4.2 - 5.3
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
60-57-1	Dieldrin	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
72-20-8	Endrin	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
53494-70-5	Endrin Ketone	ND	ND	µg/kg	NA	0 / 13	4.2 - 5.3
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
5103-74-2	Gamma-Chlordane	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 13	2.2 - 2.6
72-43-5	Methoxychlor	ND	ND	µg/kg	NA	0 / 13	22 - 27
	Inorganics						
7429-90-5	Aluminum	441	6000	mg/kg	A2-03	93 / 93	20 - 31.6
7440-36-0	Antimony	0.77 J	190	mg/kg	A2-10	83 / 94	1.3 - 188
7440-38-2	Arsenic	1.5	150	mg/kg	A2-10	94 / 94	1 - 1
7440-39-3	Barium	3.6 J	120	mg/kg	A2-09	60 / 94	6.2 - 20
7440-41-7	Beryllium	0.026 J	0.87 J	mg/kg	SED33	58 / 94	0.26 - 0.5
7440-43-9	Cadmium	0.011 J	2	mg/kg	SED88	31 / 94	0.26 - 0.5
7440-70-2	Calcium	61	32800	mg/kg	S22	68 / 93	45 - 790
7440-47-3	Chromium	2.5	32.6	mg/kg	SED33	94 / 94	1 - 1
18540-29-9	Chromium VI	0.12	2	mg/kg	A2-02	5 / 21	0.1 - 0.11
7440-48-4	Cobalt	0.32 J	4 J	mg/kg	SED30	56 / 94	0.62 - 5
7440-50-8	Copper	2.8	330	mg/kg	A2-07	94 / 94	2.5 - 2.5
7439-89-6	Iron	2260	74800 J	mg/kg	A113	93 / 93	10 - 35.4
7439-92-1	Lead	6.7	3000	mg/kg	A2-07	94 / 94	1 - 1
7439-95-4	Magnesium	70	1360	mg/kg	A129	77 / 93	500 - 790
7439-96-5	Manganese	5.1 J	180	mg/kg	S09	94 / 94	1.5 - 1.5
7439-97-6	Mercury	0.028 J	0.24	mg/kg	A118	32 / 65	0.03 - 0.069
7440-02-0	Nickel	1.1	14.5	mg/kg	SED30	80 / 94	1.7 - 4
7440-09-7	Potassium	67.4 J	873	mg/kg	A162	58 / 93	500 - 790
7782-49-2	Selenium	0.33 J	1.3 J	mg/kg	SED30/SED33	32 / 94	0.52 - 3.5
7440-22-4	Silver	0.086 J	0.38 J	mg/kg	S09	16 / 94	0.26 - 1
7440-23-5	Sodium	110	3090	mg/kg	SED32	59 / 93	87 - 790
7440-28-0	Thallium	0.62 J	0.63 J	mg/kg	A126	2 / 94	0.52 - 2.5
7440-31-5	Tin	16.6	66.9	mg/kg	S09	18 / 29	10 - 10
7440-62-2	Vanadium	5 J	53.9	mg/kg	SED33	94 / 94	5 - 5
7440-66-6	Zinc	6.1	180	mg/kg	A2-06	94 / 94	6 - 6

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1c
SUMMARY OF ANALYTICAL RESULTS - AREAS 3 AND 4 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	11 J	190 J	µg/kg	S71	3 / 50	9.5 - 93
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
78-93-3	Butanone, 2-	ND	ND	µg/kg	NA	0 / 50	9.5 - 93
75-15-0	Carbon Disulfide	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 50	95 - 930
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 50	9.5 - 93
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 50	9.5 - 93
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 50	4.7 - 46
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 50	4.7 - 46
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	61 J	61 J	µg/kg	S76	1 / 50	170 - 890
208-96-8	Acenaphthylene	ND	ND	µg/kg	NA	0 / 50	170 - 890
98-86-2	Acetophenone	ND	ND	µg/kg	NA	0 / 50	170 - 890
120-12-7	Anthracene	120 J	120 J	µg/kg	S76	1 / 50	170 - 890
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 50	170 - 890
100-52-7	Benzaldehyde	27 J	140 J	µg/kg	A4-10	5 / 50	170 - 890
56-55-3	Benzo(a)anthracene	2.1 J	290	µg/kg	S76	25 / 50	3.5 - 890
50-32-8	Benzo(a)pyrene	1.9 J	240	µg/kg	S76	24 / 50	3.5 - 890

TABLE I-1c
SUMMARY OF ANALYTICAL RESULTS - AREAS 3 AND 4 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	2.9 J	340	µg/kg	S76	32 / 50	3.5 - 890
191-24-2	Benzo(g,h,i)perylene	22 J	150 J	µg/kg	S84	6 / 50	170 - 890
207-08-9	Benzo(k)fluoranthene	25 J	200 J	µg/kg	S76	13 / 50	170 - 890
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 50	170 - 890
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 50	170 - 890
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 50	170 - 890
117-81-7	Bis(2-ethylhexyl)phthalate	260 J	2300	µg/kg	S71	6 / 50	170 - 890
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 50	170 - 890
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
85-68-7	Butylbenzylphthalate	39 J	39 J	µg/kg	S70	1 / 50	170 - 890
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 50	170 - 890
86-74-8	Carbazole	ND	ND	µg/kg	NA	0 / 50	170 - 890
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 50	91 - 890
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 50	170 - 890
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 50	170 - 890
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
218-01-9	Chrysene	30 J	280	µg/kg	S76	20 / 50	170 - 890
53-70-3	Dibenzo(a,h)anthracene	2.4 J	9.1	µg/kg	A4-13	5 / 50	3.5 - 890
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 50	170 - 890
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 50	170 - 890
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
84-66-2	Diethylphthalate	ND	ND	µg/kg	NA	0 / 50	170 - 890
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 50	91 - 890
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 50	170 - 890
84-74-2	Di-N-Butylphthalate	ND	ND	µg/kg	NA	0 / 50	170 - 890
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 50	91 - 1700
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 50	91 - 1700
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 50	91 - 890
117-84-0	Di-n-octyl phthalate	57 J	790 J	µg/kg	S76	3 / 50	170 - 890
206-44-0	Fluoranthene	23 J	730	µg/kg	S76	26 / 50	170 - 890
86-73-7	Fluorene	67 J	67 J	µg/kg	S76	1 / 50	170 - 890
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 50	170 - 890
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 50	91 - 890
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 50	170 - 890
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 50	170 - 890
193-39-5	Indeno(1,2,3-cd)pyrene	2.2 J	130 J	µg/kg	S84	17 / 50	3.5 - 890
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 50	170 - 890
91-57-6	Methylnaphthalene, 2-	ND	ND	µg/kg	NA	0 / 50	170 - 890
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 50	170 - 890
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 50	170 - 890
91-20-3	Naphthalene	ND	ND	µg/kg	NA	0 / 50	170 - 890
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 50	330 - 1700
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 50	330 - 1700
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 50	330 - 1700
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 50	170 - 890
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 50	170 - 890
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 50	330 - 1700
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 50	91 - 890
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 50	170 - 890
87-86-5	Pentachlorophenol	5.5 J	5.5 J	µg/kg	A4-02	1 / 50	7.2 - 1700
85-01-8	Phenanthrene	35 J	460	µg/kg	S76	11 / 50	170 - 890
108-95-2	Phenol	ND	ND	µg/kg	NA	0 / 50	170 - 890
129-00-0	Pyrene	27 J	580	µg/kg	S76	25 / 50	170 - 890
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 50	170 - 890
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 50	170 - 890
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 50	170 - 890

TABLE I-1c
SUMMARY OF ANALYTICAL RESULTS - AREAS 3 AND 4 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 50	0.91 - 8.9
319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 50	0.91 - 8.9
5103-71-9	Alpha-chlordane	0.93 J	4.9 J	µg/kg	A3-S88	5 / 50	0.91 - 8.9
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 50	33 - 170
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 50	33 - 170
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 50	33 - 170
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 50	33 - 170
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 50	33 - 170
11097-69-1	Aroclor 1254	60	140 J	µg/kg	A4-02	2 / 50	33 - 170
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 50	33 - 170
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 50	33 - 170
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 50	33 - 170
319-85-7	Beta-BHC	ND	ND	µg/kg	NA	0 / 50	0.91 - 8.9
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 50	64 - 890
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 50	1.8 - 17
72-55-9	DDE, 4,4'-	1.8 J	2 JN	µg/kg	S76	3 / 50	1.8 - 17
50-29-3	DDT, 4,4'-	2 J	20 JN	µg/kg	A4-02	7 / 50	1.8 - 17
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 50	0.91 - 8.9
60-57-1	Dieldrin	0.85 J	0.85 J	µg/kg	A4-04	1 / 50	1.8 - 17
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 50	0.91 - 8.9
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 50	1.8 - 17
1031-07-8	Endosulfan sulfate	5.6 J	8.6 J	µg/kg	S73	3 / 50	1.8 - 17
72-20-8	Endrin	ND	ND	µg/kg	NA	0 / 50	1.8 - 17
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 50	1.8 - 17
53494-70-5	Endrin ketone	6.8 J	6.8 J	µg/kg	S84	1 / 50	1.8 - 17
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 50	0.91 - 8.9
5103-74-2	Gamma-chlordane	0.96 J	21 J	µg/kg	S79	9 / 50	0.91 - 8.9
76-44-8	Heptachlor	1.5 J	1.5 J	µg/kg	S76	1 / 50	0.91 - 8.9
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 50	0.91 - 8.9
72-43-5	Methoxychlor	85 JN	85 JN	µg/kg	S84	1 / 50	9.1 - 89
	Inorganics						
7429-90-5	Aluminum	302 J	27600 J	mg/kg	S77	91 / 91	20 - 105
7440-36-0	Antimony	0.11 J	5.5 J	mg/kg	S82	50 / 91	0.057 - 31.4
7440-38-2	Arsenic	0.16 J	144	mg/kg	S85	87 / 91	0.078 - 5.2
7440-39-3	Barium	3.7	1050	mg/kg	A4-14	65 / 91	0.076 - 105
7440-41-7	Beryllium	0.05 J	0.93	mg/kg	S82	26 / 91	0.1 - 2.6
7440-43-9	Cadmium	0.013 J	3.3 J	mg/kg	S77	44 / 91	0.008 - 2.6
7440-70-2	Calcium	257 J	10900 J	mg/kg	S75	76 / 91	500 - 2619
7440-47-3	Chromium	3	81.3 J	mg/kg	S77	86 / 91	0.12 - 5.2
18540-29-9	Chromium VI	0.31 J	2.4 J	mg/kg	A4-09	23 / 30	1 - 1.2
7440-48-4	Cobalt	0.14 J	11.3	mg/kg	S82	38 / 91	0.099 - 26.2
7440-50-8	Copper	3	131 J	mg/kg	S61	91 / 91	0.071 - 13.1
7439-89-6	Iron	912 J	62800 J	mg/kg	S77	91 / 91	10 - 52.4
7439-92-1	Lead	7.7	97.8 J	mg/kg	S61	91 / 91	0.042 - 5.2
7439-95-4	Magnesium	118 J	2450	mg/kg	A4-13	49 / 91	500 - 2619
7439-96-5	Manganese	3	940 J	mg/kg	S85	91 / 91	0.08 - 7.9
7439-97-6	Mercury	0.015 J	0.073	mg/kg	A4-04	28 / 30	0.052 - 0.062
7440-02-0	Nickel	0.36 J	13.8 J	mg/kg	S77	88 / 91	0.088 - 21
7440-09-7	Potassium	179 J	1240	mg/kg	S81	28 / 53	500 - 606
7782-49-2	Selenium	0.03 J	4.1 J	mg/kg	S77	59 / 91	0.025 - 18.3
7440-22-4	Silver	0.1 J	1.1 J	mg/kg	S61	7 / 91	0.071 - 5.2
7440-23-5	Sodium	8.8 J	816 J	mg/kg	S65	55 / 91	500 - 2619
7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	10 / 91	0.046 - 13.1
7440-31-5	Tin	ND	ND	mg/kg	NA	0 / 23	10 - 10
7440-62-2	Vanadium	3.2 J	112 J	mg/kg	S77	81 / 91	0.092 - 26.2
7440-66-6	Zinc	2.1 J	5160 J	mg/kg	S69	91 / 91	0.1 - 31.4

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1d
SUMMARY OF ANALYTICAL RESULTS - AREAS 5, 6, AND BEACH AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	6.1 J	27	µg/kg	A5-13	5 / 11	10 - 14
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
78-93-3	Butanone, 2-	6.3 J	6.3 J	µg/kg	B4	1 / 11	10 - 14
75-15-0	Carbon disulfide	0.58 J	1.7 J	µg/kg	B14	5 / 11	5 - 7.1
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
108-90-7	Chlorobenzene	0.73 J	0.73 J	µg/kg	B63	1 / 11	5 - 7.1
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 11	100 - 140
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 11	10 - 14
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 11	10 - 14
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 11	5 - 7.1
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	ND	ND	µg/kg	NA	0 / 11	180 - 240
208-96-8	Acenaphthylene	ND	ND	µg/kg	NA	0 / 11	180 - 240
98-86-2	Acetophenone	21 J	41 J	µg/kg	B63	5 / 11	180 - 240
120-12-7	Anthracene	ND	ND	µg/kg	NA	0 / 11	180 - 240
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 11	180 - 240
100-52-7	Benzaldehyde	29 J	64 J	µg/kg	A133	5 / 11	180 - 240
56-55-3	Benzo(a)anthracene	5.4	33	µg/kg	A9-15	8 / 11	3.4 - 240
50-32-8	Benzo(a)pyrene	3.5 J	40 J	µg/kg	A133	6 / 11	3.4 - 240

TABLE I-1d
SUMMARY OF ANALYTICAL RESULTS - AREAS 5, 6, AND BEACH AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	3.9	54 J	µg/kg	A133	8 / 11	3.4 - 240
191-24-2	Benzo(g,h,i)perylene	13 J	23 J	µg/kg	A133	2 / 11	180 - 240
207-08-9	Benzo(k)fluoranthene	10 J	16 J	µg/kg	A133	2 / 11	180 - 240
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 11	180 - 240
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 11	180 - 240
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 11	180 - 240
117-81-7	Bis(2-ethylhexyl)phthalate	17 J	52 J	µg/kg	A5-13	7 / 11	180 - 240
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 11	180 - 240
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
85-68-7	Butylbenzylphthalate	ND	ND	µg/kg	NA	0 / 11	180 - 240
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 11	180 - 240
86-74-8	Carbazole	ND	ND	µg/kg	NA	0 / 11	180 - 240
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 11	88 - 240
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 11	180 - 240
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 11	180 - 240
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
218-01-9	Chrysene	7 J	32 J	µg/kg	A9-15	4 / 11	180 - 240
53-70-3	Dibenzo(a,h)anthracene	3.2 J	3.6	µg/kg	A9-15	2 / 11	3.4 - 240
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 11	180 - 240
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 11	180 - 240
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
84-66-2	Diethylphthalate	6.5 J	9.2 J	µg/kg	B34	2 / 11	180 - 240
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 11	88 - 240
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 11	180 - 240
84-74-2	Di-n-butylphthalate	8.2 J	11 J	µg/kg	B4	4 / 11	180 - 240
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 11	88 - 460
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 11	88 - 460
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 11	88 - 240
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 11	180 - 240
206-44-0	Fluoranthene	7.5 J	54 J	µg/kg	A9-15	5 / 11	180 - 240
86-73-7	Fluorene	ND	ND	µg/kg	NA	0 / 11	180 - 240
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 11	180 - 240
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 11	88 - 240
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 11	180 - 240
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 11	180 - 240
193-39-5	Indeno(1,2,3-cd)pyrene	4	32 J	µg/kg	A133	6 / 11	3.4 - 240
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 11	180 - 240
91-57-6	Methylnaphthalene, 2-	ND	ND	µg/kg	NA	0 / 11	180 - 240
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 11	180 - 240
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 11	180 - 240
91-20-3	Naphthalene	ND	ND	µg/kg	NA	0 / 11	180 - 240
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 11	340 - 460
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 11	340 - 460
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 11	340 - 460
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 11	180 - 240
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 11	180 - 240
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 11	340 - 460
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 11	88 - 240
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 11	180 - 240
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 11	6.9 - 460
85-01-8	Phenanthrene	14 J	23 J	µg/kg	A133	3 / 11	180 - 240
108-95-2	Phenol	19 J	45 J	µg/kg	B4	5 / 11	180 - 240
129-00-0	Pyrene	9.1 J	68 J	µg/kg	A9-15	6 / 11	180 - 240
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 11	180 - 240
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 11	180 - 240
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 11	180 - 240

TABLE I-1d
SUMMARY OF ANALYTICAL RESULTS - AREAS 5, 6, AND BEACH AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
5103-71-9	Alpha-Chlordane	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 11	34 - 46
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 11	34 - 46
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 11	34 - 46
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 11	34 - 46
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 11	34 - 46
11097-69-1	Aroclor 1254	50	50	µg/kg	A133	1 / 11	34 - 46
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 11	34 - 46
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 11	34 - 46
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 11	34 - 46
319-85-7	Beta-BHC	0.11 J	0.11 J	µg/kg	B63	1 / 11	0.89 - 2.4
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 11	62 - 240
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 11	1.7 - 4.6
72-55-9	DDE, 4,4'-	1.4 J	1.4 J	µg/kg	A133	1 / 11	1.7 - 4.6
50-29-3	DDT, 4,4'-	4.3 J	4.3 J	µg/kg	A133	1 / 11	1.7 - 4.6
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
60-57-1	Dieldrin	ND	ND	µg/kg	NA	0 / 11	1.7 - 4.6
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 11	1.7 - 4.6
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 11	1.7 - 4.6
72-20-8	Endrin	0.11 J	0.13 J	µg/kg	B34	2 / 11	1.7 - 4.6
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 11	1.7 - 4.6
53494-70-5	Endrin ketone	0.074 J	0.11 J	µg/kg	B63	2 / 11	1.7 - 4.6
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
5103-74-2	Gamma-Chlordane	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 11	0.89 - 2.4
72-43-5	Methoxychlor	ND	ND	µg/kg	NA	0 / 11	8.9 - 24
	Inorganics						
7429-90-5	Aluminum	160	11600	mg/kg	A9-65	309 / 310	8 - 36
7440-36-0	Antimony	0.18 J	210	mg/kg	S213	110 / 458	0.056 - 10.7
7440-38-2	Arsenic	0.51	54	mg/kg	S162	453 / 465	0.077 - 1.8
7440-39-3	Barium	0.77 J	109 J	mg/kg	S128	195 / 352	0.075 - 35.7
7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	147 / 352	0.1 - 0.89
7440-43-9	Cadmium	0.007 J	3.1	mg/kg	SED120	159 / 352	0.008 - 0.89
7440-70-2	Calcium	18.6 J	26500	mg/kg	A6-02	255 / 316	174 - 901
7440-47-3	Chromium	0.96 J	230	mg/kg	B47	457 / 458	0.11 - 1.8
18540-29-9	Chromium VI	0.37 J	1.1 J	mg/kg	A6-02	10 / 28	1 - 1.9
7440-48-4	Cobalt	0.14 J	11.1	mg/kg	A5-14	189 / 352	0.098 - 8.9
7440-50-8	Copper	0.44 J	93	mg/kg	A130	452 / 465	0.071 - 4.5
7439-89-6	Iron	1670	77000 J	mg/kg	SED198	310 / 310	4.3 - 18
7439-92-1	Lead	1.1	1090	mg/kg	SED150	447 / 465	0.042 - 1.8
7439-95-4	Magnesium	22.8 J	9920	mg/kg	SED120	276 / 316	198 - 901
7439-96-5	Manganese	2.3	3470 J	mg/kg	SED120	352 / 355	0.079 - 2.7
7439-97-6	Mercury	0.016 J	0.29	mg/kg	A130	72 / 119	0.029 - 0.18
7440-02-0	Nickel	0.074 J	23.8	mg/kg	SED195	305 / 352	0.088 - 7.1
7440-09-7	Potassium	12.7 J	2830	mg/kg	A9-65	182 / 316	191 - 901
7782-49-2	Selenium	0.027 J	4.4 J	mg/kg	SED157	168 / 352	0.025 - 6.2
7440-22-4	Silver	0.055 J	15.6 J	mg/kg	SED198	75 / 352	0.071 - 1.8
7440-23-5	Sodium	6.4 J	8610 J	mg/kg	S29	196 / 316	207 - 901
7440-28-0	Thallium	0.16 J	0.17 J	mg/kg	A5-14	2 / 352	0.046 - 4.5
7440-31-5	Tin	12.1 J	23.5 J	mg/kg	S27	4 / 46	10 - 10
7440-62-2	Vanadium	0.52	125	mg/kg	B15	346 / 352	0.092 - 8.9
7440-66-6	Zinc	3.3 J	245	mg/kg	SED127	324 / 359	0.1 - 14.6

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value
J-=estimated value, biased low

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1e
SUMMARY OF ANALYTICAL RESULTS - UPLAND AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	5 J	180	µg/kg	A9-111	22 / 128	4.6 - 16
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
78-93-3	Butanone, 2-	ND	ND	µg/kg	NA	0 / 128	4.6 - 16
75-15-0	Carbon disulfide	3 J	4.9 J	µg/kg	A9-54	3 / 128	2.3 - 8.2
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 128	2.3 - 8.2
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 128	46 - 160
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 128	4.6 - 16
98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 128	2.3 - 8.2
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 128	4.6 - 16
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 128	2.3 - 8.2
100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 128	2.3 - 8.2
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 128	2.3 - 8.2
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	25 J	1000 J	µg/kg	A9-23	6 / 128	180 - 260
208-96-8	Acenaphthylene	39 J	84 J	µg/kg	A9-42	4 / 128	180 - 260
98-86-2	Acetophenone	27 J	230 J	µg/kg	A9-23	8 / 128	180 - 260
120-12-7	Anthracene	24 J	2700 J	µg/kg	A9-23	12 / 128	180 - 260
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 128	180 - 260
100-52-7	Benzaldehyde	25 J	78 J	µg/kg	A9-52	5 / 128	180 - 260
56-55-3	Benzo(a)anthracene	2.2 J	3000 J	µg/kg	A9-23	87 / 128	3.4 - 37
50-32-8	Benzo(a)pyrene	2 J	2200 J	µg/kg	A9-23	78 / 128	3.4 - 37

