Revised Final
Remedial Investigation Report for
RVAAP-34 Sand Creek Disposal Road Landfill

Former Ravenna Army Ammunition Plant
Portage and Trumbull Counties, Ohio

November 29, 2016

Project No. 118064-RVAAP-34

Revised and Updated by:
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14. ABSTRACT

The purpose of this Draft Remedial Investigation Study is to define the nature and extent of chemical contamination, identify chemicals of potential concern (COPCs), and evaluate potential risks to human health and the environment.

15. SUBJECT TERMS

RI, remedial investigation, site characterization, nature and extent of contamination, risk assessment, Sand Creek Disposal Road Landfill, Sand Creek AOC, RVAAP-34.

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March 23, 2017

Mr. Mark Leeper
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Re: US Army Ammunition Plt RVAAP
Remediation Response
Project Records
Remedial Response
Portage County
267000859038

Subject: **Ravenna Army Ammunition Plant, Portage/Trumbull Counties. Approval of the "Revised Final Remedial Investigation Report for RVAAP-34 Sand Creek Disposal Road Landfill" at the Ravenna Army Ammunition Plant, Ravenna, Ohio, Dated November 29, 2016, Ohio EPA ID # 267-000859-038**

Dear Mr. Leeper:

The Ohio Environmental Protection Agency (Ohio EPA) has received the "Revised Final Remedial Investigation Report for RVAAP-34 Sand Creek Disposal Road Landfill" at the Ravenna Army Ammunition Plant, Ravenna, Ohio, dated November 29, 2016 and received February 28, 2017. Replacement pages were submitted based on a comment letter from Ohio EPA dated January 19, 2017. The report was prepared for the Army National Guard Directorate by The U.S. Army Corps of Engineers and Shaw Environmental and Infrastructure under project number 118064-RVAAP-34.

This document was reviewed by personnel from Ohio EPA's DERR, pursuant to the Director's Findings and Orders paragraph 39 (b), Ohio EPA considers the document final and approved.

RECEIVED
04 Apr 2017

If you have any questions, please call me at (330) 963-1292.

Sincerely,

Kevin M. Palombo
Environmental Specialist
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KP/nvr

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STATEMENT OF INDEPENDENT TECHNICAL REVIEW*

The United States Army Corps of Engineers, Louisville District (USACE) has updated and finalized this *Final Draft Remedial Investigation Report for RVAAP-34 Sand Creek Disposal Road Landfill* from the Draft Report originally completed by Shaw Environmental & Infrastructure, Inc. February 2013. Notice is hereby given that an independent technical review (ITR) has been conducted that is appropriate to the level of risk and complexity inherent in this project. During the independent technical review, compliance with established policy principals and procedures, utilizing justified and valid assumptions was verified. This included review of data quality objectives; technical assumptions, methods, procedures, and materials used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with the law and existing United States Army Corps of Engineers policy.

The Contractors that prepared the 2013 February Draft included a signed Independent Technical Review (ITR) with signatures. Since the United States Army Corps of Engineers, Louisville District (USACE) revised and updated the document, the Contractor did not review revisions or updates made by USACE; therefore, their 2013 February ITR has been removed from this Final document.

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RVAAP-34 Sand Creek Disposal Road Landfill

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ARNG—Army National Guard
DERR—Division of Environmental Response and Revitalization
NEDO—Northeast District Office
ILE—Installation, Logistics, and Environment
OHARNG—Ohio Army National Guard
RVAAP—Former Ravenna Army Ammunition Plant
VSC—Vista Sciences Corporation

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Acronyms and Abbreviations

µg/L	micrograms per liter
°F	degrees Fahrenheit
ACM	asbestos-containing material
ADD	average daily dose
AMEC	AMEC Earth and Environmental, Inc.
amsl	above mean sea level
AOC	Area of Concern
atm-m^3/mol	cubic meters of atmosphere per molecule
AUF	area use factor
BAF	bioaccumulation factor
BCF	bioconcentration factor
bgs	below ground surface
BSV	background screening value
CRJMTC	Camp Ravenna Joint Military Training Center
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental, Compensation, and Liability Act
C&D	construction and debris
CMCOPC	contaminant migration chemical of potential concern
COC	chemical of concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSM	conceptual site model
d_a	aquifer thickness
DAF	dilution attenuation factor
DGM	digital geophysical mapping
DOD	U.S. Department of Defense
DQO	data quality objective
DPT	direct-push technology
EcoSSL	ecological soil screening level
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ESA	Endangered Species Act
ESL	ecological screening level
ESV	ecological screening value
ET	evapotranspiration
EU	exposure unit
f_{oc}	organic carbon fraction of soil
FS	feasibility study
FWSAP	Facility-Wide Sampling and Analysis Plan
ft/yr	feet per year
FWBWQS	Facility-Wide Biological and Water Quality Study

Acronyms and Abbreviations (continued)

FWCUG	facility-wide cleanup goal
gpd/ft	gallons per day per foot
GPS	global positioning system
GSSL	generic soil screening level
HELP	Hydrologic Evaluation of Landfill Performance
HI	hazard index
HHRA	human health risk assessment
HHRAM	Human Health Risk Assessment Manual
HLC	Henry's Law Constant
HQ	hazard quotient
i	hydraulic gradient
IAEA	International Atomic Energy Agency
ID	identification
IRP	Installation Restoration Program
ISM	incremental sampling method
K_d	soil-water partition coefficient for inorganic chemicals
K_{oc}	soil-water partition coefficient for organic compounds
K_{ow}	log octanol-water partition coefficient
kg	kilogram
LANL	Los Alamos National Laboratory
LCG	Louisville Chemistry Guideline
LCS	laboratory control sample
LOAEL	lowest observed adverse effect level
m	meters
m/yr	meters per year
MCL	maximum contaminant level
MD	munitions debris
MDC	maximum detected concentration
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MKM	MKM Engineers, Inc.
mm	millimeter
MS	matrix spike
MSD	matrix spike duplicate
NGB	National Guard Bureau
NOAEL	no observed adverse effect level
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
ORNL	Oak Ridge National Laboratory
OWQS	Ohio Water Quality Standards

Acronyms and Abbreviations (continued)

PA	preliminary assessment
PAH	polynuclear aromatic hydrocarbon
PBT	persistent, bioaccumulative, and toxic
PCB	polychlorinated biphenyl
PID	photoionization detector
PRG	preliminary remediation goal
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
R_f	Retardation Factor
RA	removal action
RD	remedial design
RI	remedial investigation
ROD	record of decision
RME	reasonable maximum exposure
RSL	regional screening level
RRSE	relative risk site evaluation
RVAAP	Former Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SESOIL	seasonal soil compartment
Shaw	Shaw Environmental & Infrastructure, Inc.
SLERA	screening level ecological risk assessment
SMDP	scientific management decision point
SOP	standard operating procedure
SRC	site-related chemical
SSSL	site-specific soil screening level
SUXOS	Senior Unexploded Ordnance Supervisor
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TEC	threshold effect concentration
TRV	toxicity reference value
TUF	temporal use factor
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion & Preventative Medicine
USAEC	U.S. Army Environmental Command
VOC	volatile organic compound
WQC	Water Quality Criteria

EXECUTIVE SUMMARY

This *Remedial Investigation (RI) Report* was completed to document the results of the field activities performed for Area of Concern (AOC) RVAAP-34 Sand Creek Disposal Road Landfill (herein, referred to as the "Sand Creek Site"). The Sand Creek Site is located at the former Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. This work was completed in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). This RI Report was originally prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) a CB&I company, under Delivery Order 0002 for Architectural/Engineering Environmental Services at the former RVAAP under the *Indefinite Delivery/Indefinite Quantity Contract No. W912QR-08-D-0013*. The Delivery Order was issued by the United States (U.S.) Army Corps of Engineers (USACE), Louisville District on September 22, 2008.