TABLE I-1e
SUMMARY OF ANALYTICAL RESULTS - UPLAND AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	2 J	2100 J	µg/kg	A9-23	95 / 128	3.4 - 37
191-24-2	Benzo(g,h,i)perylene	25 J	890 J	µg/kg	A9-23	24 / 128	180 - 260
207-08-9	Benzo(k)fluoranthene	19 J	1100 J	µg/kg	A9-23	20 / 128	180 - 260
92-52-4	Biphenyl, 1,1'-	32 J	200 J	µg/kg	A9-23	3 / 128	180 - 260
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 128	180 - 260
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 128	180 - 260
117-81-7	Bis(2-ethylhexyl)phthalate	23 J	2000 J	µg/kg	A9-109	37 / 128	180 - 260
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 128	180 - 260
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
85-68-7	Butylbenzylphthalate	65 J	61000	µg/kg	A9-111	6 / 128	180 - 260
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 128	180 - 260
86-74-8	Carbazole	26 J	890 J	µg/kg	A9-23	6 / 128	180 - 260
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 128	88 - 130
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 128	180 - 260
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 128	180 - 260
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
218-01-9	Chrysene	19 J	3800 J	µg/kg	A9-23	41 / 128	180 - 260
53-70-3	Dibenzo(a,h)anthracene	2.3 J	520 J	µg/kg	A9-23	41 / 128	3.4 - 37
132-64-9	Dibenzofuran	24 J	920 J	µg/kg	A9-23	5 / 128	180 - 260
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 128	180 - 260
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
84-66-2	Diethylphthalate	ND	ND	µg/kg	NA	0 / 128	180 - 260
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 128	88 - 130
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 128	180 - 260
84-74-2	Di-n-butylphthalate	30 J	11000	µg/kg	A9-04	4 / 128	180 - 260
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 128	88 - 130
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 128	88 - 130
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 128	88 - 130
117-84-0	Di-n-octyl phthalate	43 J	44 J	µg/kg	A9-109	2 / 128	180 - 260
206-44-0	Fluoranthene	21 J	7800 J	µg/kg	A9-23	43 / 128	180 - 260
86-73-7	Fluorene	26 J	1200 J	µg/kg	A9-23	8 / 128	180 - 260
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 128	180 - 260
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 128	88 - 130
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 128	180 - 260
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 128	180 - 260
193-39-5	Indeno(1,2,3-cd)pyrene	1.8 J	1200 J	µg/kg	A9-23	68 / 128	3.4 - 37
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 128	180 - 260
91-57-6	Methylnaphthalene, 2-	37 J	870 J	µg/kg	A9-23	5 / 128	180 - 260
95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 128	180 - 260
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 128	180 - 260
91-20-3	Naphthalene	28 J	920	µg/kg	A9-14	10 / 128	180 - 260
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 128	340 - 510
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 128	340 - 510
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 128	340 - 510
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 128	180 - 260
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 128	180 - 260
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 128	340 - 510
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 128	88 - 130
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 128	180 - 260
87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	8 / 128	6.9 - 76
85-01-8	Phenanthrene	20 J	13000 J	µg/kg	A9-23	25 / 128	180 - 260
108-95-2	Phenol	38 J	38 J	µg/kg	A9-23	1 / 128	180 - 260
129-00-0	Pyrene	18 J	6800 J	µg/kg	A9-23	46 / 128	180 - 260
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 128	180 - 260
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 128	180 - 260
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 128	180 - 260

TABLE I-1e
SUMMARY OF ANALYTICAL RESULTS - UPLAND AREA OF AREA 9 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
5103-71-9	Alpha-chlordane	1.6 JN	14 JN	µg/kg	A9-06	14 / 128	0.87 - 13
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 128	34 - 410
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 128	34 - 410
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 128	34 - 410
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 128	34 - 410
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 128	34 - 410
11097-69-1	Aroclor 1254	25 J	62000	µg/kg	A9-61	23 / 128	34 - 410
11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 128	34 - 410
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 128	34 - 410
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 128	34 - 410
319-85-7	Beta-BHC	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 128	61 - 910
72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	6 / 128	1.7 - 25
72-55-9	DDE, 4,4'-	1.8 J	17 JN	µg/kg	A9-17	8 / 128	1.7 - 25
50-29-3	DDT, 4,4'-	2 JN	1300 JN	µg/kg	A9-25	11 / 128	1.7 - 25
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
60-57-1	Dieldrin	1.2 J	4.7	µg/kg	A9-42	6 / 128	1.7 - 25
959-98-8	Endosulfan I	2.1 JN	2.1 JN	µg/kg	A9-26	1 / 128	0.87 - 13
33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	5 / 128	1.7 - 25
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 128	1.7 - 25
72-20-8	Endrin	3	3	µg/kg	A9-42	1 / 128	1.7 - 25
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 128	1.7 - 25
53494-70-5	Endrin Ketone	ND	ND	µg/kg	NA	0 / 128	1.7 - 25
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
5103-74-2	Gamma-chlordane	1.2 J	180 JN	µg/kg	A9-25	18 / 128	0.87 - 13
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 128	0.87 - 13
72-43-5	Methoxychlor	11 JN	19 JN	µg/kg	A9-29	2 / 128	8.7 - 130
	Inorganics						
7429-90-5	Aluminum	187	13500	mg/kg	A9-37	135 / 135	9 - 43.7
7440-36-0	Antimony	0.15 J	2200	mg/kg	A9-109	62 / 135	0.13 - 39.6
7440-38-2	Arsenic	0.23	594	mg/kg	A9-109	130 / 135	0.18 - 54.3
7440-39-3	Barium	1.4 J	1120	mg/kg	A9-109	131 / 135	0.17 - 52.8
7440-41-7	Beryllium	0.28 J	0.81 J	mg/kg	A9-34	30 / 135	0.24 - 0.62
7440-43-9	Cadmium	0.021 J	12.5	mg/kg	A9-109	114 / 135	0.019 - 0.5
7440-70-2	Calcium	223 J	29600	mg/kg	A9-58	55 / 135	196 - 1090
7440-47-3	Chromium	1.4 J	155	mg/kg	A9-21	135 / 135	0.27 - 1
18540-29-9	Chromium VI	0.3 J	3.4 J-	mg/kg	A9-50	58 / 130	1 - 2.5
7440-48-4	Cobalt	0.25 J	12.7	mg/kg	A9-34	107 / 135	0.23 - 5
7440-50-8	Copper	1.3 J	1170	mg/kg	A9-21	127 / 135	0.17 - 49.9
7439-89-6	Iron	2150	70300	mg/kg	A9-109	135 / 135	4.8 - 25.1
7439-92-1	Lead	5.3	10200 J	mg/kg	S63	125 / 135	0.097 - 29.3
7439-95-4	Magnesium	53.5 J	4310	mg/kg	A9-58	73 / 135	222 - 1090
7439-96-5	Manganese	2 J	1020	mg/kg	A9-109	135 / 135	0.18 - 55.8
7439-97-6	Mercury	0.017 J	1.9	mg/kg	A9-109	96 / 130	0.052 - 0.11
7440-02-0	Nickel	0.25	46.8	mg/kg	A9-109	131 / 135	0.2 - 4
7440-09-7	Potassium	31.8 J	3080	mg/kg	A9-35	93 / 135	216 - 1090
7782-49-2	Selenium	0.064 J	8.5	mg/kg	A9-42	57 / 135	0.058 - 3.5
7440-22-4	Silver	0.19 J	10.3	mg/kg	A9-23	20 / 135	0.17 - 1
7440-23-5	Sodium	6.2 J	2620	mg/kg	A9-35	21 / 135	233 - 1090
7440-28-0	Thallium	0.12 J	0.68	mg/kg	A9-109	6 / 135	0.11 - 2.5
7440-31-5	Tin	28.1	313	mg/kg	S63	2 / 5	10 - 10
7440-62-2	Vanadium	2.2	202	mg/kg	A9-33	134 / 135	0.21 - 5
7440-66-6	Zinc	1.1	596	mg/kg	A9-109	134 / 135	0.24 - 71.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value
J-=estimated value, biased low

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1f
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT AREAS 2, 8, AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	5 J	190 J	µg/kg	S71	33 / 224	4.6 - 93
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
78-93-3	Butanone, 2-	6.3 J	15	µg/kg	A92	2 / 224	4.6 - 93
75-15-0	Carbon disulfide	0.42 J	5 J	µg/kg	A41	15 / 224	0.88 - 46
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	4 / 224	2.3 - 46
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 224	2.3 - 46
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 224	0.55 - 46
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 224	46 - 930
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 224	4.6 - 93
98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 224	2.3 - 46
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 224	4.6 - 93
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 224	2.3 - 46
100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 224	2.3 - 46
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 224	1.1 - 46
127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 224	2.3 - 46
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 224	1.1 - 46
79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 224	2.3 - 46
75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 224	2.3 - 46
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 224	2.3 - 46
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	4.9	1000 J	µg/kg	A9-23	10 / 224	3.8 - 910
208-96-8	Acenaphthylene	9.4 J	84 J	µg/kg	A9-42	7 / 224	3.8 - 910
98-86-2	Acetophenone	14 J	230 J	µg/kg	A9-23	25 / 224	170 - 910
120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	23 / 224	98 - 910
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 224	98 - 910
100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A4-10	26 / 224	170 - 910
56-55-3	Benzo(a)anthracene	2.1 J	3000 J	µg/kg	A9-23	146 / 224	3.4 - 910
50-32-8	Benzo(a)pyrene	1.9 J	2200 J	µg/kg	A9-23	130 / 224	3.4 - 910

TABLE I-1f
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT AREAS 2, 8, AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	2 J	2100 J	µg/kg	A9-23	159 / 224	3.4 - 910
191-24-2	Benzo(g,h,i)perylene	6.8 J	890 J	µg/kg	A9-23	46 / 224	170 - 910
207-08-9	Benzo(k)fluoranthene	6.9 J	1100 J	µg/kg	A9-23	49 / 224	170 - 910
92-52-4	Biphenyl, 1,1'-	15 J	200 J	µg/kg	A9-23	4 / 224	170 - 910
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 224	170 - 910
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 224	170 - 910
117-81-7	Bis(2-ethylhexyl)phthalate	15 J	2300	µg/kg	S71	63 / 224	170 - 910
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 224	170 - 910
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 224	170 - 910
85-68-7	Butylbenzylphthalate	7 J	61000	µg/kg	A9-111	8 / 224	170 - 910
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 224	170 - 910
86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	13 / 224	170 - 910
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 224	170 - 910
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 224	98 - 910
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 224	88 - 910
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 224	98 - 910
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 224	170 - 910
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 224	170 - 910
218-01-9	Chrysene	4.5	3800 J	µg/kg	A9-23	86 / 224	3.8 - 910
53-70-3	Dibenzo(a,h)anthracene	2 J	520 J	µg/kg	A9-23	64 / 224	3.4 - 910
132-64-9	Dibenzofuran	8.5 J	920 J	µg/kg	A9-23	7 / 224	170 - 910
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 224	98 - 910
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 224	98 - 910
84-66-2	Diethylphthalate	6.5 J	13 J	µg/kg	A80	6 / 224	170 - 910
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 224	88 - 910
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 224	170 - 910
84-74-2	Di-n-butylphthalate	8.2 J	11000	µg/kg	A9-04	13 / 224	170 - 910
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 224	88 - 1800
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 224	88 - 1800
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 224	98 - 910
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 224	88 - 910
117-84-0	Di-n-octyl phthalate	43 J	790 J	µg/kg	S76	5 / 224	170 - 910
206-44-0	Fluoranthene	7.5 J	7800 J	µg/kg	A9-23	95 / 224	170 - 910
86-73-7	Fluorene	11 J	1200 J	µg/kg	A9-23	11 / 224	3.8 - 910
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 224	98 - 910
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 224	88 - 910
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 224	170 - 910
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 224	170 - 910
193-39-5	Indeno(1,2,3-cd)pyrene	1.8 J	1200 J	µg/kg	A9-23	109 / 224	3.4 - 910
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 224	170 - 910
91-57-6	Methylnaphthalene, 2-	5.7 J	870 J	µg/kg	A9-23	13 / 224	3.8 - 910
95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 224	98 - 910
106-44-5	Methylphenol, 4-	6.8 J	6.8 J	µg/kg	A80	1 / 224	170 - 910
91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	25 / 224	170 - 910
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 224	330 - 1800
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 224	330 - 1800
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 224	330 - 1800
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 224	170 - 910
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 224	170 - 910
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 224	330 - 1800
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 224	88 - 910
86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 224	170 - 910
87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	9 / 224	6.9 - 1800
85-01-8	Phenanthrene	6.5 J	13000 J	µg/kg	A9-23	60 / 224	170 - 910
108-95-2	Phenol	13 J	73 J	µg/kg	A56	16 / 224	170 - 910
129-00-0	Pyrene	9.1 J	6800 J	µg/kg	A9-23	99 / 224	170 - 910
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 224	170 - 910
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 224	170 - 910
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 224	170 - 910

TABLE I-1f
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT AREAS 2, 8, AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 224	0.39 - 13
319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 224	0.39 - 13
5103-71-9	Alpha-chlordane	0.93 J	52 JN	µg/kg	A1-S05	24 / 224	0.39 - 13
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
11097-69-1	Aroclor 1254	25 J	62000	µg/kg	A9-61	38 / 224	7.5 - 410
11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 224	7.5 - 410
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 224	7.5 - 410
319-85-7	Beta-BHC	0.11 J	0.72 J	µg/kg	A1-S16	2 / 224	0.39 - 13
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 224	39 - 910
72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	7 / 224	0.75 - 25
72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	19 / 224	0.75 - 25
50-29-3	DDT, 4,4'-	0.56 J	1300 JN	µg/kg	A9-25	31 / 224	0.75 - 25
319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 224	0.39 - 13
60-57-1	Dieldrin	0.85 J	4.7	µg/kg	A9-42	9 / 224	0.75 - 25
959-98-8	Endosulfan I	0.047 J	2.1 JN	µg/kg	A9-26	3 / 224	0.39 - 13
33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	8 / 224	0.75 - 25
1031-07-8	Endosulfan Sulfate	5.6 J	58 JN	µg/kg	A1-10	4 / 224	0.75 - 25
72-20-8	Endrin	0.11 J	24 JN	µg/kg	A1-10	8 / 224	0.75 - 25
7421-93-4	Endrin Aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 224	0.75 - 25
53494-70-5	Endrin Ketone	0.059 J	6.8 J	µg/kg	S84	9 / 224	0.75 - 25
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 224	0.39 - 13
5103-74-2	Gamma-chlordane	0.96 J	180 JN	µg/kg	A9-25	35 / 224	0.39 - 13
76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	3 / 224	0.39 - 13
1024-57-3	Heptachlor Epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 224	0.39 - 13
72-43-5	Methoxychlor	3.3 J	85 JN	µg/kg	S84	4 / 224	3.9 - 130
	Inorganics						
7429-90-5	Aluminum	149	27600 J	mg/kg	S77	777 / 792	8 - 105
7440-36-0	Antimony	0.11 J	2390	mg/kg	A19	342 / 948	0.056 - 232
7440-38-2	Arsenic	0.16 J	760 J	mg/kg	A4	911 / 953	0.077 - 157
7440-39-3	Barium	0.77 J	1120	mg/kg	A9-109	538 / 827	0.075 - 105
7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	320 / 828	0.1 - 2.6
7440-43-9	Cadmium	0.007 J	12.5	mg/kg	A9-109	428 / 828	0.008 - 2.6
7440-70-2	Calcium	18.6 J	42900	mg/kg	A93	597 / 790	174 - 2619
7440-47-3	Chromium	0.96 J	230	mg/kg	B47	942 / 948	0.11 - 5.2
18540-29-9	Chromium VI	0.3 J	8.3 J	mg/kg	A1-10	114 / 218	1 - 2.5
7440-48-4	Cobalt	0.14 J	12.7	mg/kg	A9-34	539 / 828	0.098 - 26.2
7440-50-8	Copper	0.44 J	1730	mg/kg	A1-10	916 / 954	0.071 - 248
7439-89-6	Iron	912 J	96800	mg/kg	A13	793 / 793	4.3 - 52.4
7439-92-1	Lead	1.1	47700 J	mg/kg	A19	905 / 952	0.042 - 29.3
7439-95-4	Magnesium	22.8 J	9920	mg/kg	SED120	617 / 790	198 - 2619
7439-96-5	Manganese	2 J	3470 J	mg/kg	SED120	816 / 836	0.079 - 174
7439-97-6	Mercury	0.015 J	1.9	mg/kg	A9-109	346 / 491	0.029 - 0.18
7440-02-0	Nickel	0.074 J	68.4	mg/kg	A1-10	764 / 842	0.088 - 21
7440-09-7	Potassium	12.7 J	3080	mg/kg	A9-35	481 / 747	191 - 2128
7782-49-2	Selenium	0.027 J	8.5	mg/kg	A9-42	421 / 828	0.025 - 18.3
7440-22-4	Silver	0.055 J	15.6 J	mg/kg	SED198	135 / 842	0.071 - 5.2
7440-23-5	Sodium	6.2 J	21600 J	mg/kg	A56	480 / 790	207 - 2619
7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	23 / 828	0.046 - 13.1
7440-31-5	Tin	8 J	1020	mg/kg	SED26	20 / 120	8.7 - 15
7440-62-2	Vanadium	0.52	202	mg/kg	A9-33	809 / 828	0.092 - 26.2
7440-66-6	Zinc	1.1	5160 J	mg/kg	S69	810 / 847	0.1 - 71.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1g
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT AREAS 8 AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	5 J	190 J	µg/kg	S71	35 / 235	4.6 - 93
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
78-93-3	Butanone, 2-	6.3 J	15	µg/kg	A92	2 / 235	4.6 - 93
75-15-0	Carbon disulfide	0.42 J	5 J	µg/kg	A41	17 / 235	0.88 - 46
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	4 / 235	2.3 - 46
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 235	2.3 - 46
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 235	0.55 - 46
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 226	46 - 930
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 235	4.6 - 93
98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 235	2.3 - 46
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 235	4.6 - 93
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 235	2.3 - 46
100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 235	2.3 - 46
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 235	1.1 - 46
127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 235	2.3 - 46
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 235	1.1 - 46
79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 235	2.3 - 46
75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 235	2.3 - 46
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 235	2.3 - 46
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	4.9	1000 J	µg/kg	A9-23	10 / 237	3.8 - 910
208-96-8	Acenaphthylene	9.4 J	84 J	µg/kg	A9-42	7 / 237	3.8 - 910
98-86-2	Acetophenone	14 J	230 J	µg/kg	A9-23	27 / 237	120 - 910
120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	23 / 237	98 - 910
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 237	98 - 910
100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A4-10	28 / 237	120 - 910
56-55-3	Benzo(a)anthracene	2.1 J	3000 J	µg/kg	A9-23	147 / 237	3.4 - 910
50-32-8	Benzo(a)pyrene	1.9 J	2200 J	µg/kg	A9-23	131 / 237	3.4 - 910

TABLE I-1g
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT AREAS 8 AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	2 J	2100 J	µg/kg	A9-23	160 / 237	3.4 - 910
191-24-2	Benzo(g,h,i)perylene	6.8 J	890 J	µg/kg	A9-23	46 / 237	120 - 910
207-08-9	Benzo(k)fluoranthene	6.9 J	1100 J	µg/kg	A9-23	50 / 237	120 - 910
92-52-4	Biphenyl, 1,1'-	15 J	200 J	µg/kg	A9-23	4 / 237	120 - 910
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 237	120 - 910
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 237	120 - 910
117-81-7	Bis(2-ethylhexyl)phthalate	15 J	3100	µg/kg	A2-07	66 / 237	120 - 910
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 237	120 - 910
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 237	120 - 910
85-68-7	Butylbenzylphthalate	7 J	61000	µg/kg	A9-111	8 / 237	120 - 910
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 237	120 - 910
86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	13 / 237	120 - 910
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 237	120 - 910
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 237	98 - 910
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 237	88 - 910
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 237	98 - 910
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 237	170 - 910
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 237	120 - 910
218-01-9	Chrysene	4.5	3800 J	µg/kg	A9-23	87 / 237	3.8 - 910
53-70-3	Dibenzo(a,h)anthracene	2 J	520 J	µg/kg	A9-23	64 / 237	3.4 - 910
132-64-9	Dibenzofuran	8.5 J	920 J	µg/kg	A9-23	7 / 237	120 - 910
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 237	98 - 910
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 237	98 - 910
84-66-2	Diethylphthalate	6.5 J	13 J	µg/kg	A80	6 / 237	120 - 910
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 237	88 - 910
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 237	120 - 910
84-74-2	Di-n-butylphthalate	8.2 J	11000	µg/kg	A9-04	13 / 237	170 - 2300
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 237	88 - 1800
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 237	88 - 1800
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 237	98 - 910
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 237	88 - 910
117-84-0	Di-n-octyl phthalate	43 J	790 J	µg/kg	S76	5 / 237	120 - 910
206-44-0	Fluoranthene	7.5 J	7800 J	µg/kg	A9-23	96 / 237	120 - 910
86-73-7	Fluorene	11 J	1200 J	µg/kg	A9-23	11 / 237	3.8 - 910
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 237	98 - 910
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 237	88 - 910
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 237	120 - 910
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 237	120 - 910
193-39-5	Indeno(1,2,3-cd)pyrene	1.8 J	1200 J	µg/kg	A9-23	109 / 237	3.4 - 910
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 237	120 - 910
91-57-6	Methylnaphthalene, 2-	5.7 J	870 J	µg/kg	A9-23	13 / 237	3.8 - 910
95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 237	98 - 910
106-44-5	Methylphenol, 4-	6.8 J	6.8 J	µg/kg	A80	1 / 237	120 - 910
91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	25 / 237	120 - 910
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 237	120 - 1800
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 237	120 - 1800
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 237	120 - 1800
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 237	120 - 910
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 237	120 - 910
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 237	330 - 1800
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 237	88 - 910
86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 237	120 - 910
87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	9 / 237	6.9 - 1800
85-01-8	Phenanthrene	6.5 J	13000 J	µg/kg	A9-23	61 / 237	120 - 910
108-95-2	Phenol	12 J	73 J	µg/kg	A56	18 / 237	120 - 910
129-00-0	Pyrene	9.1 J	6800 J	µg/kg	A9-23	101 / 237	120 - 910
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 237	120 - 910
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 237	120 - 910
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 237	120 - 910