Work described herein was conducted under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). Due to delays in the overall cleanup program at the former RVAAP that were unrelated to Shaw's performance, Shaw could not complete this document before the Contract ended and the document was left as a Draft. Therefore, USACE has revised and completed this document. Revisions to the human health risk assessment was necessary before the Army could re-issue this RI. The human health risk assessment that was originally completed in the RI by Shaw, did not include the modifications to the human health risk assessment as required in the *"Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (Risk Assessment Technical Memo) (RVAAP Installation Restoration Program, Portage/Trumbull Counties, Ohio* (Army National Guard Directorate, 2014)." Because the human health risk assessment was the only portion that needed updated in the RI, the primary work for this RI is unchanged. For example, no new samples were taken by the USACE. No new laboratory analysises were completed by USACE.

The human health risk assessment Section of this RI was fully updated and revised by USACE. Certain information depicted on figures and contained in this RI may not reflect current conditions since this document was originally completed in 2013. Species lists and other natural resources were updated in the 2014 Integrated Natural Resource Management Plan (INRMP). Please refer to this document for a current species list. However, additions and changes to the current species list do not affect the results and findings of this RI. Future documents such as the Proposed Plan (PP), will be updated as necessary. None of these updates or modifications such updated species lists alter the findings and recommendations presented in this RI.

This document summarizes the results of the RI field activities conducted at the Sand Creek Site between September and November 2010. Data from previous studies were also considered in this RI Report that included the following:

- Surface soil, sediment, and surface water samples collected during a removal action (RA) and sampling investigation documented in the *Remedial Design/Removal Action Plan for RVAAP-34 Sand Creek Disposal Road Landfill* (MKM Engineers, Inc. [MKM], 2004) (hereafter referred to as the Remedial Design [RD]/RA Report).
- A sediment sample and surface water samples collected adjacent to the site during a facility-wide investigation of surface water and sediment conditions at the former RVAAP and documented in the 2003 Facility-Wide Biological and Water Quality Study (FWBWQS) (USACE, 2005a).

Results from the subsurface digital geophysical mapping (DGM) survey performed at the site and documented in the *Final Digital Geophysical Mapping Report for the RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site* (Shaw, 2011). The scope of this investigation is to complete the assessment of the extent of contamination and the potential impact to human health and the environment for the purpose of reaching a remedial action decision. The primary objectives of the RI are as follows:

- To conduct surface and subsurface soil and sediment sampling to define the nature and extent of contamination to support the preparation of a feasibility study (FS) at the Sand Creek Site
- To collect data to support a Record of Decision at the Sand Creek Site

ES.1 AOC Description

The Sand Creek Disposal Road Landfill is in the eastern portion of the former RVAAP and is a former open dump area. The operational history of disposal activities at the site is incomplete. Construction and debris type material were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek. The dump site extended along the embankment for approximately 1,200 feet and varied in width from 20 to 40 feet from the top of the bank to the bottom. The size of the defined AOC is approximately 1 acre. The bank slopes from east to west towards Sand Creek at 40 to 60 degrees from the horizontal. There are no records indicating the quantities or materials dumped at the site and the dates of operation for the landfill are unknown.

ES.2 Summary of Previous Investigations

Prior to the RI activities, previous investigations and other activities conducted at the Sand Creek Site included a 1996 preliminary assessment, a 2003 removal action (RA) with confirmatory sampling, and a 2010 digital geophysical mapping (DGM) survey. A facility-wide biological and water quality study (FWBWQS) was conducted for surface water and sediment adjacent to the site in 2003.

The evaluation of confirmatory data collected for the 2003 RA was performed as part of the *Final Data Quality Objectives (DQO) Report for the former RVAAP-34 Sand Creek Disposal Road Landfill* (Shaw, 2009) to identify any data gaps that needed to be addressed during the RI. Samples collected during the 2003 RA included surface soil, sediment, and surface water samples. The historical surface soil and sediment samples were collected using discrete sampling methods. The confirmatory soil samples showed elevated concentrations (i.e., greater than the RVAAP background concentrations and/or the U.S. Environmental Protection Agency [EPA] Preliminary Remediation Goals [PRGs]) of heavy metals in the northern third of the site with lower concentrations of heavy metals, semivolatile organic compounds (SVOCs), explosives, and propellants dispersed over the remainder of the site. The confirmation sediment samples collected from the neighboring floodplain and Sand Creek reported arsenic levels greater than the EPA PRG level. No analytes exceeded the background concentrations or the PRGs in the surface water samples collected from the Sand Creek located adjacent to the AOC (MKM, Engineers, Inc., 2004).