TABLE I-1g
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT AREAS 8 AND 11) SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 237	0.39 - 13
319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 237	0.39 - 13
5103-71-9	Alpha-chlordane	0.93 J	52 JN	µg/kg	A1-S05	24 / 237	0.39 - 13
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
11097-69-1	Aroclor 1254	25 J	62000	µg/kg	A9-61	40 / 237	7.5 - 410
11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 237	7.5 - 410
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 237	7.5 - 410
319-85-7	Beta-BHC	0.11 J	0.72 J	µg/kg	A1-SS16	2 / 237	0.39 - 13
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 237	39 - 910
72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	7 / 237	0.75 - 25
72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	21 / 237	0.75 - 25
50-29-3	DDT, 4,4'-	0.56 J	1300 JN	µg/kg	A9-25	33 / 237	0.75 - 25
319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 237	0.39 - 13
60-57-1	Dieldrin	0.85 J	4.7	µg/kg	A9-42	9 / 237	0.75 - 25
959-98-8	Endosulfan I	0.047 J	2.1 JN	µg/kg	A9-26	3 / 237	0.39 - 13
33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	8 / 237	0.75 - 25
1031-07-8	Endosulfan Sulfate	5.6 J	58 JN	µg/kg	A1-10	4 / 237	0.75 - 25
72-20-8	Endrin	0.11 J	24 JN	µg/kg	A1-10	8 / 237	0.75 - 25
7421-93-4	Endrin Aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 237	0.75 - 25
53494-70-5	Endrin Ketone	0.059 J	6.8 J	µg/kg	S84	9 / 237	0.75 - 25
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 237	0.39 - 13
5103-74-2	Gamma-chlordane	0.96 J	180 JN	µg/kg	A9-25	35 / 237	0.39 - 13
76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	3 / 237	0.39 - 13
1024-57-3	Heptachlor Epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 237	0.39 - 13
72-43-5	Methoxychlor	3.3 J	85 JN	µg/kg	S84	4 / 237	3.9 - 130
	Inorganics						
7429-90-5	Aluminum	149	27600 J	mg/kg	S77	870 / 885	8 - 105
7440-36-0	Antimony	0.11 J	2390	mg/kg	A19	425 / 1042	0.056 - 232
7440-38-2	Arsenic	0.16 J	760 J	mg/kg	A4	1005 / 1047	0.077 - 157
7440-39-3	Barium	0.77 J	1120	mg/kg	A9-109	599 / 922	0.075 - 105
7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	378 / 922	0.1 - 2.6
7440-43-9	Cadmium	0.007 J	12.5	mg/kg	A9-109	459 / 922	0.008 - 2.6
7440-70-2	Calcium	18.6 J	42900	mg/kg	A93	665 / 883	45 - 2619
7440-47-3	Chromium	0.96 J	230	mg/kg	B47	1036 / 1042	0.11 - 5.2
18540-29-9	Chromium VI	0.12	8.3 J	mg/kg	A1-10	119 / 239	0.1 - 2.5
7440-48-4	Cobalt	0.14 J	12.7	mg/kg	A9-34	595 / 922	0.098 - 26.2
7440-50-8	Copper	0.44 J	1730	mg/kg	A1-10	1009 / 1047	0.071 - 248
7439-89-6	Iron	912 J	96800	mg/kg	A13	886 / 886	4.3 - 52.4
7439-92-1	Lead	1.1	47700 J	mg/kg	A19	999 / 1046	0.042 - 29.3
7439-95-4	Magnesium	22.8 J	9920	mg/kg	SED120	694 / 883	198 - 2619
7439-96-5	Manganese	2 J	3470 J	mg/kg	SED120	909 / 929	0.079 - 174
7439-97-6	Mercury	0.015 J	1.9	mg/kg	A9-109	378 / 556	0.029 - 0.18
7440-02-0	Nickel	0.074 J	68.4	mg/kg	A1-10	844 / 936	0.088 - 21
7440-09-7	Potassium	12.7 J	3080	mg/kg	A9-35	539 / 840	191 - 2128
7782-49-2	Selenium	0.027 J	8.5	mg/kg	A9-42	453 / 922	0.025 - 18.3
7440-22-4	Silver	0.055 J	15.6 J	mg/kg	SED198	151 / 936	0.071 - 5.2
7440-23-5	Sodium	6.2 J	21600 J	mg/kg	A56	539 / 883	87 - 2619
7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	25 / 922	0.046 - 13.1
7440-31-5	Tin	8 J	1020	mg/kg	SED26	38 / 149	8.7 - 15
7440-62-2	Vanadium	0.52	202	mg/kg	A9-33	903 / 922	0.092 - 26.2
7440-66-6	Zinc	1.1	5160 J	mg/kg	S69	904 / 941	0.1 - 71.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1h
SUMMARY OF ANALYTICAL RESULTS - AREAS 8 AND 11 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	4.8 J	89	µg/kg	A11-07	3 / 25	4.7 - 8.4
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 25	1 - 4.2
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 25	1.8 - 4.2
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 25	1.2 - 4.2
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 25	1.5 - 4.2
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 25	2.3 - 4.2
78-93-3	Butanone, 2-	12 J	12 J	µg/kg	C71	1 / 25	4.6 - 8.4
75-15-0	Carbon disulfide	1.1 J	13	µg/kg	A11-04	6 / 25	1.8 - 0.74
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 25	1.6 - 4.2
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 25	0.75 - 4.2
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 25	2 - 4.2
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 25	2 - 4.2
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 25	1 - 4.2
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 25	0.75 - 4.2
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 25	2.4 - 4.2
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 25	1.8 - 4.2
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 25	2 - 4.2
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 25	1.9 - 4.2
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 25	0.86 - 4.2
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 25	1.9 - 4.2
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 25	1.4 - 4.2
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 25	0.72 - 0.46
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 25	1.1 - 4.2
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 25	2.4 - 4.2
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 25	1.8 - 4.2
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 25	1.5 - 4.2
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 25	1.8 - 4.2
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 25	1.5 - 4.2
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 25	2.2 - 4.2
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 25	44 - 84
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 25	0.44 - 4.2
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 25	5.2 - 8.4
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 25	0.77 - 4.2
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 25	1.9 - 4.2
1634-04-4	Methyl tert-Butyl Ether	1.3 J	1.3 J	µg/kg	C91	1 / 25	1.3 - 4.2
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 25	2.2 - 8.4
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 25	0.89 - 4.2
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 25	1.3 - 4.2
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 25	1.2 - 4.2
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 25	1.4 - 0.92
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 25	1.9 - 4.2
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 25	0.72 - 4.2
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 25	2.4 - 4.2
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 25	1.8 - 4.2
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 25	1.6 - 4.2
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 25	1.3 - 4.2
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 25	1.7 - 0.92
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 25	2 - 4.2
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 25	1.9 - 4.2
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 25	1.4 - 4.2
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 25	1.9 - 4.2
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 25	0.92 - 4.2
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	6.1	220	µg/kg	A11-07	9 / 26	3.5 - 330
208-96-8	Acenaphthylene	7.2	160	µg/kg	A8-05	15 / 26	3.5 - 330
98-86-2	Acetophenone	21 J	150 J	µg/kg	A8-05	8 / 26	180 - 330
120-12-7	Anthracene	7.7 J	690 J	µg/kg	A8-05	14 / 26	91 - 330
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 26	91 - 330
100-52-7	Benzaldehyde	27 J	93 J	µg/kg	C55	5 / 26	180 - 330
56-55-3	Benzo(a)anthracene	6	1900 J	µg/kg	A8-05	24 / 26	3.5 - 330
50-32-8	Benzo(a)pyrene	7.6	1400 J	µg/kg	A8-05	24 / 26	3.5 - 330

TABLE I-1h
SUMMARY OF ANALYTICAL RESULTS - AREAS 8 AND 11 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	51 J	1900	µg/kg	A8-05	18 / 26	3.6 - 330
191-24-2	Benzo(g,h,i)perylene	33 J	960	µg/kg	A8-05	16 / 26	180 - 330
207-08-9	Benzo(k)fluoranthene	16 J	880	µg/kg	A8-05	16 / 26	180 - 330
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 26	180 - 330
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 26	180 - 330
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 26	180 - 330
117-81-7	Bis(2-ethylhexyl)phthalate	23 J	760	µg/kg	C71	12 / 26	180 - 330
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 26	180 - 330
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 26	180 - 330
85-68-7	Butylbenzylphthalate	9.3 J	29 J	µg/kg	C71	2 / 26	180 - 330
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 26	180 - 330
86-74-8	Carbazole	7.3 J	140 J	µg/kg	A8-01	5 / 26	180 - 330
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 26	180 - 330
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 26	91 - 330
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 26	93 - 330
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 26	91 - 330
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 26	180 - 330
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 26	180 - 330
218-01-9	Chrysene	6.4	1900 J	µg/kg	A8-05	24 / 26	3.5 - 330
53-70-3	Dibenzo(a,h)anthracene	4.2	260	µg/kg	A8-05	18 / 26	3.5 - 330
132-64-9	Dibenzofuran	7.5 J	120 J	µg/kg	A8-05	3 / 26	180 - 330
91-94-1	Dichlorobenzidine, 3,3`-	210 J	210 J	µg/kg	A11-10	1 / 26	91 - 330
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 26	91 - 330
84-66-2	Diethylphthalate	7.6 J	12 J	µg/kg	C55	4 / 26	180 - 330
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 26	91 - 330
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 26	180 - 330
84-74-2	Di-n-butylphthalate	9.6 J	70 J	µg/kg	A11-05	6 / 26	180 - 330
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 26	93 - 630
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 26	91 - 630
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 26	91 - 330
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 26	91 - 330
117-84-0	Di-n-octyl phthalate	100 J	100 J	µg/kg	C71	1 / 26	180 - 330
206-44-0	Fluoranthene	42 J	3400	µg/kg	A8-05	21 / 26	180 - 330
86-73-7	Fluorene	4.4	260	µg/kg	A8-05	14 / 26	3.5 - 330
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 26	91 - 330
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 26	93 - 330
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 26	180 - 330
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 26	180 - 330
193-39-5	Indeno(1,2,3-cd)pyrene	32 J	840	µg/kg	A8-05	16 / 26	3.6 - 330
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 26	180 - 330
91-57-6	Methylnaphthalene, 2-	4.3	71 J	µg/kg	A8-05	15 / 26	3.5 - 330
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 26	91 - 330
106-44-5	Methylphenol, 4-	15 J	38 J	µg/kg	C23	4 / 26	180 - 330
91-20-3	Naphthalene	11 J	37 J	µg/kg	C91	5 / 26	180 - 330
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 26	350 - 630
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 26	350 - 630
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 26	350 - 630
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 26	180 - 330
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 26	180 - 330
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 26	350 - 630
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 26	93 - 330
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 26	180 - 330
87-86-5	Pentachlorophenol	7.2 J	7.2 J	µg/kg	A8-07	1 / 26	7.4 - 630
85-01-8	Phenanthrene	33 J	2300	µg/kg	A8-05	18 / 26	180 - 330
108-95-2	Phenol	19 J	41 J	µg/kg	C55	5 / 26	180 - 330
129-00-0	Pyrene	50 J	2500	µg/kg	A8-05	18 / 26	180 - 330
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 26	180 - 330
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 26	180 - 330
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 26	180 - 330

TABLE I-1h
SUMMARY OF ANALYTICAL RESULTS - AREAS 8 AND 11 SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
5103-71-9	Alpha-chlordane	1 J	1 J	µg/kg	A8-07	2 / 25	0.36 / 3.3
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 25	7 / 63
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 25	7 / 63
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 25	7 / 63
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 25	7 / 63
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 25	7 / 63
11097-69-1	Aroclor 1254	6.6 J	720	µg/kg	A8-05	8 / 25	7 / 63
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 25	7 / 63
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 25	7 / 63
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 25	7 / 63
319-85-7	Beta-BHC	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 25	36 / 330
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 25	0.7 / 6.3
72-55-9	DDE, 4,4'-	0.45 J	5.1	µg/kg	C71	3 / 25	0.7 / 6.3
50-29-3	DDT, 4,4'-	0.59 J	96 J	µg/kg	A8-05	6 / 25	0.7 / 6.3
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
60-57-1	Dieldrin	ND	ND	µg/kg	NA	0 / 25	0.7 / 6.3
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
33213-65-9	Endosulfan II	0.24 J	36	µg/kg	A8-05	3 / 25	0.7 / 6.3
1031-07-8	Endosulfan Sulfate	9.1 JN	24 JN	µg/kg	A8-05	2 / 25	0.7 / 6.3
72-20-8	Endrin	1.6 J	1.6 J	µg/kg	C71	1 / 25	0.7 / 6.3
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 25	0.7 / 6.3
53494-70-5	Endrin Ketone	0.068 J	0.068 J	µg/kg	C55	1 / 25	0.7 / 6.3
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
5103-74-2	Gamma-chlordane	19 J	52 JN	µg/kg	A8-05	2 / 25	0.36 / 3.3
76-44-8	Heptachlor	0.38 J	0.38 J	µg/kg	C71	1 / 25	0.36 / 3.3
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 25	0.36 / 3.3
72-43-5	Methoxychlor	ND	ND	µg/kg	NA	0 / 25	3.6 / 33
	Inorganics						
7429-90-5	Aluminum	732	13500 J	mg/kg	C23	182 / 182	16.5 / 54.1
7440-36-0	Antimony	0.21 J	3270	mg/kg	SED89	60 / 186	0.057 / 16.2
7440-38-2	Arsenic	0.62 J	2470 J	mg/kg	S98	184 / 184	0.078 / 2.7
7440-39-3	Barium	1.2 J	1340 J	mg/kg	SED89	135 / 186	0.076 / 54.1
7440-41-7	Beryllium	0.15 J	1.4	mg/kg	A8-07	119 / 186	0.11 / 1.4
7440-43-9	Cadmium	0.022 J	22.1	mg/kg	SED90	102 / 186	0.008 / 1.4
7440-70-2	Calcium	129 J	26500	mg/kg	C28	169 / 182	411 / 1350
7440-47-3	Chromium	1.6	3500	mg/kg	SED90	186 / 186	0.12 / 2.7
18540-29-9	Chromium VI	0.31 J-	2.2 J	mg/kg	A8-07	29 / 56	1.1 / 2.6
7440-48-4	Cobalt	0.34 J	24.1	mg/kg	S98	155 / 186	0.099 / 13.5
7440-50-8	Copper	2.4 J	4630	mg/kg	S98	184 / 184	0.073 / 6.8
7439-89-6	Iron	1990	183000 J	mg/kg	S98	182 / 182	8.2 / 27.1
7439-92-1	Lead	2.9	198000	mg/kg	S97	182 / 184	0.1 / 5.7
7439-95-4	Magnesium	256 J	10500 J	mg/kg	SED56	168 / 182	411 / 1350
7439-96-5	Manganese	4.8	1710	mg/kg	SED90	184 / 184	0.08 / 4.1
7439-97-6	Mercury	0.026 J	2.2	mg/kg	A8-17	159 / 168	0.03 / 0.26
7440-02-0	Nickel	0.48 J	1500	mg/kg	SED90	184 / 186	0.088 / 10.8
7440-09-7	Potassium	161 J	3870 J	mg/kg	SED56	121 / 182	411 / 1350
7782-49-2	Selenium	0.03 J	5.7 J	mg/kg	C23	106 / 186	0.025 / 9.5
7440-22-4	Silver	0.1 J	4.5 J	mg/kg	S96	73 / 186	0.072 / 2.7
7440-23-5	Sodium	96.4 J	60000 J	mg/kg	SED56	169 / 182	411 / 1350
7440-28-0	Thallium	0.24 J	1.7 J	mg/kg	S97	3 / 186	0.046 / 64
7440-31-5	Tin	10.7	3580	mg/kg	S98	11 / 18	10 / 10
7440-62-2	Vanadium	2.8 J	75.1	mg/kg	C87	186 / 186	0.093 / 13.5
7440-66-6	Zinc	3.3 J	2700 J	mg/kg	S98	184 / 184	0.1 / 16.2

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value
J-=estimated value, biased low

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-1i
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	4.8 J	190 J	µg/kg	S71	38 / 260	4.6 - 93
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 260	1 - 46
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 260	1.8 - 46
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 260	1.2 - 46
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 260	1.5 - 46
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 260	2.3 - 46
78-93-3	Butanone, 2-	6.3 J	15	µg/kg	A92	3 / 260	4.6 - 93
75-15-0	Carbon disulfide	0.42 J	13	µg/kg	A11-04	23 / 260	0.88 - 46
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 260	1.6 - 46
108-90-7	Chlorobenzene	0.42 J	1.2 J	µg/kg	A17	4 / 260	0.75 - 46
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 260	2 - 46
67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 260	2 - 46
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 260	1 - 46
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 260	0.75 - 46
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 260	2.3 - 46
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 260	1.8 - 46
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 260	2 - 46
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 260	1.9 - 46
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 260	0.86 - 46
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 260	1.9 - 46
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 260	1.4 - 46
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 260	0.55 - 46
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 260	1.1 - 46
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 260	2.3 - 46
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 260	1.8 - 46
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 260	1.5 - 46
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 260	1.8 - 46
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 260	1.5 - 46
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 260	2.2 - 46
123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 251	44 - 930
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 260	0.44 - 46
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 260	4.6 - 93
98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 260	0.77 - 46
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 260	1.9 - 46
1634-04-4	Methyl tert-Butyl Ether	1.3 J	1.3 J	µg/kg	C91	1 / 260	1.3 - 46
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 260	2.2 - 93
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 260	0.89 - 46
75-09-2	Methylene chloride	3 J	4.4 J	µg/kg	A9-30	7 / 260	1.3 - 46
100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 260	1.2 - 46
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 260	1.1 - 46
127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 260	1.9 - 46
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 260	0.72 - 46
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 260	2.3 - 46
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 260	1.8 - 46
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 260	1.6 - 46
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 260	1.3 - 46
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 260	1.1 - 46
79-01-6	Trichloroethene	7.9	7.9	µg/kg	A3-S90	1 / 260	2 - 46
75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 260	1.9 - 46
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 260	1.4 - 46
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 260	1.9 - 46
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 260	0.92 - 46
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	4.9	1000 J	µg/kg	A9-23	19 / 263	3.5 - 910
208-96-8	Acenaphthylene	7.2	160	µg/kg	A8-05	22 / 263	3.5 - 910
98-86-2	Acetophenone	14 J	230 J	µg/kg	A9-23	35 / 263	120 - 910
120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	37 / 263	91 - 910
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 263	91 - 910
100-52-7	Benzaldehyde	21 J	140 J	µg/kg	A4-10	33 / 263	120 - 910
56-55-3	Benzo(a)anthracene	2.1 J	3000 J	µg/kg	A9-23	171 / 263	3.4 - 910
50-32-8	Benzo(a)pyrene	1.9 J	2200 J	µg/kg	A9-23	155 / 263	3.4 - 910

TABLE I-1i
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	2 J	2100 J	µg/kg	A9-23	178 / 263	3.4 - 910
191-24-2	Benzo(g,h,i)perylene	6.8 J	960	µg/kg	A8-05	62 / 263	120 - 910
207-08-9	Benzo(k)fluoranthene	6.9 J	1100 J	µg/kg	A9-23	66 / 263	120 - 910
92-52-4	Biphenyl, 1,1'-	15 J	200 J	µg/kg	A9-23	4 / 263	120 - 910
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 263	120 - 910
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 263	120 - 910
117-81-7	Bis(2-ethylhexyl)phthalate	15 J	3100	µg/kg	A2-07	78 / 263	120 - 910
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 263	120 - 910
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 263	120 - 910
85-68-7	Butylbenzylphthalate	7 J	61000	µg/kg	A9-111	10 / 263	120 - 910
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 263	120 - 910
86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	18 / 263	120 - 910
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 263	120 - 910
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 263	91 - 910
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 263	88 - 910
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 263	91 - 910
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 263	170 - 910
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 263	120 - 910
218-01-9	Chrysene	4.5	3800 J	µg/kg	A9-23	111 / 263	3.5 - 910
53-70-3	Dibenzo(a,h)anthracene	2 J	520 J	µg/kg	A9-23	82 / 263	3.4 - 910
132-64-9	Dibenzofuran	7.5 J	920 J	µg/kg	A9-23	10 / 263	120 - 910
91-94-1	Dichlorobenzidine, 3,3`-	210 J	210 J	µg/kg	A11-10	1 / 263	91 - 910
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 263	91 - 910
84-66-2	Diethylphthalate	6.5 J	13 J	µg/kg	A80	10 / 263	120 - 910
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 263	88 - 910
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 263	120 - 910
84-74-2	Di-n-butylphthalate	8.2 J	11000	µg/kg	A9-04	19 / 263	170 - 2300
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 263	88 - 1800
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 263	88 - 1800
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 263	91 - 910
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 263	88 - 910
117-84-0	Di-n-octyl phthalate	43 J	790 J	µg/kg	S76	6 / 263	120 - 910
206-44-0	Fluoranthene	7.5 J	7800 J	µg/kg	A9-23	117 / 263	120 - 910
86-73-7	Fluorene	4.4	1200 J	µg/kg	A9-23	25 / 263	3.5 - 910
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 263	91 - 910
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 263	88 - 910
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 263	120 - 910
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 263	120 - 910
193-39-5	Indeno(1,2,3-cd)pyrene	1.8 J	1200 J	µg/kg	A9-23	125 / 263	3.4 - 910
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 263	120 - 910
91-57-6	Methylnaphthalene, 2-	4.3	870 J	µg/kg	A9-23	28 / 263	3.5 - 910
95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 263	91 - 910
106-44-5	Methylphenol, 4-	6.8 J	38 J	µg/kg	C23	5 / 263	120 - 910
91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	30 / 263	120 - 910
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 263	120 - 1800
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 263	120 - 1800
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 263	120 - 1800
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 263	120 - 910
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 263	120 - 910
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 263	330 - 1800
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 263	88 - 910
86-30-6	Nitrosodiphenylamine, N-	25 J	25 J	µg/kg	A1-S14	1 / 263	120 - 910
87-86-5	Pentachlorophenol	4.1 J	12 J	µg/kg	A9-08	10 / 263	6.9 - 1800
85-01-8	Phenanthrene	6.5 J	13000 J	µg/kg	A9-23	79 / 263	120 - 910
108-95-2	Phenol	12 J	73 J	µg/kg	A56	23 / 263	120 - 910
129-00-0	Pyrene	9.1 J	6800 J	µg/kg	A9-23	119 / 263	120 - 910
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 263	120 - 910
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 263	120 - 910
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 263	120 - 910

TABLE I-1i
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS SURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 262	0.36 - 13
319-84-6	Alpha-BHC	2.2 J	13 J	µg/kg	S79	3 / 262	0.36 - 13
5103-71-9	Alpha-chlordane	0.93 J	52 JN	µg/kg	A1-S05	26 / 262	0.36 - 13
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 262	7 - 410
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 262	7 - 410
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 262	7 - 410
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 262	7 - 410
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 262	7 - 410
11097-69-1	Aroclor 1254	6.6 J	62000	µg/kg	A9-61	48 / 262	7 - 410
11096-82-5	Aroclor 1260	23 J	36 J	µg/kg	A9-44	3 / 262	7 - 410
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 262	7 - 410
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 262	7 - 410
319-85-7	Beta-BHC	0.11 J	0.72 J	µg/kg	A1-SS16	2 / 262	0.36 - 13
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 262	36 - 910
72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	7 / 262	0.7 - 25
72-55-9	DDE, 4,4'-	0.13 J	130	µg/kg	A1-S15	24 / 262	0.7 - 25
50-29-3	DDT, 4,4'-	0.56 J	1300 JN	µg/kg	A9-25	39 / 262	0.7 - 25
319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	2 / 262	0.36 - 13
60-57-1	Dieldrin	0.85 J	4.7	µg/kg	A9-42	9 / 262	0.7 - 25
959-98-8	Endosulfan I	0.047 J	2.1 JN	µg/kg	A9-26	3 / 262	0.36 - 13
33213-65-9	Endosulfan II	0.24 J	280	µg/kg	A9-25	11 / 262	0.7 - 25
1031-07-8	Endosulfan Sulfate	5.6 J	58 JN	µg/kg	A1-10	6 / 262	0.7 - 25
72-20-8	Endrin	0.11 J	24 JN	µg/kg	A1-10	9 / 262	0.7 - 25
7421-93-4	Endrin Aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 262	0.7 - 25
53494-70-5	Endrin Ketone	0.059 J	6.8 J	µg/kg	S84	10 / 262	0.7 - 25
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 262	0.36 - 13
5103-74-2	Gamma-chlordane	0.96 J	180 JN	µg/kg	A9-25	37 / 262	0.36 - 13
76-44-8	Heptachlor	0.15 J	3.6	µg/kg	A1-S05	4 / 262	0.36 - 13
1024-57-3	Heptachlor Epoxide	0.082 J	8.5 JN	µg/kg	A1-S05	8 / 262	0.36 - 13
72-43-5	Methoxychlor	3.3 J	85 JN	µg/kg	S84	4 / 262	3.6 - 130
	Inorganics						
7429-90-5	Aluminum	149	27600 J	mg/kg	S77	1052 / 1067	8 - 105
7440-36-0	Antimony	0.11 J	3270	mg/kg	SED89	485 / 1228	0.056 - 232
7440-38-2	Arsenic	0.16 J	2470 J	mg/kg	S98	1189 / 1231	0.077 - 157
7440-39-3	Barium	0.77 J	1340 J	mg/kg	SED89	734 / 1108	0.075 - 105
7440-41-7	Beryllium	0.02 J	2	mg/kg	B15	497 / 1108	0.1 - 2.6
7440-43-9	Cadmium	0.007 J	22.1	mg/kg	SED90	561 / 1108	0.008 - 2.6
7440-70-2	Calcium	18.6 J	42900	mg/kg	A93	834 / 1065	45 - 2619
7440-47-3	Chromium	0.96 J	3500	mg/kg	SED90	1222 / 1228	0.11 - 5.2
18540-29-9	Chromium VI	0.12	8.3 J	mg/kg	A1-10	148 / 295	0.1 - 2.6
7440-48-4	Cobalt	0.14 J	24.1	mg/kg	S98	750 / 1108	0.098 - 26.2
7440-50-8	Copper	0.44 J	4630	mg/kg	S98	1193 / 1231	0.071 - 248
7439-89-6	Iron	912 J	183000 J	mg/kg	S98	1068 / 1068	4.3 - 52.4
7439-92-1	Lead	1.1	198000	mg/kg	S97	1181 / 1230	0.042 - 29.3
7439-95-4	Magnesium	22.8 J	10500 J	mg/kg	SED56	862 / 1065	198 - 2619
7439-96-5	Manganese	2 J	3470 J	mg/kg	SED120	1093 / 1113	0.079 - 174
7439-97-6	Mercury	0.015 J	2.2	mg/kg	A8-17	537 / 724	0.029 - 0.26
7440-02-0	Nickel	0.074 J	1500	mg/kg	SED90	1028 / 1122	0.088 - 21
7440-09-7	Potassium	12.7 J	3870 J	mg/kg	SED56	660 / 1022	191 - 2128
7782-49-2	Selenium	0.027 J	8.5	mg/kg	A9-42	559 / 1108	0.025 - 18.3
7440-22-4	Silver	0.055 J	15.6 J	mg/kg	SED198	224 / 1122	0.071 - 5.2
7440-23-5	Sodium	6.2 J	60000 J	mg/kg	SED56	708 / 1065	87 - 2619
7440-28-0	Thallium	0.065 J	2.8	mg/kg	S80	28 / 1108	0.046 - 64
7440-31-5	Tin	8 J	3580	mg/kg	S98	49 / 167	8.7 - 15
7440-62-2	Vanadium	0.52	202	mg/kg	A9-33	1089 / 1108	0.092 - 26.2
7440-66-6	Zinc	1.1	5160 J	mg/kg	S69	1088 / 1125	0.1 - 71.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-2
SUMMARY OF ANALYTICAL RESULTS - ALL UPLAND AREAS SURFACE/SUBSURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	5 J	190 J	µg/kg	S71	59 / 420	4.6 - 93
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
78-93-3	Butanone, 2-	ND	ND	µg/kg	NA	0 / 420	4.6 - 93
75-15-0	Carbon disulfide	3 J	13	µg/kg	A11-04	8 / 420	0.88 - 46
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
67-66-3	Chloroform	13	13	µg/kg	A9-52	1 / 420	2.3 - 46
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 420	0.55 - 46
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
123-91-1	Dioxane, 1,4-	420	420	µg/kg	S77	1 / 403	46 - 930
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 420	4.6 - 93
98-82-8	Isopropylbenzene	2.9 J	11	µg/kg	A9-45	2 / 420	2.3 - 46
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 420	4.6 - 93
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
75-09-2	Methylene chloride	2.2 J	5 J	µg/kg	A9-31	12 / 420	2.3 - 46
100-42-5	Styrene	4.7 J	130	µg/kg	A9-45	7 / 420	2.3 - 46
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 420	1.1 - 46
127-18-4	Tetrachloroethene	0.41 J	0.41 J	µg/kg	A1-S07	1 / 420	2.3 - 46
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 420	1.1 - 46
79-01-6	Trichloroethene	0.77 J	7.9	µg/kg	A3-S90	2 / 420	2.3 - 46
75-69-4	Trichlorofluoromethane	0.38 J	0.38 J	µg/kg	A1-S08	1 / 420	2.3 - 46
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 420	2.3 - 46
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	6.5 J	1000 J	µg/kg	A9-23	24 / 423	4.1 - 990
208-96-8	Acenaphthylene	6.5 J	84 J	µg/kg	A9-42	17 / 423	4.1 - 990
98-86-2	Acetophenone	27 J	230 J	µg/kg	A9-23	16 / 423	120 - 990
120-12-7	Anthracene	6 J	2700 J	µg/kg	A9-23	49 / 423	110 - 990
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 423	110 - 990
100-52-7	Benzaldehyde	24 J	510	µg/kg	A4-08	14 / 423	120 - 990
56-55-3	Benzo(a)anthracene	2.1 J	3000 J	µg/kg	A9-23	241 / 423	3.4 - 990
50-32-8	Benzo(a)pyrene	1.9 J	2300 J	µg/kg	A9-23	222 / 423	3.4 - 990

TABLE I-2
SUMMARY OF ANALYTICAL RESULTS - ALL UPLAND AREAS SURFACE/SUBSURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	2 J	3100 J	µg/kg	A9-23	265 / 423	3.4 - 990
191-24-2	Benzo(g,h,i)perylene	22 J	890 J	µg/kg	A9-23	81 / 423	120 - 990
207-08-9	Benzo(k)fluoranthene	10 J	1100 J	µg/kg	A9-23	91 / 423	120 - 990
92-52-4	Biphenyl, 1,1'-	6.4 J	200 J	µg/kg	A9-23	10 / 423	120 - 990
111-91-1	Bis(2-Chloroethoxy)methane	11 J	11 J	µg/kg	A1-S14	1 / 423	120 - 990
111-44-4	Bis(2-Chloroethyl)ether	11 J	11 J	µg/kg	A1-S14	1 / 423	120 - 990
117-81-7	Bis(2-Ethylhexyl)phthalate	23 J	3100	µg/kg	A2-07	66 / 423	120 - 990
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 423	120 - 990
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 423	120 - 990
85-68-7	Butylbenzylphthalate	39 J	61000	µg/kg	A9-111	8 / 423	120 - 990
105-60-2	Caprolactam	49 J	86 J	µg/kg	A9-46	2 / 423	120 - 990
86-74-8	Carbazole	5.7 J	890 J	µg/kg	A9-23	27 / 423	120 - 990
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 423	120 - 990
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 423	110 - 990
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 423	88 - 990
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 423	110 - 990
58-90-2	Chlorophenols	28 J	28 J	µg/kg	A9-06	1 / 423	170 - 990
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 423	120 - 990
218-01-9	Chrysene	14 J	3800 J	µg/kg	A9-23	138 / 423	4.1 - 990
53-70-3	Dibenzo(a,h)anthracene	1.9 J	520 J	µg/kg	A9-23	111 / 423	3.4 - 990
132-64-9	Dibenzofuran	6.1 J	920 J	µg/kg	A9-23	21 / 423	120 - 990
91-94-1	Dichlorobenzidine, 3,3`-	210 J	210 J	µg/kg	A11-10	1 / 423	110 - 990
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 423	110 - 990
84-66-2	Diethylphthalate	ND	ND	µg/kg	NA	0 / 423	120 - 990
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 423	88 - 990
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 423	120 - 990
84-74-2	Di-N-Butylphthalate	30 J	11000	µg/kg	A9-04	4 / 423	170 - 4200
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 423	88 - 1900
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 423	88 - 1900
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 423	110 - 990
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 423	88 - 990
117-84-0	Di-N-Octyl Phthalate	43 J	790 J	µg/kg	S76	5 / 423	120 - 990
206-44-0	Fluoranthene	20 J	7800 J	µg/kg	A9-23	159 / 423	120 - 990
86-73-7	Fluorene	4.4	1200 J	µg/kg	A9-23	33 / 423	4.1 - 990
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 423	110 - 990
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 423	88 - 990
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 423	120 - 990
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 423	120 - 990
193-39-5	Indeno(1,2,3-cd)pyrene	1.8 J	1200 J	µg/kg	A9-23	186 / 423	3.4 - 990
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 423	120 - 990
91-57-6	Methylnaphthalene, 2-	4.8	870 J	µg/kg	A9-23	27 / 423	4.1 - 990
95-48-7	Methylphenol, 2-	46 J	170 J	µg/kg	A9-111	2 / 423	110 - 990
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 423	120 - 990
91-20-3	Naphthalene	5.6 J	920	µg/kg	A9-14	33 / 423	120 - 990
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 423	120 - 1900
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 423	120 - 1900
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 423	120 - 1900
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 423	120 - 990
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 423	120 - 990
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 423	330 - 1900
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 423	88 - 990
86-30-6	Nitrosodiphenylamine, N-	25 J	110 J	µg/kg	A1-S14	2 / 423	120 - 990
87-86-5	Pentachlorophenol	2 J	720 J	µg/kg	A9-06	18 / 423	6.9 - 1900
85-01-8	Phenanthrene	8.4 J	13000 J	µg/kg	A9-23	97 / 423	120 - 990
108-95-2	Phenol	32 J	38 J	µg/kg	A9-23	2 / 423	120 - 990
129-00-0	Pyrene	18 J	6800 J	µg/kg	A9-23	159 / 423	120 - 990
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 423	120 - 990
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 423	120 - 990
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 423	120 - 990

TABLE I-2
SUMMARY OF ANALYTICAL RESULTS - ALL UPLAND AREAS SURFACE/SUBSURFACE SOIL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 422	0.42 - 13
319-84-6	Alpha-BHC	0.29 J	13 J	µg/kg	S79	4 / 422	0.42 - 13
5103-71-9	Alpha-chlordane	0.37 J	52 JN	µg/kg	A1-S05	41 / 422	0.42 - 13
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
11097-69-1	Aroclor 1254	17 J	62000	µg/kg	A9-61	58 / 422	8.2 - 410
11096-82-5	Aroclor 1260	23 J	46	µg/kg	A9-44	4 / 422	8.2 - 410
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 422	8.2 - 410
319-85-7	Beta-BHC	0.72 J	0.72 J	µg/kg	A1-S16	1 / 422	0.42 - 13
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 422	42 - 910
72-54-8	DDD, 4,4'-	2.5 JN	14 JN	µg/kg	A9-06	13 / 422	0.82 - 25
72-55-9	DDE, 4,4'-	0.51 J	130	µg/kg	A1-S15	28 / 422	0.82 - 25
50-29-3	DDT, 4,4'-	0.19 J	1300 JN	µg/kg	A9-25	45 / 422	0.82 - 25
319-86-8	Delta-BHC	0.13 J	2 J	µg/kg	A1-S07	3 / 422	0.42 - 13
60-57-1	Dieldrin	0.85 J	41 JN	µg/kg	A9-23	12 / 422	0.82 - 25
959-98-8	Endosulfan I	2.1 JN	2.1 JN	µg/kg	A9-26	1 / 422	0.42 - 13
33213-65-9	Endosulfan II	0.99 J	280	µg/kg	A9-25	10 / 422	0.82 - 25
1031-07-8	Endosulfan sulfate	2.2	58 JN	µg/kg	A1-10	5 / 422	0.82 - 25
72-20-8	Endrin	0.21 J	24 JN	µg/kg	A1-10	9 / 422	0.82 - 25
7421-93-4	Endrin aldehyde	11 JN	11 JN	µg/kg	A1-S15	1 / 422	0.82 - 25
53494-70-5	Endrin ketone	1.2 J	6.8 J	µg/kg	S84	4 / 422	0.82 - 25
58-89-9	Gamma-BHC (lindane)	0.059 J	0.059 J	µg/kg	A1-S18	1 / 422	0.42 - 13
5103-74-2	Gamma-chlordane	0.25 J	180 JN	µg/kg	A9-25	51 / 422	0.42 - 13
76-44-8	Heptachlor	1.5 J	3.6	µg/kg	A1-S05	5 / 422	0.42 - 13
1024-57-3	Heptachlor epoxide	1.9	8.5 JN	µg/kg	A1-S05	7 / 422	0.42 - 13
72-43-5	Methoxychlor	0.65 J	85 JN	µg/kg	S84	7 / 422	4.2 - 130
	Inorganics						
7429-90-5	Aluminum	149	30400 J	mg/kg	S75	771 / 771	8 - 105
7440-36-0	Antimony	0.095 J	3270	mg/kg	SED89	385 / 861	0.056 - 39.6
7440-38-2	Arsenic	0.13 J	2100 J	mg/kg	SED89	828 / 859	0.077 - 54.3
7440-39-3	Barium	0.72 J	1340 J	mg/kg	SED89	631 / 781	0.075 - 105
7440-41-7	Beryllium	0.02 J	1.4 J	mg/kg	A5-14/A8-07	215 / 781	0.1 - 2.6
7440-43-9	Cadmium	0.0083 J	12.5	mg/kg	A9-109	461 / 781	0.008 - 2.6
7440-70-2	Calcium	18.6 J	32800	mg/kg	S22	472 / 771	45 - 2619
7440-47-3	Chromium	0.76 J	230	mg/kg	B47	854 / 859	0.11 - 5.2
18540-29-9	Chromium VI	0.12	46 J	mg/kg	A9-23	257 / 496	0.1 - 6.2
7440-48-4	Cobalt	0.14 J	24.8	mg/kg	A8-06	491 / 781	0.098 - 26.2
7440-50-8	Copper	0.46 J	4950 J	mg/kg	A5	832 / 859	0.071 - 49.9
7439-89-6	Iron	912 J	154000	mg/kg	SED89	771 / 771	4.3 - 52.4
7439-92-1	Lead	1.7 J	40000	mg/kg	A8-04	837 / 862	0.042 - 29.3
7439-95-4	Magnesium	22.8 J	4310	mg/kg	A9-58	472 / 771	47 - 2619
7439-96-5	Manganese	0.66 J	1250	mg/kg	SED89	781 / 781	0.057 - 55.8
7439-97-6	Mercury	0.014 J	1.9	mg/kg	A9-109	391 / 547	0.03 - 0.12
7440-02-0	Nickel	0.074 J	88.8 J	mg/kg	SED89	722 / 781	0.087 - 21
7440-09-7	Potassium	12.7 J	3080	mg/kg	A9-35	445 / 704	191 - 1090
7782-49-2	Selenium	0.027 J	13.8	mg/kg	A9-23	331 / 781	0.025 - 18.3
7440-22-4	Silver	0.054 J	31.1	mg/kg	A9-23	125 / 781	0.071 - 5.2
7440-23-5	Sodium	6.2 J	7230	mg/kg	SED89	215 / 771	87 - 2619
7440-28-0	Thallium	0.049 J	2.8	mg/kg	S80	57 / 781	0.046 - 13.1
7440-31-5	Tin	10.7	1980 J	mg/kg	SED89	18 / 69	10 - 10
7440-62-2	Vanadium	1.5 J	202	mg/kg	A9-33	767 / 781	0.091 - 26.2
7440-66-6	Zinc	0.26 J	5160 J	mg/kg	S69	751 / 781	0.1 - 71.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-3a
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER (<10 FEET BGS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	ND	ND	µg/L	NA	0 - 7	5 - 5
71-43-2	Benzene	ND	ND	µg/L	NA	0 - 7	0.2 - 0.2
74-97-5	Bromochloromethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-27-4	Bromodichloromethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-25-2	Bromoform	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
74-83-9	Bromomethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
78-93-3	Butanone, 2-	ND	ND	µg/L	NA	0 - 7	5 - 5
75-15-0	Carbon Disulfide	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
56-23-5	Carbon tetrachloride	ND	ND	µg/L	NA	0 - 7	0.4 - 0.4
108-90-7	Chlorobenzene	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-00-3	Chloroethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
67-66-3	Chloroform	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
74-87-3	Chloromethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
110-82-7	Cyclohexane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/L	NA	0 - 7	0.2 - 0.2
124-48-1	Dibromochloromethane	ND	ND	µg/L	NA	0 - 7	0.4 - 0.4
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/L	NA	0 - 7	0.2 - 0.2
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-71-8	Dichlorodifluoromethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/L	NA	0 - 7	0.3 - 0.3
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/L	NA	0 - 7	0.4 - 0.4
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/L	NA	0 - 7	0.4 - 0.4
123-91-1	Dioxane, 1,4-						
100-41-4	Ethylbenzene	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
591-78-6	Hexanone, 2-	ND	ND	µg/L	NA	0 - 7	5 - 5
98-82-8	Isopropylbenzene	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
79-20-9	Methyl Acetate	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/L	NA	0 - 7	5 - 5
108-87-2	Methylcyclohexane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-09-2	Methylene chloride	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
100-42-5	Styrene	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
127-18-4	Tetrachloroethene	ND	ND	µg/L	NA	0 - 7	0.4 - 0.4
108-88-3	Toluene	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
79-01-6	Trichloroethene	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-69-4	Trichlorofluoromethane	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
75-01-4	Vinyl Chloride	ND	ND	µg/L	NA	0 - 7	0.2 - 0.2
179601-23-1	Xylene, m,p-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
95-47-6	Xylene, o-	ND	ND	µg/L	NA	0 - 7	0.5 - 0.5
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	1.1 J	23	µg/L	MW-13S	2 / 7	5 - 5
208-96-8	Acenaphthylene	ND	ND	µg/L	NA	0 / 7	5 - 5
98-86-2	Acetophenone	ND	ND	µg/L	NA	0 / 7	5 - 5
120-12-7	Anthracene	ND	ND	µg/L	NA	0 / 7	5 - 5
1912-24-9	Atrazine	ND	ND	µg/L	NA	0 / 7	3 - 3
100-52-7	Benzaldehyde	ND	ND	µg/L	NA	0 / 7	5 - 5
56-55-3	Benzo(a)anthracene	0.17	0.17	µg/L	MW-13S	1 / 7	0.1 - 0.1
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1

TABLE I-3a
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER (<10 FEET BGS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	NA	0 / 7	5 - 5
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	NA	0 / 7	5 - 5
92-52-4	Biphenyl, 1,1'-	2.2 J	2.2 J	µg/L	MW-13S	1 / 7	5 - 5
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/L	NA	0 / 7	5 - 5
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/L	NA	0 / 7	0.2 - 0.2
117-81-7	Bis(2-Ethylhexyl)phthalate	1.3 J	1.3 J	µg/L	MW-01D	1 / 7	2 - 2
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/L	NA	0 / 7	5 - 5
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
85-68-7	Butylbenzylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
105-60-2	Caprolactam	ND	ND	µg/L	NA	0 / 7	5 - 5
86-74-8	Carbazole	1.7 J	1.7 J	µg/L	MW-13S	1 / 7	5 - 5
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
106-47-8	Chloroaniline, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
95-57-8	Chlorophenol, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
58-90-2	Chlorophenols	ND	ND	µg/L	NA	0 / 7	5 - 5
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
218-01-9	Chrysene	ND	ND	µg/L	NA	0 / 7	5 - 5
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
132-64-9	Dibenzofuran	11	11	µg/L	MW-13S	1 / 7	5 - 5
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/L	NA	0 / 7	5 - 5
84-66-2	Diethylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
105-67-9	Dimethylphenol, 2,4-	4.3 J	4.3 J	µg/L	MW-13S	1 / 7	5 - 5
131-11-3	Dimethylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
84-74-2	Di-N-Butylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/L	NA	0 / 7	10 - 10
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/L	NA	0 / 7	10 - 10
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/L	NA	0 / 7	5 - 5
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
206-44-0	Fluoranthene	2.6 J	2.6 J	µg/L	MW-13S	1 / 7	5 - 5
86-73-7	Fluorene	9.5	9.5	µg/L	MW-13S	1 / 7	5 - 5
118-74-1	Hexachlorobenzene	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	NA	0 / 7	0.4 - 0.4
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	NA	0 / 7	5 - 5
67-72-1	Hexachloroethane	ND	ND	µg/L	NA	0 / 7	2 - 2
193-39-5	Indeno(1,2,3-Cd)Pyrene	ND	ND	µg/L	NA	0 / 7	5 - 5
78-59-1	Isophorone	ND	ND	µg/L	NA	0 / 7	5 - 5
91-57-6	Methylnaphthalene, 2-	9.6	9.6	µg/L	MW-13S	1 / 7	5 - 5
95-48-7	Methylphenol, 2-	1.1 J	1.1 J	µg/L	MW-13S	1 / 7	5 - 5
106-44-5	Methylphenol, 4-	1.5 J	1.5 J	µg/L	MW-13S	1 / 7	5 - 5
91-20-3	Naphthalene	16	16	µg/L	MW-13S	1 / 7	5 - 5
88-74-4	Nitroaniline, 2-	ND	ND	µg/L	NA	0 / 7	10 - 10
99-09-2	Nitroaniline, 3-	ND	ND	µg/L	NA	0 / 7	10 - 10
100-01-6	Nitroaniline, 4-	ND	ND	µg/L	NA	0 / 7	10 - 10
98-95-3	Nitrobenzene	ND	ND	µg/L	NA	0 / 7	4 - 4
88-75-5	Nitrophenol, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
100-02-7	Nitrophenol, 4-	ND	ND	µg/L	NA	0 / 7	10 - 10
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/L	NA	0 / 7	5 - 5
87-86-5	Pentachlorophenol	ND	ND	µg/L	NA	0 / 7	10 - 10
85-01-8	Phenanthrene	12	12	µg/L	MW-13S	1 / 7	5 - 5
108-95-2	Phenol	ND	ND	µg/L	NA	0 / 7	5 - 5
129-00-0	Pyrene	ND	ND	µg/L	NA	0 / 7	5 - 5
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/L	NA	0 / 7	5 - 5
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/L	NA	0 / 7	5 - 5
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/L	NA	0 / 7	1 - 1

TABLE I-3a
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER (<10 FEET BGS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/L	NA	0 / 7	0.005 - 0.005
319-84-6	Alpha-BHC	ND	ND	µg/L	NA	0 / 7	0.005 - 0.005
5103-71-9	Alpha-Chlordane	0.013 JN	0.013 JN	µg/L	MW-01S	1 / 7	0.01 - 0.01
12674-11-2	Aroclor 1016	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
11104-28-2	Aroclor 1221	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
11141-16-5	Aroclor 1232	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
53469-21-9	Aroclor 1242	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
12672-29-6	Aroclor 1248	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
11097-69-1	Aroclor 1254	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
11096-82-5	Aroclor 1260	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
37324-23-5	Aroclor 1262	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
11100-14-4	Aroclor 1268	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
319-85-7	Beta-BHC	ND	ND	µg/L	NA	0 / 7	0.02 - 0.02
8001-35-2	Chlorinated Camphene	ND	ND	µg/L	NA	0 / 7	0.5 - 0.5
60-57-1	Dieldrin	ND	ND	µg/L	NA	0 / 7	0.01 - 0.01
5103-74-2	Gamma-Chlordane	ND	ND	µg/L	ND	0 / 7	0.01 - 0.01
76-44-8	Heptachlor	ND	ND	µg/L	ND	0 / 7	0.008 - 0.008
1024-57-3	Heptachlor Epoxide	ND	ND	µg/L	ND	0 / 7	0.005 - 0.005
	Inorganics						
7429-90-5	Aluminum	16.3 J	34800 J	µg/L	MW-15S	7 / 7	20 - 40
7440-36-0	Antimony	1.8 J	2.1 J	µg/L	MW-01S	2 / 7	2 - 4
7440-38-2	Arsenic	0.46	6.8 J	µg/L	MW-13S	7 / 7	0.2 - 0.4
7440-39-3	Barium	16.5 J	537 J	µg/L	MW-12S	7 / 7	10 - 20
7440-41-7	Beryllium	0.095 J	2	µg/L	MW-15S	2 / 7	1 - 2
7440-43-9	Cadmium	0.055 J	4.7	µg/L	MW-12S	4 / 7	0.25 - 0.5
7440-70-2	Calcium	8090	185000	µg/L	MW-01D	7 / 7	500 - 1000
7440-47-3	Chromium	0.76 J	23.5	µg/L	MW-14S	6 / 7	2 - 4
18540-29-9	Chromium VI	ND	ND	µg/L	NA	0 / 7	10 - 10
7440-48-4	Cobalt	0.38 J	40.1 J	µg/L	MW-15S	7 / 7	1 - 2
7440-50-8	Copper	0.63 J	15.8	µg/L	MW-15S	7 / 7	2 - 4
7439-89-6	Iron	64.2 J	372000	µg/L	MW-12S	7 / 7	10 - 400
7439-92-1	Lead	0.4 J	20.4	µg/L	MW-12S	6 / 7	1 - 2
7439-95-4	Magnesium	1840	473000	µg/L	MW-01D	7 / 7	500 - 2000
7439-96-5	Manganese	2.7 J	1840 J	µg/L	MW-12S	7 / 7	1 - 2
7439-97-6	Mercury	ND	ND	µg/L	NA	0 / 7	0.2 - 0.2
7440-02-0	Nickel	3.1	52.5	µg/L	MW-15S	6 / 7	1 - 2
7440-09-7	Potassium	1080	137000	µg/L	MW-01D	7 / 7	500 - 1000
7782-49-2	Selenium	0.8 J	2.3 J	µg/L	MW-13S	5 / 7	5 - 10
7440-22-4	Silver	0.037 J	0.14 J	µg/L	MW-01S	5 / 7	1 - 2
7440-23-5	Sodium	6240	4110000	µg/L	MW-01D	7 / 7	500 - 25000
7440-28-0	Thallium	0.19 J	0.19 J	µg/L	MW-01D	1 / 7	0.5 - 1
7440-62-2	Vanadium	6.4 J	16.5	µg/L	MW-14S	3 / 7	5 - 10
7440-66-6	Zinc	1.9 J	74.2	µg/L	MW-15S	7 / 7	2 - 4