During the 2003 FWBWQS, the USACE performed surface water and sediment sampling and biological monitoring at 26 stream sites at the former RVAAP that included a location adjacent to the Sand Creek Site. The samples included two surface water samples that were collected at the intersection of the Sand Creek and the former railroad that transects the site. The surface water samples were collected at separate times of the year. A sediment sample was collected at the same time as the initial surface water sample using the incremental sampling method (ISM) along a reach of Sand Creek; however, the exact location where the sediment sample was collected is not known. The results of this survey are used in this RI to evaluate potential contaminant migration from the site to sediment and surface water adjacent to the AOC. In addition, the surface water results are further used in this RI to assess potential impacts to human health and the environment. Inorganics were detected in the sediment sample that exceeded the RVAAP background value of zero. Concentrations of arsenic, chromium, cobalt, silver, and vanadium were detected in surface water above the background concentrations. All other detected metals in surface water were either essential nutrients or the maximum concentration was less than the RVAAP surface water background values. Low concentrations of SVOCs and nutrient parameters were also detected in both the sediment and the surface water samples (USACE, 2005a).

The 2010 DGM survey was performed at the Sand Creek by Shaw to determine the broader limits of metallic waste materials as well as to define more localized regions within and outside the AOC footprint that contain relatively higher metal content. The DGM data indicated that the largest portion of the metal debris at the site is present northeast of the former railroad bed. Several areas characterized by relatively higher density of anomalies are located between the stream and the edge of the eastern plateau. Areas characterized by relatively lower density of anomalies are present throughout the southern portion of the survey area.

ES.3 Summary of Remedial Investigation Activities

The RI field activities conducted at the Sand Creek Site between September 21 and November 9, 2010, included the collection of surface soil and sediment samples using the ISM and subsurface soil samples using a modified version of the ISM. Sampling locations for these activities were based on data gaps identified in the DQO Report (Shaw, 2009). Surface water samples were not collected during the RI based on the recommendations made in the DQO Report. Groundwater sampling is performed on a facility-wide basis and was not included in Shaw's scope of work for the RI at the Sand Creek Site. Based on the data gaps and need for additional information regarding contaminants identified during the previous investigations at the AOC, the following samples were collected for the RI:

- 18 ISM surface soil samples from 0 to 1 foot below ground surface (bgs) from along the AOC source area slopes and upgradient locations at the top of slope where historical dumping activities occurred
- 2 ISM sediment samples from 0 to 0.5 foot bgs along the floodplain downgradient of the AOC source area slopes and adjacent to the Sand Creek
- 58 modified ISM subsurface soil samples using direct-push technology (DPT) and manual hand augers (The DPT samples were collected at the top of slope upgradient of the AOC source areas at the following intervals: 1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet. The hand-auger samples were collected at the 1- to 5-foot sample intervals along the sloped areas of the AOC where DPT sampling could not be performed.)

ES.4 Summary of Nature and Extent of Contamination

Available data were evaluated to identify site-related chemicals (SRCs) at the Sand Creek Site in accordance with the evaluation process presented in the *Final Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (Science Applications International Corporation [SAIC], 2010), hereafter, referred to as the Facility-Wide Cleanup Goal (FWCUG) Report. Much of the SRCs identified in the environmental media evaluated for nature and extent of contamination (surface soil, subsurface soil, sediment, and surface water)

occurred at the northern portion of the AOC. Between the 2003 RA and RI data, a total of 58 SRCs was identified in surface soil (0 to 1 foot). Subsurface soils were collected during the RI only, and a total of 64 SRCs was identified in the five sample intervals between 1 and 20 feet bgs. A total of 50 SRCs were identified in sediment between the 2003 RA (0 to 1 foot), the 2003 FWBWQS (0 to 0.5 foot), and the RI data sets (0 to 0.5 foot). Eleven SRCs consisting of inorganics, SVOCs, and two nutrient parameters were identified in surface water between the two samples collected for the 2003 FWBWQS. The spatial distribution of the SRCs, particularly inorganics, is consistent among the environmental media and the types of methods used to collect the samples (i.e., discrete vs. ISM).