NA = not available
ND = not detected
µg/L = micrograms per liter

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
bgs = below ground surface

TABLE I-3b
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER (ALL WELLS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	ND	ND	µg/L	NA	0 / 20	5 - 5
71-43-2	Benzene	ND	ND	µg/L	NA	0 / 20	0.2 - 0.2
74-97-5	Bromochloromethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-27-4	Bromodichloromethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-25-2	Bromoform	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
74-83-9	Bromomethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
78-93-3	Butanone, 2-	ND	ND	µg/L	NA	0 / 20	5 - 5
75-15-0	Carbon Disulfide	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
56-23-5	Carbon tetrachloride	ND	ND	µg/L	NA	0 / 20	0.4 - 0.4
108-90-7	Chlorobenzene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-00-3	Chloroethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
67-66-3	Chloroform	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
74-87-3	Chloromethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
110-82-7	Cyclohexane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/L	NA	0 / 20	0.2 - 0.2
124-48-1	Dibromochloromethane	ND	ND	µg/L	NA	0 / 20	0.4 - 0.4
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/L	NA	0 / 20	0.2 - 0.2
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-71-8	Dichlorodifluoromethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/L	NA	0 / 20	0.3 - 0.3
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/L	NA	0 / 20	0.4 - 0.4
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/L	NA	0 / 20	0.4 - 0.4
123-91-1	Dioxane, 1,4-						-
100-41-4	Ethylbenzene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
591-78-6	Hexanone, 2-	ND	ND	µg/L	NA	0 / 20	5 - 5
98-82-8	Isopropylbenzene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
79-20-9	Methyl Acetate	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
1634-04-4	Methyl tert-Butyl Ether	2.5	10	µg/L	MW-05D	5 / 20	0.5 - 0.5
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/L	NA	0 / 20	5 - 5
108-87-2	Methylcyclohexane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-09-2	Methylene chloride	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
100-42-5	Styrene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
127-18-4	Tetrachloroethene	0.54	5.3	µg/L	MW-08S	5 / 20	0.4 - 0.4
108-88-3	Toluene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
79-01-6	Trichloroethene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-69-4	Trichlorofluoromethane	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
75-01-4	Vinyl Chloride	ND	ND	µg/L	NA	0 / 20	0.2 - 0.2
179601-23-1	Xylene, m,p-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
95-47-6	Xylene, o-	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	1.1 J	23	µg/L	MW-13S	2 / 20	5 - 5
208-96-8	Acenaphthylene	ND	ND	µg/L	NA	0 / 20	5 - 5
98-86-2	Acetophenone	ND	ND	µg/L	NA	0 / 20	5 - 5
120-12-7	Anthracene	ND	ND	µg/L	NA	0 / 20	5 - 5
1912-24-9	Atrazine	ND	ND	µg/L	NA	0 / 20	3 - 3
100-52-7	Benzaldehyde	ND	ND	µg/L	NA	0 / 20	5 - 5
56-55-3	Benzo(a)anthracene	0.17	0.17	µg/L	MW-13S	1 / 20	0.1 - 0.1
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1

TABLE I-3b
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER (ALL WELLS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	NA	0 / 20	5 - 5
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	NA	0 / 20	5 - 5
92-52-4	Biphenyl, 1,1'-	2.2 J	2.2 J	µg/L	MW-13S	1 / 20	5 - 5
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/L	NA	0 / 20	5 - 5
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/L	NA	0 / 20	0.2 - 0.2
117-81-7	Bis(2-Ethylhexyl)phthalate	1.2 J	1.4 J	µg/L	MW-04D	3 / 20	2 - 2
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/L	NA	0 / 20	5 - 5
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/L	NA	0 / 20	5 - 5
85-68-7	Butylbenzylphthalate	ND	ND	µg/L	NA	0 / 20	5 - 5
105-60-2	Caprolactam	ND	ND	µg/L	NA	0 / 20	5 - 5
86-74-8	Carbazole	1.7 J	1.7 J	µg/L	MW-13S	1 / 20	5 - 5
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/L	NA	0 / 20	5 - 5
106-47-8	Chloroaniline, 4-	ND	ND	µg/L	NA	0 / 20	5 - 5
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/L	NA	0 / 20	5 - 5
95-57-8	Chlorophenol, 2-	ND	ND	µg/L	NA	0 / 20	5 - 5
58-90-2	Chlorophenols	ND	ND	µg/L	NA	0 / 20	5 - 5
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/L	NA	0 / 20	5 - 5
218-01-9	Chrysene	ND	ND	µg/L	NA	0 / 20	5 - 5
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1
132-64-9	Dibenzofuran	11	11	µg/L	MW-13S	1 / 20	5 - 5
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/L	NA	0 / 20	5 - 5
84-66-2	Diethylphthalate	ND	ND	µg/L	NA	0 / 20	5 - 5
105-67-9	Dimethylphenol, 2,4-	4.3 J	4.3 J	µg/L	MW-13S	1 / 20	5 - 5
131-11-3	Dimethylphthalate	ND	ND	µg/L	NA	0 / 20	5 - 5
84-74-2	Di-N-Butylphthalate	ND	ND	µg/L	NA	0 / 20	5 - 5
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/L	NA	0 / 20	10 - 10
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/L	NA	0 / 20	10 - 10
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/L	NA	0 / 20	5 - 5
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/L	NA	0 / 20	5 - 5
206-44-0	Fluoranthene	2.6 J	2.6 J	µg/L	MW-13S	1 / 20	5 - 5
86-73-7	Fluorene	9.5	9.5	µg/L	MW-13S	1 / 20	5 - 5
118-74-1	Hexachlorobenzene	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	NA	0 / 20	0.4 - 0.4
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	NA	0 / 20	5 - 5
67-72-1	Hexachloroethane	ND	ND	µg/L	NA	0 / 20	2 - 2
193-39-5	Indeno(1,2,3-Cd)Pyrene	ND	ND	µg/L	NA	0 / 20	5 - 5
78-59-1	Isophorone	ND	ND	µg/L	NA	0 / 20	5 - 5
91-57-6	Methylnaphthalene, 2-	9.6	9.6	µg/L	MW-13S	1 / 20	5 - 5
95-48-7	Methylphenol, 2-	1.1 J	1.1 J	µg/L	MW-13S	1 / 20	5 - 5
106-44-5	Methylphenol, 4-	1.5 J	1.5 J	µg/L	MW-13S	1 / 20	5 - 5
91-20-3	Naphthalene	16	16	µg/L	MW-13S	1 / 20	5 - 5
88-74-4	Nitroaniline, 2-	ND	ND	µg/L	NA	0 / 20	10 - 10
99-09-2	Nitroaniline, 3-	ND	ND	µg/L	NA	0 / 20	10 - 10
100-01-6	Nitroaniline, 4-	ND	ND	µg/L	NA	0 / 20	10 - 10
98-95-3	Nitrobenzene	ND	ND	µg/L	NA	0 / 20	4 - 4
88-75-5	Nitrophenol, 2-	ND	ND	µg/L	NA	0 / 20	5 - 5
100-02-7	Nitrophenol, 4-	ND	ND	µg/L	NA	0 / 20	10 - 10
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/L	NA	0 / 20	0.1 - 0.1
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/L	NA	0 / 20	5 - 5
87-86-5	Pentachlorophenol	ND	ND	µg/L	NA	0 / 20	10 - 10
85-01-8	Phenanthrene	12	12	µg/L	MW-13S	1 / 20	5 - 5
108-95-2	Phenol	ND	ND	µg/L	NA	0 / 20	5 - 5
129-00-0	Pyrene	ND	ND	µg/L	NA	0 / 20	5 - 5
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/L	NA	0 / 20	5 - 5
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/L	NA	0 / 20	5 - 5
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/L	NA	0 / 20	1 - 1

TABLE I-3b
SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER (ALL WELLS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/L	NA	0 / 20	0.005 - 0.005
319-84-6	Alpha-BHC	ND	ND	µg/L	NA	0 / 20	0.005 - 0.005
5103-71-9	Alpha-Chlordane	0.013 JN	0.013 JN	µg/L	MW-01S	1 / 20	0.01 - 0.01
12674-11-2	Aroclor 1016	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
11104-28-2	Aroclor 1221	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
11141-16-5	Aroclor 1232	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
53469-21-9	Aroclor 1242	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
12672-29-6	Aroclor 1248	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
11097-69-1	Aroclor 1254	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
11096-82-5	Aroclor 1260	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
37324-23-5	Aroclor 1262	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
11100-14-4	Aroclor 1268	ND	ND	µg/L	NA	0 / 20	0.05 - 0.05
319-85-7	Beta-BHC	ND	ND	µg/L	NA	0 / 20	0.02 - 0.02
8001-35-2	Chlorinated Camphene	ND	ND	µg/L	NA	0 / 20	0.5 - 0.5
60-57-1	Dieldrin	ND	ND	µg/L	NA	0 / 20	0.01 - 0.01
5103-74-2	Gamma-Chlordane	0.0056 J	0.018 J	µg/L	MW-07S	2 / 20	0.01 - 0.01
76-44-8	Heptachlor	ND	ND	µg/L	NA	0 / 20	0.008 - 0.008
1024-57-3	Heptachlor Epoxide	0.0075 J	0.0075 J	µg/L	MW-07S	1 / 20	0.005 - 0.005
	Inorganics						
7429-90-5	Aluminum	16.3 J	34800 J	µg/L	MW-15S	20 / 20	20 - 40
7440-36-0	Antimony	0.036 J	5.4	µg/L	MW-10S	13 / 20	2 - 4
7440-38-2	Arsenic	0.45	6.8 J	µg/L	MW-13S	20 / 20	0.2 - 0.4
7440-39-3	Barium	16.5 J	537 J	µg/L	MW-12S	20 / 20	10 - 20
7440-41-7	Beryllium	0.095 J	6.2	µg/L	MW-05S	14 / 20	1 - 2
7440-43-9	Cadmium	0.041 J	4.7	µg/L	MW-12S	15 / 20	0.25 - 0.5
7440-70-2	Calcium	7990	186000	µg/L	MW-10S	20 / 20	500 - 1000
7440-47-3	Chromium	0.76 J	27.3	µg/L	MW-03S	19 / 20	2 - 4
18540-29-9	Chromium VI	ND	ND	µg/L	NA	0 / 20	10 - 10
7440-48-4	Cobalt	0.38 J	40.1 J	µg/L	MW-15S	20 / 20	1 - 2
7440-50-8	Copper	0.63 J	271	µg/L	MW-09S	20 / 20	2 - 4
7439-89-6	Iron	64.2 J	372000	µg/L	MW-12S	20 / 20	10 - 400
7439-92-1	Lead	0.4 J	107	µg/L	MW-10S	19 / 20	1 - 2
7439-95-4	Magnesium	1840	502000	µg/L	MW-10S	20 / 20	500 - 5000
7439-96-5	Manganese	2.7 J	2060	µg/L	MW-10D	20 / 20	1 - 2
7439-97-6	Mercury	ND	ND	µg/L	NA	0 / 20	0.2 - 0.2
7440-02-0	Nickel	3.1	52.5	µg/L	MW-15S	19 / 20	1 - 2
7440-09-7	Potassium	1080	153000	µg/L	MW-10S	20 / 20	500 - 1000
7782-49-2	Selenium	0.49 J	2.3 J	µg/L	MW-13S	16 / 20	5 - 10
7440-22-4	Silver	0.0071 J	0.14 J	µg/L	MW-01S	14 / 20	1 - 2
7440-23-5	Sodium	6240	4420000	µg/L	MW-10S	20 / 20	500 - 25000
7440-28-0	Thallium	0.039 J	1.1	µg/L	MW-08D	13 / 20	0.5 - 1
7440-62-2	Vanadium	0.63 J	16.5	µg/L	MW-14S	15 / 20	5 - 10
7440-66-6	Zinc	1.9 J	438	µg/L	MW-08S	20 / 20	2 - 4

NA = not available
ND = not detected
µg/L = micrograms per liter

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride

TABLE I-4a
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	ND	ND	µg/L	NA	0 / 15	5 - 5
71-43-2	Benzene	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
74-97-5	Bromochloromethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-27-4	Bromodichloromethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-25-2	Bromoform	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
74-83-9	Bromomethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
78-93-3	Butanone, 2-	ND	ND	µg/L	NA	0 / 15	5 - 5
75-15-0	Carbon Disulfide	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
56-23-5	Carbon tetrachloride	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
108-90-7	Chlorobenzene	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-00-3	Chloroethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
67-66-3	Chloroform	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
74-87-3	Chloromethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
110-82-7	Cyclohexane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
124-48-1	Dibromochloromethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-71-8	Dichlorodifluoromethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
100-41-4	Ethylbenzene	0.55	0.55	µg/L	A1-31	1 / 15	0.5 - 0.5
591-78-6	Hexanone, 2-	ND	ND	µg/L	NA	0 / 15	5 - 5
98-82-8	Isopropylbenzene	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
79-20-9	Methyl Acetate	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/L	NA	0 / 15	5 - 5
108-87-2	Methylcyclohexane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-09-2	Methylene chloride	0.54	0.63 J	µg/L	A8-14	2 / 15	0.5 - 0.5
100-42-5	Styrene	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
127-18-4	Tetrachloroethene	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
108-88-3	Toluene	0.38 J	2.4	µg/L	A1-31	4 / 15	0.5 - 0.5
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
79-01-6	Trichloroethene	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-69-4	Trichlorofluoromethane	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
75-01-4	Vinyl Chloride	ND	ND	µg/L	NA	0 / 15	0.5 - 0.5
179601-23-1	Xylene, m,p-	0.26 J	1.7	µg/L	A1-31	4 / 15	0.5 - 0.5
95-47-6	Xylene, o-	0.23 J	0.62	µg/L	A1-31	2 / 15	0.5 - 0.5
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	ND	ND	µg/L	NA	0 / 7	5 - 5
208-96-8	Acenaphthylene	ND	ND	µg/L	NA	0 / 7	5 - 5
98-86-2	Acetophenone	ND	ND	µg/L	NA	0 / 7	5 - 5
120-12-7	Anthracene	ND	ND	µg/L	NA	0 / 7	5 - 5
1912-24-9	Atrazine	ND	ND	µg/L	NA	0 / 7	5 - 5
100-52-7	Benzaldehyde	ND	ND	µg/L	NA	0 / 7	5 - 5
56-55-3	Benzo(a)anthracene	0.055	0.055	µg/L	A11-26	1 / 7	0.05 - 0.05
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05

TABLE I-4a
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	0.063	0.063	µg/L	A11-26	1 / 7	0.05 - 0.05
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	NA	0 / 7	5 - 5
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	NA	0 / 7	0.1 - 0.1
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/L	NA	0 / 7	5 - 5
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/L	NA	0 / 7	5 - 5
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
117-81-7	Bis(2-Ethylhexyl)phthalate	ND	ND	µg/L	NA	0 / 7	1 - 1
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/L	NA	0 / 7	5 - 5
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
85-68-7	Butylbenzylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
105-60-2	Caprolactam	ND	ND	µg/L	NA	0 / 7	5 - 5
86-74-8	Carbazole	ND	ND	µg/L	NA	0 / 7	5 - 5
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
106-47-8	Chloroaniline, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
95-57-8	Chlorophenol, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
58-90-2	Chlorophenols	ND	ND	µg/L	NA	0 / 7	5 - 5
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
218-01-9	Chrysene	0.067 J	0.067 J	µg/L	A11-26	1 / 7	0.1 - 0.1
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
132-64-9	Dibenzofuran	ND	ND	µg/L	NA	0 / 7	5 - 5
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/L	NA	0 / 7	5 - 5
84-66-2	Diethylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/L	NA	0 / 7	5 - 5
131-11-3	Dimethylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
84-74-2	Di-N-Butylphthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/L	NA	0 / 7	10 - 10
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/L	NA	0 / 7	10 - 10
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/L	NA	0 / 7	0.11 - 0.11
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/L	NA	0 / 7	5 - 5
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/L	NA	0 / 7	5 - 5
206-44-0	Fluoranthene	ND	ND	µg/L	NA	0 / 7	5 - 5
86-73-7	Fluorene	ND	ND	µg/L	NA	0 / 7	5 - 5
118-74-1	Hexachlorobenzene	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	NA	0 / 7	0.44 - 0.44
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	NA	0 / 7	5 - 5
67-72-1	Hexachloroethane	ND	ND	µg/L	NA	0 / 7	1.4 - 1.4
193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
78-59-1	Isophorone	ND	ND	µg/L	NA	0 / 7	5 - 5
91-57-6	Methylnaphthalene, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
95-48-7	Methylphenol, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
106-44-5	Methylphenol, 4-	ND	ND	µg/L	NA	0 / 7	5 - 5
91-20-3	Naphthalene	ND	ND	µg/L	NA	0 / 7	5 - 5
88-74-4	Nitroaniline, 2-	ND	ND	µg/L	NA	0 / 7	10 - 10
99-09-2	Nitroaniline, 3-	ND	ND	µg/L	NA	0 / 7	10 - 10
100-01-6	Nitroaniline, 4-	ND	ND	µg/L	NA	0 / 7	10 - 10
98-95-3	Nitrobenzene	ND	ND	µg/L	NA	0 / 7	5 - 5
88-75-5	Nitrophenol, 2-	ND	ND	µg/L	NA	0 / 7	5 - 5
100-02-7	Nitrophenol, 4-	ND	ND	µg/L	NA	0 / 7	10 - 10
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/L	NA	0 / 7	0.05 - 0.05
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/L	NA	0 / 7	3.3 - 3.3
87-86-5	Pentachlorophenol	ND	ND	µg/L	NA	0 / 7	0.2 - 0.2
85-01-8	Phenanthrene	ND	ND	µg/L	NA	0 / 7	5 - 5
108-95-2	Phenol	ND	ND	µg/L	NA	0 / 7	5 - 5
129-00-0	Pyrene	ND	ND	µg/L	NA	0 / 7	5 - 5
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/L	NA	0 / 7	0.97 - 0.97
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/L	NA	0 / 7	5 - 5
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/L	NA	0 / 7	0.58 - 0.58

TABLE I-4a
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
319-84-6	Alpha-BHC	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
5103-71-9	Alpha-Chlordane	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
12674-11-2	Aroclor 1016	ND	ND	µg/L	NA	0 / 14	1 - 1
11104-28-2	Aroclor 1221	ND	ND	µg/L	NA	0 / 14	1 - 1
11141-16-5	Aroclor 1232	ND	ND	µg/L	NA	0 / 14	1 - 1
53469-21-9	Aroclor 1242	ND	ND	µg/L	NA	0 / 14	1 - 1
12672-29-6	Aroclor 1248	ND	ND	µg/L	NA	0 / 14	1 - 1
11097-69-1	Aroclor 1254	ND	ND	µg/L	NA	0 / 14	1 - 1
11096-82-5	Aroclor 1260	ND	ND	µg/L	NA	0 / 14	1 - 1
37324-23-5	Aroclor 1262	ND	ND	µg/L	NA	0 / 14	1 - 1
11100-14-4	Aroclor 1268	ND	ND	µg/L	NA	0 / 14	1 - 1
319-85-7	Beta-BHC	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
8001-35-2	Chlorinated Camphene	ND	ND	µg/L	NA	0 / 14	5 - 5
72-54-8	DDD, 4,4'-	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
72-55-9	DDE, 4,4'-	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
50-29-3	DDT, 4,4'-	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
319-86-8	Delta-BHC	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
60-57-1	Dieldrin	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
959-98-8	Endosulfan I	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
33213-65-9	Endosulfan II	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
1031-07-8	Endosulfan Sulfate	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
72-20-8	Endrin	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
7421-93-4	Endrin Aldehyde	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
53494-70-5	Endrin Ketone	ND	ND	µg/L	NA	0 / 14	0.1 - 0.1
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
5103-74-2	Gamma-Chlordane	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
76-44-8	Heptachlor	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
1024-57-3	Heptachlor Epoxide	ND	ND	µg/L	NA	0 / 14	0.05 - 0.05
72-43-5	Methoxychlor	ND	ND	µg/L	NA	0 / 14	0.5 - 0.5
	Inorganics						
7429-90-5	Aluminum	102 J	12600 J	µg/L	SW16	35 / 117	5.4 - 2000
7440-36-0	Antimony	1.6 J	53.2 J	µg/L	SW16	19 / 139	0.68 - 600
7440-38-2	Arsenic	1.9 J	70.9	µg/L	SW16	31 / 139	0.052 - 100
7440-39-3	Barium	20.4 J	64.9 J	µg/L	SW16	19 / 117	3.2 - 2000
7440-41-7	Beryllium	0.054 J	1.8 J	µg/L	SW28	7 / 117	0.21 - 50
7440-43-9	Cadmium	0.09 J	1 J	µg/L	SW35	5 / 117	0.13 - 50
7440-70-2	Calcium	26600	403000	µg/L	A7-15	116 / 117	173 - 50000
7440-47-3	Chromium	2.1 J	28.9 J	µg/L	SW12	25 / 139	0.65 - 100
18540-29-9	Chromium VI	ND	ND	µg/L	NA	0 / 37	10 - 10
7440-48-4	Cobalt	1.1 J	17 J	µg/L	SW12	15 / 117	0.35 - 500
7440-50-8	Copper	4 J	154 J	µg/L	SW16	38 / 139	0.7 - 250
7439-89-6	Iron	345 J	74400	µg/L	SW19	49 / 117	10 - 1000
7439-92-1	Lead	5.8 J	1580 J	µg/L	SW16	40 / 139	0.29 - 100
7439-95-4	Magnesium	38500	1230000	µg/L	A7-15	116 / 117	145 - 50000
7439-96-5	Manganese	60.3 J	2620 J	µg/L	SW12	43 / 117	0.31 - 150
7439-97-6	Mercury	ND	ND	µg/L	NA	0 / 139	0.1 - 0.1
7440-02-0	Nickel	1.4 J	22.1 J	µg/L	SW16	23 / 117	0.3 - 400
7440-09-7	Potassium	17600	365000	µg/L	A7-15	108 / 112	177 - 50000
7782-49-2	Selenium	2.4 J	3.9 J	µg/L	SW01	12 / 117	1.5 - 350
7440-22-4	Silver	1.3 J	2 J	µg/L	SW14	3 / 117	0.35 - 100
7440-23-5	Sodium	1850000	8390000	µg/L	A7-15	91 / 111	166 - 85000
7440-28-0	Thallium	ND	ND	µg/L	NA	0 / 117	0.075 - 250
7440-31-5	Tin	0.9 J	33.1 J	µg/L	SW11	6 / 22	100 - 100
7440-62-2	Vanadium	3.8 J	94.9 J	µg/L	SW12	17 / 117	1.9 - 500
7440-66-6	Zinc	0.97 J	352	µg/L	SW28	26 / 117	0.6 - 600

NA = not available
ND = not detected
µg/L = micrograms per liter

J = estimated value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-4b
SUMMARY OF ANALYTICAL RESULTS - WETLAND AREA OF AREA 9 SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	ND	ND	µg/L	NA	0 / 18	5 - 5
71-43-2	Benzene	ND	ND	µg/L	NA	0 / 18	0.15 - 0.15
74-97-5	Bromochloromethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-27-4	Bromodichloromethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-25-2	Bromoform	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
74-83-9	Bromomethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
78-93-3	Butanone, 2-	ND	ND	µg/L	NA	0 / 18	5 - 5
75-15-0	Carbon Disulfide	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
56-23-5	Carbon tetrachloride	ND	ND	µg/L	NA	0 / 18	0.3 - 0.3
108-90-7	Chlorobenzene	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-00-3	Chloroethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
67-66-3	Chloroform	0.46 J	0.46 J	µg/L	A9-95	1 / 18	0.5 - 0.5
74-87-3	Chloromethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
110-82-7	Cyclohexane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
124-48-1	Dibromochloromethane	ND	ND	µg/L	NA	0 / 18	0.4 - 0.4
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-71-8	Dichlorodifluoromethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/L	NA	0 / 18	0.29 - 0.29
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
542-75-6	Dichloropropylene, 1,3-	ND	ND	µg/L	NA	0 / 18	0.34 - 0.34
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
100-41-4	Ethylbenzene	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
591-78-6	Hexanone, 2-	ND	ND	µg/L	NA	0 / 18	5 - 5
98-82-8	Isopropylbenzene	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
79-20-9	Methyl Acetate	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/L	NA	0 / 18	5 - 5
108-87-2	Methylcyclohexane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-09-2	Methylene chloride	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
100-42-5	Styrene	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
127-18-4	Tetrachloroethene	ND	ND	µg/L	NA	0 / 18	0.34 - 0.34
108-88-3	Toluene	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
79-01-6	Trichloroethene	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-69-4	Trichlorofluoromethane	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
75-01-4	Vinyl Chloride	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
179601-23-1	Xylene, m,p-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
95-47-6	Xylene, o-	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	ND	ND	µg/L	NA	0 / 17	5 - 5
208-96-8	Acenaphthylene	ND	ND	µg/L	NA	0 / 17	5 - 5
98-86-2	Acetophenone	ND	ND	µg/L	NA	0 / 17	5 - 5
120-12-7	Anthracene	ND	ND	µg/L	NA	0 / 17	5 - 5
1912-24-9	Atrazine	ND	ND	µg/L	NA	0 / 17	5 - 5
100-52-7	Benzaldehyde	ND	ND	µg/L	NA	0 / 17	5 - 5
56-55-3	Benzo(a)anthracene	0.053	0.053	µg/L	A9-89	1 / 17	0.05 - 0.05
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05

TABLE I-4b
SUMMARY OF ANALYTICAL RESULTS - WETLAND AREA OF AREA 9 SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	NA	0 / 17	5 - 5
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	NA	0 / 17	0.1 - 0.1
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/L	NA	0 / 17	5 - 5
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/L	NA	0 / 17	5 - 5
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05
117-81-7	Bis(2-Ethylhexyl)phthalate	0.51 J	0.51 J	µg/L	A9-93	1 / 17	1 - 1
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/L	NA	0 / 17	5 - 5
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/L	NA	0 / 17	5 - 5
85-68-7	Butylbenzylphthalate	ND	ND	µg/L	NA	0 / 17	5 - 5
105-60-2	Caprolactam	ND	ND	µg/L	NA	0 / 17	5 - 5
86-74-8	Carbazole	ND	ND	µg/L	NA	0 / 17	5 - 5
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/L	NA	0 / 17	5 - 5
106-47-8	Chloroaniline, 4-	ND	ND	µg/L	NA	0 / 17	5 - 5
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/L	NA	0 / 17	5 - 5
95-57-8	Chlorophenol, 2-	ND	ND	µg/L	NA	0 / 17	5 - 5
58-90-2	Chlorophenols	ND	ND	µg/L	NA	0 / 17	5 - 5
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/L	NA	0 / 17	5 - 5
218-01-9	Chrysene	ND	ND	µg/L	NA	0 / 17	0.1 - 0.1
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05
132-64-9	Dibenzofuran	ND	ND	µg/L	NA	0 / 17	5 - 5
91-94-1	Dichlorobenzidine, 3,3`-	0.064	0.064	µg/L	A9-87	1 / 17	0.05 - 0.05
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/L	NA	0 / 17	5 - 5
84-66-2	Diethylphthalate	ND	ND	µg/L	NA	0 / 17	5 - 5
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/L	NA	0 / 17	5 - 5
131-11-3	Dimethylphthalate	ND	ND	µg/L	NA	0 / 17	5 - 5
84-74-2	Di-N-Butylphthalate	ND	ND	µg/L	NA	0 / 17	5 - 5
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/L	NA	0 / 17	10 - 10
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/L	NA	0 / 17	10 - 10
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/L	NA	0 / 17	0.11 - 0.11
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/L	NA	0 / 17	5 - 5
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/L	NA	0 / 17	5 - 5
206-44-0	Fluoranthene	ND	ND	µg/L	NA	0 / 17	5 - 5
86-73-7	Fluorene	ND	ND	µg/L	NA	0 / 17	5 - 5
118-74-1	Hexachlorobenzene	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	NA	0 / 17	0.44 - 0.44
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	NA	0 / 17	5 - 5
67-72-1	Hexachloroethane	ND	ND	µg/L	NA	0 / 17	1.4 - 1.4
193-39-5	Indeno(1,2,3-Cd)Pyrene	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05
78-59-1	Isophorone	ND	ND	µg/L	NA	0 / 17	5 - 5
91-57-6	Methylnaphthalene, 2-	ND	ND	µg/L	NA	0 / 17	5 - 5
95-48-7	Methylphenol, 2-	ND	ND	µg/L	NA	0 / 17	5 - 5
106-44-5	Methylphenol, 4-	ND	ND	µg/L	NA	0 / 17	5 - 5
91-20-3	Naphthalene	ND	ND	µg/L	NA	0 / 17	5 - 5
88-74-4	Nitroaniline, 2-	ND	ND	µg/L	NA	0 / 17	10 - 10
99-09-2	Nitroaniline, 3-	ND	ND	µg/L	NA	0 / 17	10 - 10
100-01-6	Nitroaniline, 4-	ND	ND	µg/L	NA	0 / 17	10 - 10
98-95-3	Nitrobenzene	ND	ND	µg/L	NA	0 / 17	5 - 5
88-75-5	Nitrophenol, 2-	ND	ND	µg/L	NA	0 / 17	5 - 5
100-02-7	Nitrophenol, 4-	ND	ND	µg/L	NA	0 / 17	10 - 10
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/L	NA	0 / 17	0.05 - 0.05
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/L	NA	0 / 17	3.3 - 3.3
87-86-5	Pentachlorophenol	0.52 J	0.52 J	µg/L	A9-70	1 / 17	0.2 - 0.2
85-01-8	Phenanthrene	ND	ND	µg/L	NA	0 / 17	5 - 5
108-95-2	Phenol	ND	ND	µg/L	NA	0 / 17	5 - 5
129-00-0	Pyrene	ND	ND	µg/L	NA	0 / 17	5 - 5
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/L	NA	0 / 17	0.97 - 0.97
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/L	NA	0 / 17	5 - 5
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/L	NA	0 / 17	0.58 - 0.58

TABLE I-4b
SUMMARY OF ANALYTICAL RESULTS - WETLAND AREA OF AREA 9 SURFACE WATER
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
319-84-6	Alpha-BHC	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
5103-71-9	Alpha-Chlordane	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
12674-11-2	Aroclor 1016	ND	ND	µg/L	NA	0 / 18	1 - 1
11104-28-2	Aroclor 1221	ND	ND	µg/L	NA	0 / 18	1 - 1
11141-16-5	Aroclor 1232	ND	ND	µg/L	NA	0 / 18	1 - 1
53469-21-9	Aroclor 1242	ND	ND	µg/L	NA	0 / 18	1 - 1
12672-29-6	Aroclor 1248	ND	ND	µg/L	NA	0 / 18	1 - 1
11097-69-1	Aroclor 1254	ND	ND	µg/L	NA	0 / 18	1 - 1
11096-82-5	Aroclor 1260	ND	ND	µg/L	NA	0 / 18	1 - 1
37324-23-5	Aroclor 1262	ND	ND	µg/L	NA	0 / 18	1 - 1
11100-14-4	Aroclor 1268	ND	ND	µg/L	NA	0 / 18	1 - 1
319-85-7	Beta-BHC	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
8001-35-2	Chlorinated Camphene	ND	ND	µg/L	NA	0 / 18	5 - 5
72-54-8	DDD, 4,4'-	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
72-55-9	DDE, 4,4'-	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
50-29-3	DDT, 4,4'-	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
319-86-8	Delta-BHC	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
60-57-1	Dieldrin	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
959-98-8	Endosulfan I	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
33213-65-9	Endosulfan II	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
1031-07-8	Endosulfan Sulfate	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
72-20-8	Endrin	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
7421-93-4	Endrin Aldehyde	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
53494-70-5	Endrin Ketone	ND	ND	µg/L	NA	0 / 18	0.1 - 0.1
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
5103-74-2	Gamma-Chlordane	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
76-44-8	Heptachlor	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
1024-57-3	Heptachlor Epoxide	ND	ND	µg/L	NA	0 / 18	0.05 - 0.05
72-43-5	Methoxychlor	ND	ND	µg/L	NA	0 / 18	0.5 - 0.5
	Inorganics						
7429-90-5	Aluminum	85.8	2000	µg/L	A9-95	2 / 15	5.4 - 2000
7440-36-0	Antimony	ND	ND	µg/L	NA	0 / 15	0.68 - 600
7440-38-2	Arsenic	0.44	2.1	µg/L	A9-95	2 / 15	0.052 - 100
7440-39-3	Barium	14.8	21.8	µg/L	A9-95	2 / 15	3.2 - 2000
7440-41-7	Beryllium	0.52 J	0.52 J	µg/L	A9-95	1 / 15	0.21 - 50
7440-43-9	Cadmium	0.45	0.45	µg/L	A9-95	1 / 15	0.13 - 50
7440-70-2	Calcium	348 J	257000	µg/L	A9-70	14 / 15	173 - 50000
7440-47-3	Chromium	2 J	2 J	µg/L	A9-95	1 / 15	0.65 - 100
18540-29-9	Chromium VI	ND	ND	µg/L	NA	0 / 18	10 - 10
7440-48-4	Cobalt	0.93 J	0.93 J	µg/L	A9-95	1 / 15	0.35 - 500
7440-50-8	Copper	1.1 J	1.1 J	µg/L	A9-95	1 / 15	0.7 - 250
7439-89-6	Iron	501	21100 J	µg/L	A9-102	10 / 15	54 - 1000
7439-92-1	Lead	2.2	23.2	µg/L	A9-95	2 / 15	0.29 - 100
7439-95-4	Magnesium	5000	741000	µg/L	A9-70	13 / 15	145 - 50000
7439-96-5	Manganese	13	637	µg/L	A9-78	12 / 15	0.31 - 150
7439-97-6	Mercury	0.04 J	0.04 J	µg/L	A9-91	1 / 18	0.1 - 0.1
7440-02-0	Nickel	0.51 J	3.4	µg/L	A9-95	2 / 15	0.3 - 400
7440-09-7	Potassium	2560	242000	µg/L	A9-70	9 / 15	177 - 50000
7782-49-2	Selenium	ND	ND	µg/L	NA	0 / 15	1.5 - 350
7440-22-4	Silver	ND	ND	µg/L	NA	0 / 15	0.35 - 100
7440-23-5	Sodium	170 J	5780000	µg/L	A9-70	15 / 15	166 - 50000
7440-28-0	Thallium	ND	ND	µg/L	NA	0 / 15	0.075 - 250
7440-62-2	Vanadium	5.5	5.5	µg/L	A9-95	1 / 15	1.9 - 500
7440-66-6	Zinc	5.4	91.6	µg/L	A9-95	4 / 15	0.6 - 600

NA = not available
ND = not detected
µg/L = micrograms per liter

J = estimated value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-5a
SUMMARY OF ANALYTICAL RESULTS - AREA 1 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	40	40	µg/kg	A68	1 / 9	9.9 - 21
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
78-93-3	Butanone, 2-	ND	ND	µg/kg	NA	0 / 9	9.9 - 21
75-15-0	Carbon disulfide	9.7 J	16	µg/kg	A68	2 / 9	0.79 - 11
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 9	0.49 - 11
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 9	99 - 210
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 9	9.9 - 21
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 9	9.9 - 21
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 9	0.99 - 11
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 9	0.99 - 11
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 9	4.9 - 11
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	15	15	µg/kg	A1-13	1 / 9	4.2 - 260
208-96-8	Acenaphthylene	ND	ND	µg/kg	NA	0 / 9	4.2 - 260
98-86-2	Acetophenone	16 J	42 J	µg/kg	A60	4 / 9	210 - 260
120-12-7	Anthracene	ND	ND	µg/kg	NA	0 / 9	110 - 260
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 9	110 - 260
100-52-7	Benzaldehyde	33 J	140 J	µg/kg	A60	4 / 9	210 - 260
56-55-3	Benzo(a)anthracene	3.4 J	16 J	µg/kg	A61	7 / 9	4.2 - 260
50-32-8	Benzo(a)pyrene	4.6	16 J	µg/kg	A61	4 / 9	4.2 - 260

TABLE I-5a
SUMMARY OF ANALYTICAL RESULTS - AREA 1 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	6.9 J	14 J	µg/kg	A61	3 / 9	210 - 260
191-24-2	Benzo(g,h,i)perylene	7.7 J	7.7 J	µg/kg	A61	1 / 9	210 - 260
207-08-9	Benzo(k)fluoranthene	7.2 J	7.2 J	µg/kg	A61	1 / 9	210 - 260
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 9	210 - 260
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 9	210 - 260
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 9	210 - 260
117-81-7	Bis(2-ethylhexyl)phthalate	12 J	99 J	µg/kg	A1-17	5 / 9	210 - 260
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 9	210 - 260
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 9	210 - 260
85-68-7	Butylbenzylphthalate	ND	ND	µg/kg	NA	0 / 9	210 - 260
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 9	210 - 260
86-74-8	Carbazole	ND	ND	µg/kg	NA	0 / 9	210 - 260
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 9	210 - 260
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 9	110 - 260
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 9	210 - 260
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 9	110 - 260
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 9	210 - 260
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 9	210 - 260
218-01-9	Chrysene	4.3 J	12 J	µg/kg	A61	5 / 9	4.2 - 260
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/kg	NA	0 / 9	4.2 - 260
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 9	210 - 260
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 9	110 - 260
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 9	110 - 260
84-66-2	Diethylphthalate	8.5 J	8.8 J	µg/kg	A60	2 / 9	210 - 260
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 9	110 - 260
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 9	210 - 260
84-74-2	Di-n-butylphthalate	8.3 J	12 J	µg/kg	A60	3 / 9	210 - 260
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 9	410 - 500
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 9	110 - 500
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 9	110 - 260
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 9	110 - 260
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 9	210 - 260
206-44-0	Fluoranthene	10 J	29 J	µg/kg	A61	3 / 9	210 - 260
86-73-7	Fluorene	8.8	8.8	µg/kg	A1-13	1 / 9	4.2 - 260
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 9	110 - 260
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 9	210 - 260
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 9	210 - 260
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 9	210 - 260
193-39-5	Indeno(1,2,3-Cd)Pyrene	ND	ND	µg/kg	NA	0 / 9	210 - 260
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 9	210 - 260
91-57-6	Methylnaphthalene, 2-	9.9	9.9	µg/kg	A1-13	1 / 9	4.2 - 260
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 9	110 - 260
106-44-5	Methylphenol, 4-	9.2 J	14 J	µg/kg	A68	2 / 9	210 - 260
91-20-3	Naphthalene	9.8 J	9.8 J	µg/kg	A60	1 / 9	210 - 260
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 9	410 - 500
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 9	410 - 500
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 9	410 - 500
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 9	210 - 260
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 9	210 - 260
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 9	410 - 500
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 9	210 - 260
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 9	210 - 260
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 9	410 - 500
85-01-8	Phenanthrene	6.6 J	22 J	µg/kg	A61	4 / 9	210 - 260
108-95-2	Phenol	27 J	110 J	µg/kg	A60	4 / 9	210 - 260
129-00-0	Pyrene	8.7 J	25 J	µg/kg	A61	4 / 9	210 - 260
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 9	210 - 260
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 9	210 - 260
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 9	210 - 260

TABLE I-5a
SUMMARY OF ANALYTICAL RESULTS - AREA 1 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
5103-71-9	Alpha-Chlordane	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
11097-69-1	Aroclor 1254	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 9	8.3 - 50
319-85-7	Beta-BHC	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 9	43 - 260
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 9	0.83 - 5
72-55-9	DDE, 4,4'-	0.16 J	0.17 J	µg/kg	A60	2 / 9	0.83 - 5
50-29-3	DDT, 4,4'-	0.41 J	0.41 J	µg/kg	A146	1 / 9	0.83 - 5
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
60-57-1	Dieldrin	ND	ND	µg/kg	NA	0 / 9	0.83 - 5
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 9	0.83 - 5
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 9	0.83 - 5
72-20-8	Endrin	ND	ND	µg/kg	NA	0 / 9	0.83 - 5
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 9	0.83 - 5
53494-70-5	Endrin ketone	0.054 J	0.054 J	µg/kg	A68	1 / 9	0.83 - 5
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
5103-74-2	Gamma-chlordane	0.23 J	0.23 J	µg/kg	A146	1 / 9	0.43 - 2.6
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 9	0.43 - 2.6
1024-57-3	Heptachlor epoxide	0.3 J	0.3 J	µg/kg	A61	1 / 9	0.43 - 2.6
72-43-5	Methoxychlor	ND	ND	µg/kg	NA	0 / 9	4.3 - 26
	Inorganics						
7429-90-5	Aluminum	276 J	9950	mg/kg	A68	73 / 73	17.9 - 34.6
7440-36-0	Antimony	1.2 J	3.1	mg/kg	A64	17 / 73	1.1 - 8.3
7440-38-2	Arsenic	0.92 J	40.2 J	mg/kg	A63	73 / 73	1 - 1.4
7440-39-3	Barium	1.4 J	17.3	mg/kg	A68	35 / 73	6.1 - 27.8
7440-41-7	Beryllium	0.098 J	0.96	mg/kg	A156	36 / 73	0.28 - 1
7440-43-9	Cadmium	0.091 J	1	mg/kg	A1-12	36 / 73	0.31 - 1
7440-70-2	Calcium	141 J	31200	mg/kg	A1-22	70 / 73	448 - 865
7440-47-3	Chromium	2.5	36.5	mg/kg	A156	73 / 73	1.2 - 2
18540-29-9	Chromium VI	0.39 J	1 J	mg/kg	A1-17	7 / 25	1.2 - 1.5
7440-48-4	Cobalt	0.41 J	5.9 J	mg/kg	A68	57 / 73	1 - 6.9
7440-50-8	Copper	2.9 J	35 J	mg/kg	A1-14	73 / 73	2.6 - 3.5
7439-89-6	Iron	2000	36800 J	mg/kg	A101	73 / 73	9 - 17.3
7439-92-1	Lead	7.4	52.9	mg/kg	A64	73 / 73	1.1 - 1.4
7439-95-4	Magnesium	286 J	4910	mg/kg	A68	70 / 73	448 - 865
7439-96-5	Manganese	12.6	219	mg/kg	A68	73 / 73	1.6 - 2.1
7439-97-6	Mercury	0.027 J	0.38	mg/kg	A1-14	71 / 73	0.034 - 0.14
7440-02-0	Nickel	0.9 J	14.9	mg/kg	A68	61 / 73	1 - 5.6
7440-09-7	Potassium	132 J	2390	mg/kg	A68	23 / 73	448 - 865
7782-49-2	Selenium	0.094 J	7	mg/kg	A1-12	40 / 73	0.61 - 5
7440-22-4	Silver	0.3 J	0.42	mg/kg	A64	6 / 73	0.28 - 1.4
7440-23-5	Sodium	1190	6430 J	mg/kg	A68	73 / 73	448 - 865
7440-28-0	Thallium	0.61 J	2.4 J	mg/kg	A1-12	5 / 73	0.56 - 3.5
7440-62-2	Vanadium	4.2 J	66.3	mg/kg	A65	73 / 73	1 - 6.9
7440-66-6	Zinc	13.4	100 J	mg/kg	A64	73 / 73	6.3 - 8.3

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-5b
SUMMARY OF ANALYTICAL RESULTS - AREA 2 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Inorganics						
7429-90-5	Aluminum	3660	3660	mg/kg	A161	1 / 1	27.6 - 27.6
7440-36-0	Antimony	ND	ND	mg/kg	NA	0 / 1	2 - 2
7440-38-2	Arsenic	6.9 J	6.9 J	mg/kg	A161	1 / 1	1 - 1
7440-39-3	Barium	ND	ND	mg/kg	NA	0 / 1	10 - 10
7440-41-7	Beryllium	0.36	0.36	mg/kg	A161	1 / 1	1 - 1
7440-43-9	Cadmium	ND	ND	mg/kg	NA	0 / 1	1 - 1
7440-70-2	Calcium	408 J	408 J	mg/kg	A161	1 / 1	690 - 690
7440-47-3	Chromium	12.3 J	12.3 J	mg/kg	A161	1 / 1	2 - 2
7440-48-4	Cobalt	2	2	mg/kg	A161	1 / 1	1 - 1
7440-50-8	Copper	13.7 J	13.7 J	mg/kg	A161	1 / 1	2 - 2
7439-89-6	Iron	9630	9630	mg/kg	A161	1 / 1	13.8 - 13.8
7439-92-1	Lead	18.5	18.5	mg/kg	A161	1 / 1	1 - 1
7439-95-4	Magnesium	1080	1080	mg/kg	A161	1 / 1	690 - 690
7439-96-5	Manganese	44.1	44.1	mg/kg	A161	1 / 1	1 - 1
7439-97-6	Mercury	0.19	0.19	mg/kg	A161	1 / 1	0.039 - 0.039
7440-02-0	Nickel	5.5	5.5	mg/kg	A161	1 / 1	1 - 1
7440-09-7	Potassium	698	698	mg/kg	A161	1 / 1	690 - 690
7782-49-2	Selenium	0.45 J	0.45 J	mg/kg	A161	1 / 1	5 - 5
7440-22-4	Silver	ND	ND	mg/kg	NA	0 / 1	1 - 1
7440-23-5	Sodium	2210	2210	mg/kg	A161	1 / 1	690 - 690
7440-28-0	Thallium	ND	ND	mg/kg	NA	0 / 1	1 - 1
7440-62-2	Vanadium	16.7	16.7	mg/kg	A161	1 / 1	1 - 1
7440-66-6	Zinc	35.3 J	35.3 J	mg/kg	A161	1 / 1	2 - 2

NA = not available
ND = not detected
mg/kg = milligrams per kilogram
J = estimated value

TABLE I-5c
SUMMARY OF ANALYTICAL RESULTS - AREAS 5, 6, AND BEACH AREA OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	5.9 J	6.4 J	µg/kg	B11	2 / 5	8.3 - 14
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
78-93-3	Butanone, 2-	5.5 J	5.5 J	µg/kg	B31	1 / 5	8.3 - 14
75-15-0	Carbon disulfide	0.47 J	0.71 J	µg/kg	B11	2 / 5	0.67 - 6
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 5	0.42 - 6
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 5	83 - 140
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 5	8.3 - 14
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 5	8.3 - 14
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 5	0.83 - 6
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 5	0.83 - 6
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 5	4.2 - 6.8
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	ND	ND	µg/kg	NA	0 / 5	4 - 230
208-96-8	Acenaphthylene	ND	ND	µg/kg	NA	0 / 5	4 - 230
98-86-2	Acetophenone	22 J	23 J	µg/kg	B11	2 / 5	210 - 230
120-12-7	Anthracene	ND	ND	µg/kg	NA	0 / 5	100 - 230
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 5	100 - 230
100-52-7	Benzaldehyde	44 J	220 J	µg/kg	A5-17	3 / 5	210 - 230
56-55-3	Benzo(a)anthracene	7.7 J	16 J	µg/kg	B31	3 / 5	4 - 230
50-32-8	Benzo(a)pyrene	3.4 J	18 J	µg/kg	B31	3 / 5	4 - 230