- In surface soils collected during the RI, the greatest concentrations of inorganic, SVOCs, and explosives and propellants SRCs occurred at the northern portion of the AOC where historical disposal activities occurred and where much of the RA was conducted in 2003. Explosives were detected at two locations at the northern portion of the AOC. The detections of inorganics and SVOCs were well distributed across the site. However, the greatest concentrations also occurred in the northern portion of the site. The number of detected inorganics and SVOCs and elevated concentrations generally decreased the further south the samples were collected at the AOC.
- A total of 22 soil borings was advanced during the RI field activities. Bedrock was not encountered at any of the borings which were advanced to a maximum depth of 20 feet bgs. Three explosives concentrations were detected at one soil boring location at 1 to 5 feet bgs along the slope at the northern portion of the AOC. The spatial distribution of inorganics and SVOCs was like that observed in surface soil samples with the greatest concentrations detected along and adjacent to the slope at the northern portion of the AOC. The greatest number of detects and the greatest concentrations for both inorganics and SVOCs were typically found in the 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet sample intervals. However, the number of detections and concentrations generally decreased with the sample distance to the south at the AOC and with boring depth. Concentrations of volatile organic compounds, pesticides, and polychlorinated biphenyls that were detected were at two boring locations at the northern portion of the AOC at the 1- to 5-foot sample intervals.
- Like the surface soils, the greatest concentrations of SRCs in the two ISM sediment samples collected for the RI occurred at the northern portion of the AOC. The SRCs included primarily inorganics, SVOCs, and pesticides. Two polychlorinated biphenyl analytes were detected in the northern floodplain sediment sampling unit. One explosive/propellant (nitroguanidine) was detected in both sediment sampling

units. Many the SRCs identified in sediment during the 2003 RA were detected north of the former rail bed and correlate with the results from the RI. The exact location of the 2003 FWBWQS sediment sample collected using ISM is not known; therefore, a distribution comparison to the sediment samples from the other investigations cannot be made.

- Although 11 SRCs were detected in the surface water samples collected adjacent to the AOC for the 2003 FWBWQS, a cursory review of the overall surface water data collected along the Sand Creek as part of the 2003 survey indicates that detected analyte concentrations in the samples collected adjacent to the AOC are consistent with the other surface water samples collected both upstream and downstream of the site. Based on these results, it appears that surface water conditions downstream of the AOC have not been impacted by historical disposal activities at the Sand Creek Site.

ES.5 Summary of Contaminant Fate and Transport

Contaminant fate and transport modeling was performed to evaluate the potential for the SRCs in surface and subsurface soils to migrate vertically downward and impact groundwater quality and eventually surface water. Any SRCs identified would require further evaluation in the FS.

Seasonal Soil Compartment (SESOIL) modeling (Waterloo Hydrogeologic, Inc., 2004) was performed for constituents identified in potential source surface soils as contaminant migration chemicals of potential concern (CMCOPCs) after screening against the 1,000-year travel time criteria. The SESOIL model defines the soil compartment as a soil column extending from the ground surface through the unsaturated zone and to the upper level of the saturated zone. Processes simulated in SESOIL are categorized in three cycles: (1) the hydrologic cycle (rainfall, surface runoff, infiltration, soil-water content, evapotranspiration, and groundwater recharge), (2) the sedimentation cycle, and (3) the pollutant cycle (convective transport, volatilization, adsorption/desorption, and degradation/decay),

The CMCOPCs identified as having the potential for impacting groundwater and surface water include 2,4,6-trinitrotoluene and 2-amino-4,6-dinitrotoluene, 1,4-dichlorobenzene, carbazole, pentachlorophenol, benzene, alpha-BHC, and beta-BHC. The CMCOPCs identified represent a conservative comparison since groundwater at the site has not been investigated and the hydrogeologic parameters are either assumed values or literature values for comparable lithologies.