TABLE I-5c
SUMMARY OF ANALYTICAL RESULTS - AREAS 5, 6, AND BEACH AREA OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	18 J	18 J	µg/kg	B31	1 / 5	210 - 230
191-24-2	Benzo(g,h,i)perylene	11 J	11 J	µg/kg	B31	1 / 5	210 - 230
207-08-9	Benzo(k)fluoranthene	8.5 J	8.5 J	µg/kg	B31	1 / 5	210 - 230
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 5	210 - 230
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 5	210 - 230
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 5	210 - 230
117-81-7	Bis(2-ethylhexyl)phthalate	24 J	26 J	µg/kg	B31	2 / 5	210 - 230
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 5	210 - 230
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 5	210 - 230
85-68-7	Butylbenzylphthalate	ND	ND	µg/kg	NA	0 / 5	210 - 230
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 5	210 - 230
86-74-8	Carbazole	ND	ND	µg/kg	NA	0 / 5	210 - 230
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 5	210 - 230
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 5	100 - 230
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 5	210 - 230
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 5	100 - 230
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 5	210 - 230
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 5	210 - 230
218-01-9	Chrysene	14 J	17 J	µg/kg	B31	2 / 5	4 - 230
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/kg	NA	0 / 5	4 - 230
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 5	210 - 230
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 5	100 - 230
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 5	100 - 230
84-66-2	Diethylphthalate	ND	ND	µg/kg	NA	0 / 5	210 - 230
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 5	100 - 230
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 5	210 - 230
84-74-2	Di-n-butylphthalate	8.1 J	12 J	µg/kg	B31	2 / 5	210 - 230
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 5	400 - 440
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 5	100 - 440
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 5	100 - 230
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 5	100 - 230
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 5	210 - 230
206-44-0	Fluoranthene	8.1 J	49 J	µg/kg	B31	2 / 5	210 - 230
86-73-7	Fluorene	ND	ND	µg/kg	NA	0 / 5	4 - 230
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 5	100 - 230
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 5	210 - 230
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 5	210 - 230
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 5	210 - 230
193-39-5	Indeno(1,2,3-cd)pyrene	11 J	11 J	µg/kg	B31	1 / 5	210 - 230
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 5	210 - 230
91-57-6	Methylnaphthalene, 2-	ND	ND	µg/kg	NA	0 / 5	4 - 230
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 5	100 - 230
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 5	210 - 230
91-20-3	Naphthalene	9 J	9 J	µg/kg	B31	1 / 5	210 - 230
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 5	400 - 440
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 5	400 - 440
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 5	400 - 440
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 5	210 - 230
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 5	210 - 230
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 5	400 - 440
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 5	210 - 230
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 5	210 - 230
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 5	400 - 440
85-01-8	Phenanthrene	49 J	49 J	µg/kg	B31	1 / 5	210 - 230
108-95-2	Phenol	44 J	64 J	µg/kg	B11	2 / 5	210 - 230
129-00-0	Pyrene	10 J	45 J	µg/kg	B31	2 / 5	210 - 230
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 5	210 - 230
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 5	210 - 230
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 5	210 - 230

TABLE I-5c
SUMMARY OF ANALYTICAL RESULTS - AREAS 5, 6, AND BEACH AREA OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
319-84-6	Alpha-BHC	0.042 J	0.042 J	µg/kg	B31	1 / 5	0.42 - 2.3
5103-71-9	Alpha-Chlordane	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
11097-69-1	Aroclor 1254	17 J	37 J	µg/kg	B11	2 / 5	8.1 - 44
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 5	8.1 - 44
319-85-7	Beta-BHC	0.052 J	0.052 J	µg/kg	B31	1 / 5	0.42 - 2.3
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 5	42 - 230
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
72-55-9	DDE, 4,4'-	1.3 J	1.3 J	µg/kg	B11	1 / 5	0.81 - 4.4
50-29-3	DDT, 4,4'-	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
60-57-1	Dieldrin	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
72-20-8	Endrin	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 5	0.81 - 4.4
53494-70-5	Endrin ketone	0.13 J	0.13 J	µg/kg	B11	1 / 5	0.81 - 4.4
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
5103-74-2	Gamma-Chlordane	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 5	0.42 - 2.3
72-43-5	Methoxychlor	ND	ND	µg/kg	NA	0 / 5	4.2 - 23
	Inorganics						
7429-90-5	Aluminum	672 J	7080 J	mg/kg	B19	13 / 22	20 - 30.4
7440-36-0	Antimony	0.63 J	0.63 J	mg/kg	SED65	1 / 27	1 - 7.9
7440-38-2	Arsenic	0.66 J	12.3 J	mg/kg	B19	11 / 27	1 - 1.3
7440-39-3	Barium	1.4 J	14 J	mg/kg	B24	9 / 27	5 - 26.2
7440-41-7	Beryllium	0.036 J	0.2 J	mg/kg	SED206	10 / 27	0.25 - 0.66
7440-43-9	Cadmium	0.048 J	0.23 J	mg/kg	B51	7 / 27	0.25 - 0.66
7440-70-2	Calcium	179 J	497 J	mg/kg	B31	7 / 22	500 - 760
7440-47-3	Chromium	3.2 J	29 J	mg/kg	B19	12 / 27	1 - 1
18540-29-9	Chromium VI	0.38 J	0.55 J	mg/kg	A5-18	2 / 6	1 - 1.4
7440-48-4	Cobalt	0.029 J	1.5 J	mg/kg	B40	12 / 27	0.64 - 6.6
7440-50-8	Copper	1.1 J	18.5 J	mg/kg	B51	12 / 27	2.5 - 3.3
7439-89-6	Iron	2900 J	27900 J	mg/kg	A1	11 / 22	10 - 15.2
7439-92-1	Lead	7.4 J	29.1 J	mg/kg	B11	9 / 27	1 - 1.3
7439-95-4	Magnesium	151 J	566 J	mg/kg	B30	13 / 22	500 - 760
7439-96-5	Manganese	11.8 J	130 J	mg/kg	SED206	9 / 27	1.5 - 2
7439-97-6	Mercury	0.023 J	0.067 J	mg/kg	A5-19	6 / 23	0.033 - 0.13
7440-02-0	Nickel	0.67 J	7.5 J	mg/kg	B29	12 / 27	4 - 5.2
7440-09-7	Potassium	108 J	399 J	mg/kg	B11	3 / 22	500 - 760
7782-49-2	Selenium	0.11 J	0.7 J	mg/kg	SED65	7 / 27	0.5 - 4.6
7440-22-4	Silver	0.035 J	5.3 J	mg/kg	SED206	7 / 27	0.25 - 1.3
7440-23-5	Sodium	356 J	3420 J	mg/kg	B19	5 / 22	500 - 760
7440-28-0	Thallium	ND	ND	mg/kg	NA	0 / 27	0.5 - 3.3
7440-31-5	Tin	ND	ND	mg/kg	NA	0 / 1	10 - 10
7440-62-2	Vanadium	4 J	45 J	mg/kg	B19	19 / 27	5 - 6.6
7440-66-6	Zinc	17.3 J	49.7 J	mg/kg	B51	9 / 27	6 - 7.9

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-5d
SUMMARY OF ANALYTICAL RESULTS - WETLAND OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	15 J	180 J	µg/kg	A9-81/A9-99	9 / 38	8.5 - 69
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
78-93-3	Butanone, 2-	13 J	40	µg/kg	A9-99	3 / 38	8.5 - 69
75-15-0	Carbon disulfide	6.4	34	µg/kg	A9-75	9 / 38	0.68 - 5.5
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 38	0.43 - 3.5
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 38	85 - 690
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 38	8.5 - 69
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 38	8.5 - 69
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 38	0.85 - 6.9
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
108-88-3	Toluene	31	31	µg/kg	A9-99	1 / 38	4.3 - 35
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 38	0.85 - 6.9
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 38	4.3 - 35
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	3 J	64 J	µg/kg	A9-74	6 / 38	3.8 - 19
208-96-8	Acenaphthylene	3.2 J	110 J	µg/kg	A9-88	18 / 38	3.8 - 19
98-86-2	Acetophenone	55 J	380 J	µg/kg	A9-93	6 / 38	190 - 1000
120-12-7	Anthracene	82 J	95 J	µg/kg	A9-85	2 / 38	97 - 500
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 38	97 - 500
100-52-7	Benzaldehyde	ND	ND	µg/kg	NA	0 / 38	190 - 1000
56-55-3	Benzo(a)anthracene	5.4 J	550 J	µg/kg	A9-85	35 / 38	3.8 - 19
50-32-8	Benzo(a)pyrene	5.9	570 J	µg/kg	A9-85	35 / 38	3.8 - 19

TABLE I-5d
SUMMARY OF ANALYTICAL RESULTS - WETLAND OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	100 J	1000	µg/kg	A9-85	13 / 38	190 - 1000
191-24-2	Benzo(g,h,i)perylene	74 J	480	µg/kg	A9-85	6 / 38	190 - 1000
207-08-9	Benzo(k)fluoranthene	84 J	480	µg/kg	A9-85	7 / 38	190 - 1000
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 38	190 - 1000
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 38	190 - 1000
117-81-7	Bis(2-ethylhexyl)phthalate	98 J	12000	µg/kg	A9-104	10 / 38	190 - 1000
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 38	190 - 1000
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
85-68-7	Butylbenzylphthalate	120 J	240 J	µg/kg	A9-83	3 / 38	190 - 1000
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 38	190 - 1000
86-74-8	Carbazole	73 J	73 J	µg/kg	A9-85	1 / 38	190 - 1000
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 38	97 - 500
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 38	97 - 500
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 38	190 - 1000
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
218-01-9	Chrysene	5.7 J	610 J	µg/kg	A9-85	35 / 38	3.8 - 19
53-70-3	Dibenzo(a,h)anthracene	4 J	76	µg/kg	A9-85	17 / 38	3.8 - 19
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 38	190 - 1000
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 38	97 - 500
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 38	97 - 500
84-66-2	Diethylphthalate	ND	ND	µg/kg	NA	0 / 38	190 - 1000
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 38	97 - 500
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 38	190 - 1000
84-74-2	Di-n-butylphthalate	ND	ND	µg/kg	NA	0 / 38	190 - 1000
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 38	380 - 1900
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 38	97 - 500
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 38	97 - 500
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 38	97 - 500
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 38	190 - 1000
206-44-0	Fluoranthene	72 J	1700	µg/kg	A9-85	16 / 38	190 - 1000
86-73-7	Fluorene	2.5 J	24 J	µg/kg	A9-88	8 / 38	3.8 - 19
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 38	97 - 500
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 38	190 - 1000
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 38	190 - 1000
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 38	190 - 1000
193-39-5	Indeno(1,2,3-cd)pyrene	68 J	430	µg/kg	A9-85	6 / 38	190 - 1000
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 38	190 - 1000
91-57-6	Methylnaphthalene, 2-	4.1 J	45	µg/kg	A9-84	6 / 38	3.8 - 19
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 38	97 - 500
106-44-5	Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
91-20-3	Naphthalene	320 J	320 J	µg/kg	A9-84	1 / 38	190 - 1000
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 38	380 - 1900
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 38	380 - 1900
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 38	380 - 1900
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 38	190 - 1000
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 38	380 - 1900
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 38	380 - 1900
85-01-8	Phenanthrene	51 J	490	µg/kg	A9-85	4 / 38	190 - 1000
108-95-2	Phenol	ND	ND	µg/kg	NA	0 / 38	190 - 1000
129-00-0	Pyrene	60 J	1100	µg/kg	A9-85	16 / 38	190 - 1000
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 38	190 - 1000
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 38	190 - 1000

TABLE I-5d
SUMMARY OF ANALYTICAL RESULTS - WETLAND OF AREA 9 SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
319-84-6	Alpha-BHC	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
5103-71-9	Alpha-Chlordane	0.76 JN	9.2 J	µg/kg	A9-85	2 / 38	0.4 - 1.8
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
11097-69-1	Aroclor 1254	7 J	19	µg/kg	A9-84	2 / 38	7.8 - 34
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 38	7.8 - 34
319-85-7	Beta-BHC	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 38	40 - 180
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
72-55-9	DDE, 4,4'-	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
50-29-3	DDT, 4,4'-	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
60-57-1	Dieldrin	2	2	µg/kg	A9-85	1 / 38	0.78 - 3.4
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
72-20-8	Endrin	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
53494-70-5	Endrin ketone	ND	ND	µg/kg	NA	0 / 38	0.78 - 3.4
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
5103-74-2	Gamma-Chlordane	5.7 JN	5.7 JN	µg/kg	A9-85	1 / 38	0.4 - 1.8
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
1024-57-3	Heptachlor Epoxide	ND	ND	µg/kg	NA	0 / 38	0.4 - 1.8
72-43-5	Methoxychlor	5 J	5 J	µg/kg	A9-106	1 / 38	4 - 18
	Inorganics						
7429-90-5	Aluminum	936	20900	mg/kg	A9-104	40 / 40	19.5 - 78.7
7440-36-0	Antimony	0.72 J	10.9	mg/kg	A9-70	3 / 40	5.9 - 23.6
7440-38-2	Arsenic	3.7	88.9	mg/kg	A9-97	40 / 40	0.98 - 3.9
7440-39-3	Barium	13.5 J	138	mg/kg	A9-104	32 / 40	19.5 - 78.7
7440-41-7	Beryllium	0.19 J	1.5 J	mg/kg	A9-97	24 / 40	0.49 - 2
7440-43-9	Cadmium	0.34 J	3.8	mg/kg	A9-97	20 / 40	0.49 - 2
7440-70-2	Calcium	271 J	7210	mg/kg	A9-97	37 / 40	488 - 1970
7440-47-3	Chromium	8.3	59.7	mg/kg	A9-104	40 / 40	0.98 - 3.9
18540-29-9	Chromium VI	0.8 J	1.8	mg/kg	A9-112	5 / 38	1 - 4.2
7440-48-4	Cobalt	0.15 J	12.7 J	mg/kg	A9-74	18 / 40	4.9 - 19.7
7440-50-8	Copper	3 J	1790	mg/kg	A9-97	40 / 40	2.4 - 9.8
7439-89-6	Iron	9940 J	89700	mg/kg	A9-106	40 / 40	9.8 - 39.4
7439-92-1	Lead	2.9	564	mg/kg	A9-97	40 / 40	0.98 - 3.9
7439-95-4	Magnesium	270 J	6500	mg/kg	A9-104	39 / 40	488 - 1970
7439-96-5	Manganese	16.9	218 J	mg/kg	A9-74	40 / 40	1.5 - 5.9
7439-97-6	Mercury	0.018 J	2.6	mg/kg	A9-90	38 / 38	0.098 - 0.39
7440-02-0	Nickel	1.9 J	61.3	mg/kg	A9-97	39 / 40	3.9 - 15.7
7440-09-7	Potassium	425 J	2390	mg/kg	A9-96	37 / 40	488 - 1970
7782-49-2	Selenium	1.2 J	6.2	mg/kg	A9-75	3 / 40	3.4 - 13.8
7440-22-4	Silver	0.27 J	1.7 J	mg/kg	A9-97	3 / 40	0.98 - 3.9
7440-23-5	Sodium	356 J	12400	mg/kg	A9-90	35 / 40	488 - 1970
7440-28-0	Thallium	2.2 J	2.2 J	mg/kg	A9-75	1 / 40	2.4 - 9.8
7440-31-5	Tin	ND	ND	mg/kg	NA	0 / 2	10 - 10
7440-62-2	Vanadium	10.5	106	mg/kg	A9-104	40 / 40	4.9 - 19.7
7440-66-6	Zinc	11.4	300	mg/kg	A9-104	40 / 40	5.9 - 23.6

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value
JN = tentatively identified value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-5e
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Volatile Organic Compounds						
67-64-1	Acetone	5.9 J	40	µg/kg	A68	3 / 14	8.3 - 21
71-43-2	Benzene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
74-97-5	Bromochloromethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-27-4	Bromodichloromethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-25-2	Bromoform	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
74-83-9	Bromomethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
78-93-3	Butanone, 2-	5.5 J	5.5 J	µg/kg	B31	1 / 14	8.3 - 21
75-15-0	Carbon disulfide	0.47 J	16	µg/kg	A68	4 / 14	0.67 - 11
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
108-90-7	Chlorobenzene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-00-3	Chloroethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
67-66-3	Chloroform	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
74-87-3	Chloromethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
110-82-7	Cyclohexane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
96-12-8	Dibromo-3-chloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
124-48-1	Dibromochloromethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
106-93-4	Dibromoethane, 1,2-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
95-50-1	Dichlorobenzene, 1,2-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
541-73-1	Dichlorobenzene, 1,3-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
106-46-7	Dichlorobenzene, 1,4-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-71-8	Dichlorodifluoromethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-34-3	Dichloroethane, 1,1-	ND	ND	µg/kg	NA	0 / 14	0.42 - 11
107-06-2	Dichloroethane, 1,2-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-35-4	Dichloroethene, 1,1-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
156-59-2	Dichloroethene, 1,2-cis-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
156-60-5	Dichloroethene, 1,2-trans-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
78-87-5	Dichloropropane, 1,2-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
10061-01-5	Dichloropropene, 1,3-cis-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
10061-02-6	Dichloropropene, trans-1,3-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
123-91-1	Dioxane, 1,4-	ND	ND	µg/kg	NA	0 / 14	83 - 210
100-41-4	Ethylbenzene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
591-78-6	Hexanone, 2-	ND	ND	µg/kg	NA	0 / 14	8.3 - 21
98-82-8	Isopropylbenzene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
79-20-9	Methyl Acetate	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
1634-04-4	Methyl tert-Butyl Ether	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
108-10-1	Methyl-2-Pentanone, 4-	ND	ND	µg/kg	NA	0 / 14	8.3 - 21
108-87-2	Methylcyclohexane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-09-2	Methylene chloride	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
100-42-5	Styrene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
79-34-5	Tetrachloroethane, 1,1,2,2-	ND	ND	µg/kg	NA	0 / 14	0.83 - 11
127-18-4	Tetrachloroethene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
108-88-3	Toluene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
76-13-1	Trichloro-1,2,2-trifluoroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
87-61-6	Trichlorobenzene, 1,2,3-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
120-82-1	Trichlorobenzene, 1,2,4-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
71-55-6	Trichloroethane, 1,1,1-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
79-00-5	Trichloroethane, 1,1,2-	ND	ND	µg/kg	NA	0 / 14	0.83 - 11
79-01-6	Trichloroethene	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-69-4	Trichlorofluoromethane	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
75-01-4	Vinyl Chloride	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
179601-23-1	Xylene, m,p-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
95-47-6	Xylene, o-	ND	ND	µg/kg	NA	0 / 14	4.2 - 11
	Semi-volatile Organic Compounds						
83-32-9	Acenaphthene	15	15	µg/kg	A1-13	1 / 14	4 - 260
208-96-8	Acenaphthylene	ND	ND	µg/kg	NA	0 / 14	4 - 260
98-86-2	Acetophenone	16 J	42 J	µg/kg	A60	6 / 14	210 - 260
120-12-7	Anthracene	ND	ND	µg/kg	NA	0 / 14	100 - 260
1912-24-9	Atrazine	ND	ND	µg/kg	NA	0 / 14	100 - 260
100-52-7	Benzaldehyde	33 J	220 J	µg/kg	A5-17	7 / 14	210 - 260
56-55-3	Benzo(a)anthracene	3.4 J	16 J	µg/kg	A61	10 / 14	4 - 260
50-32-8	Benzo(a)pyrene	3.4 J	18 J	µg/kg	B31	7 / 14	4 - 260

TABLE I-5e
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Semi-volatile Organic Compounds (continued)						
205-99-2	Benzo(b)fluoranthene	6.9 J	18 J	µg/kg	B31	4 / 14	210 - 260
191-24-2	Benzo(g,h,i)perylene	7.7 J	11 J	µg/kg	B31	2 / 14	210 - 260
207-08-9	Benzo(k)fluoranthene	7.2 J	8.5 J	µg/kg	B31	2 / 14	210 - 260
92-52-4	Biphenyl, 1,1'-	ND	ND	µg/kg	NA	0 / 14	210 - 260
111-91-1	Bis(2-Chloroethoxy)methane	ND	ND	µg/kg	NA	0 / 14	210 - 260
111-44-4	Bis(2-Chloroethyl)ether	ND	ND	µg/kg	NA	0 / 14	210 - 260
117-81-7	Bis(2-ethylhexyl)phthalate	12 J	99 J	µg/kg	A1-17	7 / 14	210 - 260
108-60-1	Bis-Chloroisopropyl ether	ND	ND	µg/kg	NA	0 / 14	210 - 260
101-55-3	Bromophenyl Phenyl Ether, 4-	ND	ND	µg/kg	NA	0 / 14	210 - 260
85-68-7	Butylbenzylphthalate	ND	ND	µg/kg	NA	0 / 14	210 - 260
105-60-2	Caprolactam	ND	ND	µg/kg	NA	0 / 14	210 - 260
86-74-8	Carbazole	ND	ND	µg/kg	NA	0 / 14	210 - 260
59-50-7	Chloro-3-Methylphenol, 4-	ND	ND	µg/kg	NA	0 / 14	210 - 260
106-47-8	Chloroaniline, 4-	ND	ND	µg/kg	NA	0 / 14	100 - 260
91-58-7	Chloronaphthalene, 2-	ND	ND	µg/kg	NA	0 / 14	210 - 260
95-57-8	Chlorophenol, 2-	ND	ND	µg/kg	NA	0 / 14	100 - 260
58-90-2	Chlorophenols	ND	ND	µg/kg	NA	0 / 14	210 - 260
7005-72-3	Chlorophenyl Phenylether, 4-	ND	ND	µg/kg	NA	0 / 14	210 - 260
218-01-9	Chrysene	4.3 J	17 J	µg/kg	B31	7 / 14	4 - 260
53-70-3	Dibenzo(a,h)anthracene	ND	ND	µg/kg	NA	0 / 14	4 - 260
132-64-9	Dibenzofuran	ND	ND	µg/kg	NA	0 / 14	210 - 260
91-94-1	Dichlorobenzidine, 3,3`-	ND	ND	µg/kg	NA	0 / 14	100 - 260
120-83-2	Dichlorophenol, 2,4-	ND	ND	µg/kg	NA	0 / 14	100 - 260
84-66-2	Diethylphthalate	8.5 J	8.8 J	µg/kg	A60	2 / 14	210 - 260
105-67-9	Dimethylphenol, 2,4-	ND	ND	µg/kg	NA	0 / 14	100 - 260
131-11-3	Dimethylphthalate	ND	ND	µg/kg	NA	0 / 14	210 - 260
84-74-2	Di-n-butylphthalate	8.1 J	12 J	µg/kg	A60	5 / 14	210 - 260
534-52-1	Dinitro-2-Methylphenol, 4,6-	ND	ND	µg/kg	NA	0 / 14	400 - 500
51-28-5	Dinitrophenol, 2,4-	ND	ND	µg/kg	NA	0 / 14	100 - 500
121-14-2	Dinitrotoluene, 2,4-	ND	ND	µg/kg	NA	0 / 14	100 - 260
606-20-2	Dinitrotoluene, 2,6-	ND	ND	µg/kg	NA	0 / 14	100 - 260
117-84-0	Di-N-Octyl Phthalate	ND	ND	µg/kg	NA	0 / 14	210 - 260
206-44-0	Fluoranthene	8.1 J	49 J	µg/kg	B31	5 / 14	210 - 260
86-73-7	Fluorene	8.8	8.8	µg/kg	A1-13	1 / 14	4 - 260
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	NA	0 / 14	100 - 260
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	NA	0 / 14	210 - 260
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	NA	0 / 14	210 - 260
67-72-1	Hexachloroethane	ND	ND	µg/kg	NA	0 / 14	210 - 260
193-39-5	Indeno(1,2,3-cd)pyrene	11 J	11 J	µg/kg	B31	1 / 14	210 - 260
78-59-1	Isophorone	ND	ND	µg/kg	NA	0 / 14	210 - 260
91-57-6	Methylnaphthalene, 2-	9.9	9.9	µg/kg	A1-13	1 / 14	4 - 260
95-48-7	Methylphenol, 2-	ND	ND	µg/kg	NA	0 / 14	100 - 260
106-44-5	Methylphenol, 4-	9.2 J	14 J	µg/kg	A68	2 / 14	210 - 260
91-20-3	Naphthalene	9 J	9.8 J	µg/kg	A60	2 / 14	210 - 260
88-74-4	Nitroaniline, 2-	ND	ND	µg/kg	NA	0 / 14	400 - 500
99-09-2	Nitroaniline, 3-	ND	ND	µg/kg	NA	0 / 14	400 - 500
100-01-6	Nitroaniline, 4-	ND	ND	µg/kg	NA	0 / 14	400 - 500
98-95-3	Nitrobenzene	ND	ND	µg/kg	NA	0 / 14	210 - 260
88-75-5	Nitrophenol, 2-	ND	ND	µg/kg	NA	0 / 14	210 - 260
100-02-7	Nitrophenol, 4-	ND	ND	µg/kg	NA	0 / 14	400 - 500
621-64-7	Nitroso-Di-N-Propylamine, N-	ND	ND	µg/kg	NA	0 / 14	210 - 260
86-30-6	Nitrosodiphenylamine, N-	ND	ND	µg/kg	NA	0 / 14	210 - 260
87-86-5	Pentachlorophenol	ND	ND	µg/kg	NA	0 / 14	400 - 500
85-01-8	Phenanthrene	6.6 J	49 J	µg/kg	B31	5 / 14	210 - 260
108-95-2	Phenol	27 J	110 J	µg/kg	A60	6 / 14	210 - 260
129-00-0	Pyrene	8.7 J	45 J	µg/kg	B31	6 / 14	210 - 260
95-94-3	Tetrachlorobenzene, 1,2,4,5-	ND	ND	µg/kg	NA	0 / 14	210 - 260
95-95-4	Trichlorophenol, 2,4,5-	ND	ND	µg/kg	NA	0 / 14	210 - 260
88-06-2	Trichlorophenol, 2,4,6-	ND	ND	µg/kg	NA	0 / 14	210 - 260

TABLE I-5e
SUMMARY OF ANALYTICAL RESULTS - ALL AREAS (EXCEPT WETLAND AREA OF AREA 9) SEDIMENT
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	PCBs/Pesticides						
309-00-2	Aldrin	ND	ND	µg/kg	NA	0 / 14	0.42 - 2.6
319-84-6	Alpha-BHC	0.042 J	0.042 J	µg/kg	B31	1 / 14	0.42 - 2.6
5103-71-9	Alpha-Chlordane	ND	ND	µg/kg	NA	0 / 14	0.42 - 2.6
12674-11-2	Aroclor 1016	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
11104-28-2	Aroclor 1221	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
11141-16-5	Aroclor 1232	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
53469-21-9	Aroclor 1242	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
12672-29-6	Aroclor 1248	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
11097-69-1	Aroclor 1254	17 J	37 J	µg/kg	B11	2 / 14	8.1 - 50
11096-82-5	Aroclor 1260	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
37324-23-5	Aroclor 1262	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
11100-14-4	Aroclor 1268	ND	ND	µg/kg	NA	0 / 14	8.1 - 50
319-85-7	Beta-BHC	0.052 J	0.052 J	µg/kg	B31	1 / 14	0.42 - 2.6
8001-35-2	Chlorinated Camphene	ND	ND	µg/kg	NA	0 / 14	42 - 260
72-54-8	DDD, 4,4'-	ND	ND	µg/kg	NA	0 / 14	0.81 - 5
72-55-9	DDE, 4,4'-	0.16 J	1.3 J	µg/kg	B11	3 / 14	0.81 - 5
50-29-3	DDT, 4,4'-	0.41 J	0.41 J	µg/kg	A146	1 / 14	0.81 - 5
319-86-8	Delta-BHC	ND	ND	µg/kg	NA	0 / 14	0.42 - 2.6
60-57-1	Dieldrin	ND	ND	µg/kg	NA	0 / 14	0.81 - 5
959-98-8	Endosulfan I	ND	ND	µg/kg	NA	0 / 14	0.42 - 2.6
33213-65-9	Endosulfan II	ND	ND	µg/kg	NA	0 / 14	0.81 - 5
1031-07-8	Endosulfan Sulfate	ND	ND	µg/kg	NA	0 / 14	0.81 - 5
72-20-8	Endrin	ND	ND	µg/kg	NA	0 / 14	0.81 - 5
7421-93-4	Endrin Aldehyde	ND	ND	µg/kg	NA	0 / 14	0.81 - 5
53494-70-5	Endrin ketone	0.054 J	0.13 J	µg/kg	B11	2 / 14	0.81 - 5
58-89-9	Gamma-BHC (Lindane)	ND	ND	µg/kg	NA	0 / 14	0.42 - 2.6
5103-74-2	Gamma-Chlordane	0.23 J	0.23 J	µg/kg	A146	1 / 14	0.42 - 2.6
76-44-8	Heptachlor	ND	ND	µg/kg	NA	0 / 14	0.42 - 2.6
1024-57-3	Heptachlor Epoxide	0.3 J	0.3 J	µg/kg	A61	1 / 14	0.42 - 2.6
72-43-5	Methoxychlor	ND	ND	µg/kg	NA	0 / 14	4.2 - 26
	Inorganics						
7429-90-5	Aluminum	276 J	9950	mg/kg	A68	87 / 96	17.9 - 34.6
7440-36-0	Antimony	0.63 J	3.1	mg/kg	A64	18 / 101	1 - 8.3
7440-38-2	Arsenic	0.66 J	40.2 J	mg/kg	A63	85 / 101	1 - 1.4
7440-39-3	Barium	1.4 J	17.3	mg/kg	A68	44 / 101	5 - 27.8
7440-41-7	Beryllium	0.036 J	0.96	mg/kg	A156	47 / 101	0.25 - 1
7440-43-9	Cadmium	0.048 J	1	mg/kg	A1-12	43 / 101	0.25 - 1
7440-70-2	Calcium	141 J	31200	mg/kg	A1-22	78 / 96	448 - 865
7440-47-3	Chromium	2.5	36.5	mg/kg	A156	86 / 101	1 - 2
18540-29-9	Chromium VI	0.38 J	1 J	mg/kg	A1-17	9 / 31	1 - 1.5
7440-48-4	Cobalt	0.029 J	5.9 J	mg/kg	A68	70 / 101	0.64 - 6.9
7440-50-8	Copper	1.1 J	35 J	mg/kg	A1-14	86 / 101	2 - 3.5
7439-89-6	Iron	2000	36800 J	mg/kg	A101	85 / 96	9 - 17.3
7439-92-1	Lead	7.4	52.9	mg/kg	A64	83 / 101	1 - 1.4
7439-95-4	Magnesium	151 J	4910	mg/kg	A68	84 / 96	448 - 865
7439-96-5	Manganese	11.8 J	219	mg/kg	A68	83 / 101	1 - 2.1
7439-97-6	Mercury	0.023 J	0.38	mg/kg	A1-14	78 / 97	0.033 - 0.14
7440-02-0	Nickel	0.67 J	14.9	mg/kg	A68	74 / 101	1 - 5.6
7440-09-7	Potassium	108 J	2390	mg/kg	A68	27 / 96	448 - 865
7782-49-2	Selenium	0.094 J	7	mg/kg	A1-12	48 / 101	0.5 - 5
7440-22-4	Silver	0.035 J	5.3 J	mg/kg	SED206	13 / 101	0.25 - 1.4
7440-23-5	Sodium	356 J	6430 J	mg/kg	A68	79 / 96	448 - 865
7440-28-0	Thallium	0.61 J	2.4 J	mg/kg	A1-12	5 / 101	0.5 - 3.5
7440-31-5	Tin	ND	ND	mg/kg	NA	0 / 1	10 - 10
7440-62-2	Vanadium	4 J	66.3	mg/kg	A65	93 / 101	1 - 6.9
7440-66-6	Zinc	13.4	100 J	mg/kg	A64	83 / 101	2 - 8.3

NA = not available
ND = not detected
µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram

J = estimated value

BHC = benzene hexachloride
DDD = p,p'-dichlorodiphenyldichloroethane
DDE = p,p'-dichlorodiphenyldichloroethylene
DDT = p,p'-dichlorodiphenyltrichloroethane

TABLE I-6a
SUMMARY OF ANALYTICAL RESULTS - FISH
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Inorganics						
7429-90-5	Aluminum	0.54 J	0.54 J	mg/kg wet wt.	FT-1	1 / 6	3.2 - 5
7440-36-0	Antimony	ND	ND	mg/kg wet wt.	NA	0 / 6	0.97 - 1.5
7440-38-2	Arsenic	0.079 J	0.68	mg/kg wet wt.	FT-1	6 / 6	0.16 - 0.25
7440-39-3	Barium	ND	ND	mg/kg wet wt.	NA	0 / 6	3.2 - 5
7440-41-7	Beryllium	ND	ND	mg/kg wet wt.	NA	0 / 6	0.081 - 0.13
7440-43-9	Cadmium	ND	ND	mg/kg wet wt.	NA	0 / 6	0.081 - 0.13
7440-70-2	Calcium	8.9 J	240	mg/kg wet wt.	FT-3	6 / 6	81 - 130
7440-47-3	Chromium	0.032 J	0.042 J	mg/kg wet wt.	FT-3	5 / 6	0.16 - 0.25
7440-48-4	Cobalt	ND	ND	mg/kg wet wt.	NA	0 / 6	0.81 - 1.3
7440-50-8	Copper	ND	ND	mg/kg wet wt.	NA	0 / 6	0.41 - 0.63
7439-89-6	Iron	ND	ND	mg/kg wet wt.	NA	0 / 6	1.6 - 2.5
7439-92-1	Lead	0.038 J	0.046 J	mg/kg wet wt.	FT-1	2 / 6	0.16 - 0.25
7439-95-4	Magnesium	ND	ND	mg/kg wet wt.	NA	0 / 6	81 - 130
7439-96-5	Manganese	0.35	0.35	mg/kg wet wt.	FT-4	1 / 6	0.24 - 0.38
7439-97-6	Mercury	0.0046 J	0.053	mg/kg wet wt.	FT-5	6 / 6	0.016 - 0.025
7440-02-0	Nickel	ND	ND	mg/kg wet wt.	NA	0 / 6	0.65 - 1
7440-09-7	Potassium	ND	ND	mg/kg wet wt.	NA	0 / 6	81 - 130
7782-49-2	Selenium	ND	ND	mg/kg wet wt.	NA	0 / 6	0.57 - 0.88
7440-22-4	Silver	ND	ND	mg/kg wet wt.	NA	0 / 6	0.16 - 0.25
7440-23-5	Sodium	15 J	170	mg/kg wet wt.	FT-3	6 / 6	81 - 130
7440-28-0	Thallium	ND	ND	mg/kg wet wt.	NA	0 / 6	0.41 - 0.63
7440-62-2	Vanadium	ND	ND	mg/kg wet wt.	NA	0 / 6	0.81 - 1.3
7440-66-6	Zinc	1.5	1.7	mg/kg wet wt.	FT-1	3 / 6	0.97 - 1.5

NA = not available
J = estimated value
ND = not detected
mg/kg wet wt. = milligrams per kilogram wet weight

TABLE I-6b
SUMMARY OF ANALYTICAL RESULTS - HARD CLAM
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Inorganics						
7429-90-5	Aluminum	1.5 J	1.8 J	mg/kg wet wt.	ML-2A	2 / 5	3.3 - 5.8
7440-36-0	Antimony	ND	ND	mg/kg wet wt.	NA	0 / 5	0.016 - 1
7440-38-2	Arsenic	0.18	1.6	mg/kg wet wt.	MER-3	4 / 5	0.083 - 0.17
7440-39-3	Barium	0.11 J+	0.11 J+	mg/kg wet wt.	MER-1	3 / 5	0.016 - 3.3
7440-41-7	Beryllium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.016 - 0.083
7440-43-9	Cadmium	0.14	0.17	mg/kg wet wt.	MER-2	3 / 5	0.016 - 0.083
7440-70-2	Calcium	290 J	530 J	mg/kg wet wt.	ML-2A	2 / 2	83 - 83
7440-47-3	Chromium	0.19	0.31	mg/kg wet wt.	MER-1	3 / 5	0.05 - 0.17
7440-48-4	Cobalt	0.056	0.13	mg/kg wet wt.	MER-3	3 / 5	0.016 - 0.83
7440-50-8	Copper	0.52	2.4	mg/kg wet wt.	MER-1	5 / 5	0.016 - 0.42
7439-89-6	Iron	13 J	15 J	mg/kg wet wt.	ML-2A	2 / 2	1.7 - 1.7
7439-92-1	Lead	0.29	3.8	mg/kg wet wt.	ML-2A	5 / 5	0.016 - 0.17
7439-95-4	Magnesium	91 J	100 J	mg/kg wet wt.	ML-1A	2 / 2	83 - 83
7439-96-5	Manganese	8.8	34	mg/kg wet wt.	MER-2	5 / 5	0.016 - 0.25
7439-97-6	Mercury	ND	ND	mg/kg wet wt.	NA	0 / 2	0.017 - 0.017
7440-02-0	Nickel	0.16 J+	0.26 J+	mg/kg wet wt.	MER-3	3 / 5	0.016 - 0.67
7440-09-7	Potassium	330 J	380 J	mg/kg wet wt.	ML-2A	2 / 2	83 - 83
7782-49-2	Selenium	0.16	0.22	mg/kg wet wt.	MER-2	3 / 5	0.083 - 0.58
7440-22-4	Silver	0.032	0.34	mg/kg wet wt.	MER-3	3 / 5	0.016 - 0.17
7440-23-5	Sodium	530 J	650 J	mg/kg wet wt.	ML-1A	2 / 2	83 - 83
7440-28-0	Thallium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.034 - 0.42
7440-31-5	Tin	ND	ND	mg/kg wet wt.	NA	0 / 3	1.6 - 1.9
7440-62-2	Vanadium	0.088	0.088	mg/kg wet wt.	MER-3	1 / 5	0.083 - 0.83
7440-66-6	Zinc	4.6	19	mg/kg wet wt.	MER-3	5 / 5	0.16 - 1

NA = not available
ND = not detected
mg/kg wet wt. = milligrams per kilogram wet weight
J = estimated value
J+=estimated value, biased high

TABLE I-6c
SUMMARY OF ANALYTICAL RESULTS - RIBBED MUSSEL
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Inorganics						
7429-90-5	Aluminum	0.89 J	6.2 J	mg/kg wet wt.	RM-3	5 / 10	2 - 5.8
7440-36-0	Antimony	0.022	0.03	mg/kg wet wt.	RM-3	3 / 10	0.018 - 0.59
7440-38-2	Arsenic	0.66	0.89	mg/kg wet wt.	RM-6	6 / 10	0.09 - 0.1
7440-39-3	Barium	0.041 J+	0.06 J+	mg/kg wet wt.	RM-3	6 / 10	0.018 - 2
7440-41-7	Beryllium	ND	ND	mg/kg wet wt.	NA	0 / 10	0.018 - 0.049
7440-43-9	Cadmium	0.038	0.085	mg/kg wet wt.	RM-2	6 / 10	0.018 - 0.049
7440-70-2	Calcium	23 J	38 J	mg/kg wet wt.	ML-3A	4 / 4	49 - 49
7440-47-3	Chromium	0.13	0.23	mg/kg wet wt.	RM-3	6 / 10	0.055 - 0.098
7440-48-4	Cobalt	0.024	0.029	mg/kg wet wt.	RM-3	6 / 10	0.018 - 0.49
7440-50-8	Copper	0.16 J	1.4 J+	mg/kg wet wt.	RM-2	10 / 10	0.018 - 0.24
7439-89-6	Iron	3.3 J	4.2 J	mg/kg wet wt.	ML-3A	4 / 4	0.98 - 0.98
7439-92-1	Lead	0.14	0.81	mg/kg wet wt.	RM-6	10 / 10	0.018 - 0.098
7439-95-4	Magnesium	37 J	40 J	mg/kg wet wt.	ML-4A	4 / 4	49 - 49
7439-96-5	Manganese	0.27 J	0.67 J+	mg/kg wet wt.	RM-6	10 / 10	0.018 - 0.15
7439-97-6	Mercury	ND	ND	mg/kg wet wt.	NA	0 / 4	0.0098 - 0.0098
7440-02-0	Nickel	0.045 J+	0.074 J+	mg/kg wet wt.	RM-3	6 / 10	0.018 - 0.39
7440-09-7	Potassium	130 J	140 J	mg/kg wet wt.	ML-4A	4 / 4	49 - 49
7782-49-2	Selenium	0.18	0.25	mg/kg wet wt.	RM-5	6 / 10	0.09 - 0.34
7440-22-4	Silver	0.036	0.066	mg/kg wet wt.	RM-1	6 / 10	0.018 - 0.098
7440-23-5	Sodium	250 J	270 J	mg/kg wet wt.	ML-4A	4 / 4	49 - 49
7440-28-0	Thallium	ND	ND	mg/kg wet wt.	NA	0 / 10	0.036 - 0.24
7440-31-5	Tin	ND	ND	mg/kg wet wt.	NA	0 / 6	1.8 - 2
7440-62-2	Vanadium	0.1	0.16	mg/kg wet wt.	RM-2	3 / 10	0.09 - 0.49
7440-66-6	Zinc	0.88	5.8	mg/kg wet wt.	RM-2	10 / 10	0.18 - 0.59

NA = not available
ND = not detected
mg/kg wet wt. = milligrams per kilogram wet weight

J = estimated value
J+=estimated value, biased high

TABLE I-6d
SUMMARY OF ANALYTICAL RESULTS - BLUE CRAB (MUSCLE)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Inorganics						
7429-90-5	Aluminum	2.9	6.3	mg/kg wet wt.	BC-1	5 / 5	2.7 - 3.7
7440-36-0	Antimony	ND	ND	mg/kg wet wt.	NA	0 / 5	0.8 - 1.1
7440-38-2	Arsenic	0.13 J	0.28	mg/kg wet wt.	BC-5	5 / 5	0.13 - 0.19
7440-39-3	Barium	ND	ND	mg/kg wet wt.	NA	0 / 5	2.7 - 3.7
7440-41-7	Beryllium	0.0046 J	0.0046 J	mg/kg wet wt.	BC-3	1 / 5	0.067 - 0.094
7440-43-9	Cadmium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.067 - 0.094
7440-70-2	Calcium	160	380 J	mg/kg wet wt.	BC-1	5 / 5	67 - 94
7440-47-3	Chromium	0.03 J	0.039 J	mg/kg wet wt.	BC-2	3 / 5	0.13 - 0.19
7440-48-4	Cobalt	ND	ND	mg/kg wet wt.	NA	0 / 5	0.67 - 0.94
7440-50-8	Copper	1.9	4	mg/kg wet wt.	BC-4	5 / 5	0.34 - 0.47
7439-89-6	Iron	10	21 J	mg/kg wet wt.	BC-1	5 / 5	1.3 - 1.9
7439-92-1	Lead	0.039 J	0.2	mg/kg wet wt.	BC-1	4 / 5	0.13 - 0.19
7439-95-4	Magnesium	76 J	89	mg/kg wet wt.	BC-4	3 / 5	67 - 94
7439-96-5	Manganese	0.51	1.9	mg/kg wet wt.	BC-2	5 / 5	0.2 - 0.28
7439-97-6	Mercury	0.0056	0.011	mg/kg wet wt.	BC-5	4 / 5	0.013 - 0.019
7440-02-0	Nickel	0.043 J	0.043 J	mg/kg wet wt.	BC-3	1 / 5	0.54 - 0.75
7440-09-7	Potassium	430 J	430 J	mg/kg wet wt.	BC-1	1 / 5	67 - 94
7782-49-2	Selenium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.47 - 0.65
7440-22-4	Silver	0.063 J	0.1 J	mg/kg wet wt.	BC-2	5 / 5	0.13 - 0.19
7440-23-5	Sodium	490	690	mg/kg wet wt.	BC-4	5 / 5	67 - 94
7440-28-0	Thallium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.34 - 0.47
7440-62-2	Vanadium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.67 - 0.94
7440-66-6	Zinc	2.4	7	mg/kg wet wt.	BC-5	5 / 5	0.8 - 1.1

NA = not available
J = estimated value
ND = not detected
mg/kg wet wt. = milligrams per kilogram wet weight

TABLE I-6e
SUMMARY OF ANALYTICAL RESULTS - BLUE CRAB (HEPATOPANCREAS)
Raritan Bay Slag Superfund Site
Old Bridge/Sayreville, New Jersey

CAS No.	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Unit	Location of Maximum Concentration	Detection Frequency	Range of Reporting Limit
	Inorganics						
7429-90-5	Aluminum	0.68 J	2 J	mg/kg wet wt.	BC-5	5 / 5	3.4 - 4.8
7440-36-0	Antimony	ND	ND	mg/kg wet wt.	NA	0 / 5	1 - 1.4
7440-38-2	Arsenic	0.29	0.72	mg/kg wet wt.	BC-4	5 / 5	0.17 - 0.24
7440-39-3	Barium	ND	ND	mg/kg wet wt.	NA	0 / 5	3.4 - 4.8
7440-41-7	Beryllium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.085 - 0.12
7440-43-9	Cadmium	0.13	0.53	mg/kg wet wt.	BC-5	4 / 5	0.085 - 0.12
7440-70-2	Calcium	510	1500	mg/kg wet wt.	BC-5	5 / 5	85 - 120
7440-47-3	Chromium	0.034 J	0.079 J	mg/kg wet wt.	BC-5	4 / 5	0.17 - 0.24
7440-48-4	Cobalt	0.009 J	0.021 J	mg/kg wet wt.	BC-4	3 / 5	0.85 - 1.2
7440-50-8	Copper	11	26	mg/kg wet wt.	BC-5	5 / 5	0.42 - 0.6
7439-89-6	Iron	4.1	6.6 J	mg/kg wet wt.	BC-1	5 / 5	1.7 - 2.4
7439-92-1	Lead	0.1 J	0.1 J	mg/kg wet wt.	BC-1	1 / 5	0.17 - 0.24
7439-95-4	Magnesium	88	170	mg/kg wet wt.	BC-4	5 / 5	85 - 120
7439-96-5	Manganese	0.35	1.3	mg/kg wet wt.	BC-5	5 / 5	0.25 - 0.36
7439-97-6	Mercury	0.0016 J	0.012	mg/kg wet wt.	BC-5	4 / 5	0.017 - 0.024
7440-02-0	Nickel	0.041 J	0.041 J	mg/kg wet wt.	BC-4	1 / 5	0.68 - 0.96
7440-09-7	Potassium	330 J	330 J	mg/kg wet wt.	BC-1	1 / 5	85 - 120
7782-49-2	Selenium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.59 - 0.84
7440-22-4	Silver	0.36	1	mg/kg wet wt.	BC-5	5 / 5	0.17 - 0.24
7440-23-5	Sodium	870	1100	mg/kg wet wt.	BC-4	5 / 5	85 - 120
7440-28-0	Thallium	ND	ND	mg/kg wet wt.	NA	0 / 5	0.42 - 0.6
7440-62-2	Vanadium	0.048 J	0.048 J	mg/kg wet wt.	BC-5	1 / 5	0.85 - 1.2
7440-66-6	Zinc	5.3	8.3	mg/kg wet wt.	BC-5	5 / 5	1 - 1.4

NA = not available
J = estimated value
ND = not detected
mg/kg wet wt. = milligrams per kilogram wet weight