ES.6 Summary of Human Health Risk Assessment

A human health risk assessment (HHRA) was performed to evaluate whether site conditions may pose a risk to current or future human receptors and to identify which, if any site

conditions need to be addressed in the FS. The data sets used for the risk assessment process were primarily from the RI and included the ISM surface soil and sediment samples and subsurface samples. The surface water samples from the 2003 RA and the 2003 FWBWQS were also used. Also, the RI included data that was used to evaluate the need for use restrictions such as land-use controls.

The Sand Creek Site is in the eastern central portion of the facility. The AOC is not currently used for military training activities but may receive periodic foot traffic during maintenance, restoration, and security activities. The most likely future land use for the AOC is the Military Training. The Representative Receptor for this Land Use is the NGT per the *USACE's Facility-Wide Human Health Risk Assessment Manual* (HHRAM - USACE, 2005b) and the 2014 Risk Assessment Tech Memo. This anticipated future Land Use, in conjunction with the evaluation of Unrestricted (Residential) Land Use, form the basis for identifying chemicals of concern (COCs) in this RI. Unrestricted (Residential) Land Use is included to evaluate COCs for Unrestricted (Residential) Land Use at the AOC, as required by the CERCLA process and as outlined in the HHRAM (USACE, 2005b).

A third Land Use was also included in this revised RI. The third Land Use, Commercial Industrial Land Use was identified in the Risk Assessment Tech Memo to evaluate the site to determine if it is suitable for full-time, permanent employees. Per the Risk Assessment Tech Memo (NGB, 2014), if the criteria for the Commercial Industrial Land Use is met, then no additional remedial actions are required except for the development of Land Use Controls through the CERCLA process (FS, PP, ROD, etc.). The Military Training Land Use is the primary Land Use and is protective of all activities that the OHARNG may conduct on the site except for full-time, permanent-occupational use. Evaluation of the three Land Uses in the RI will allow better risk management decisions in an FS is needed.

The Sand Creek Site was considered as a single EU based on the future land use. Although the site is being evaluated as a single EU, soil data collected within and adjacent to the AOC were aggregated by depth intervals since different future use receptors with different depths of potential exposure are required to be evaluated. This RI includes analyses to assess potential risks at various depths to assess whether the most likely receptor to deep surface soil and subsurface soil, the NGT, would be able to dig and to what depth. The soil intervals for Unrestricted (Residential) Land Use and Commercial Industrial Land Use were also assessed. Sediment samples collected for the RI and previously collected surface water samples were evaluated in the same manner for the identified receptors. The purpose of evaluating the receptors in this manner is to provide information for further evaluation in the FS, if required, and to determine the best remedial action to meet the evaluation criteria. The COPC identification was completed for the following data sets:

- Resident Receptor (Adult and Child)—Surface soil (0–1 foot bgs)
- Industrial Receptor—Surface soil (0–1 foot bgs)
- National Guard Trainee —Deep Surface soil (0–4 feet bgs)
- Resident Receptor (Adult/Child)—Subsurface soil (1–13 feet bgs)
- Industrial Receptor —Subsurface soil (1–13 feet bgs)
- National Guard Trainee—Subsurface soil (4–7 feet bgs))
- Resident Receptor (Adult and Child), Industrial Receptor, and National Guard Trainee—Sediment
- Resident Receptor (Adult and Child), Industrial Receptor, and National Guard Trainee—Surface water.

The exposure scenarios for RVAAP-specific receptors (Resident Receptor and NGT) are presented in the FWCUG Report (SAIC, 2010). The exposure parameters for the Industrial Receptor (Composite Indoor and Outdoor Worker) can be found on the USEPA's RSL website and are those used to calculate Industrial RSLs. There is no depth or intrusive activity associated with the Industrial Receptor so for the HHRA, they are assumed to be exposed to depths like that of the Resident Receptor.

The HHRA was prepared using the streamlined approach to risk decision making as described in the *U.S. Army Corps of Engineers Ravenna Army Ammunition Plant Position Paper for the Application and Use of Facility-Wide Cleanup Goals* (USACE, 2012). The approach identifies chemicals of potential concern (COPCs) by comparing concentrations to background screening values, eliminating essential nutrients, and comparing site concentrations to the FWCUGs. The COCs are identified through additional screening of the COPCs by comparing site concentrations to specific FWCUGs and using a "sum of ratios" approach to account for accumulative effects for carcinogens and noncarcinogens acting on the same critical effect.

COPCs in Surface Soil and Deep Surface Soil

Surface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 0- to 1-foot interval.

- The COPCs identified for the Unrestricted (Residential) Land Use receptors in surface soil are antimony, arsenic, cadmium, copper, mercury, silver, thallium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and ideno(1,2,3-cd) pyrene. These chemicals are provided in **Table ES-1.**

- The COPCs identified for the Commercial Industrial Land Use receptors in surface soil are arsenic, thallium, and benzo(a)pyrene. These chemicals are highlighted in **Table ES-1.**

Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. Samples from this interval include the ISM surface soil samples from 0 to 1 foot and the subsurface samples from the 1- to 5-foot interval.

- The COPCs identified for this interval and NGT Receptor are arsenic, barium, cadmium, cobalt, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h) anthracene. These chemicals are provided in **Table ES-1**.

A summary of COPCs in surface soil for the Resident Receptor, Industrial Receptor, and deep surface soils for the National Guard is presented in **Table ES-1**.

COPCs in Subsurface Soil

Subsurface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 1- to 13-foot interval. Samples from this interval include the subsurface samples from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet.

- The COPCs identified for the Unrestricted (Residential) Land Use receptors identified in subsurface soils based on the MDC are antimony, arsenic, copper, lead, thallium, vanadium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene. These chemicals are provided in **Table ES-1**.

- The COPCs identified for the Commercial Industrial Land Use in subsurface soil are arsenic, lead, thallium, benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene. These chemicals are provided in **Table ES-1**.

Subsurface soil for the National Guard Trainee is defined as the 4- to 7-foot interval. Samples from the 4- to 7-foot interval include the subsurface samples from 5 to 9 feet since the sample intervals overlap.

- Arsenic was the only COPC identified for this interval for Commercial Industrial Land Use. All SRCs were screened and the resulting COPCs are provided in **Table ES-1**.

A summary of results for the screening process used to evaluate for COPCs in subsurface soil for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use is presented in **Table ES-1**.

COPCs in Sediment

The COPCs identified in sediment for the Unrestricted (Residential) Land Use are antimony, silver, thallium, and benzo(a)pyrene. Only benzo(a)pyrene was identified as a COPC in sediment for the Commercial Industrial and the Military Training Land Use. Sediment is not considered an exposure medium for the Industrial Receptor. Therefore, no Industrial RSLs were developed for this receptor. For this risk assessment, it was assumed that an Industrial Receptor would be exposed similarly as the NGT receptor. The FWCUGs for the NGT were used to determine COPCs in the sediment for the Commercial Industrial Land Use.

A summary of the COPCs identified for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use Receptors in sediment is presented in **Table ES-1**.

COPCs in Surface Water

Arsenic is the only COPC identified in surface water for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors. Surface water is not considered an exposure medium for the Industrial Receptor. Therefore, no Industrial RSLs were developed for this receptor for surface water. For this risk assessment, it was assumed that an Industrial Receptor would be exposed similarly as the NGT receptor. The FWCUGs for the NGT were used to determine COPCs in the surface water for the Commercial Industrial Land Use.

A summary of the COPCs identified for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors in surface water is presented in **Table ES-1**.

COCs in Surface Soil and Deep Surface Soil

Surface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 0- to 1-foot interval. Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. The COC determination for each receptor was determined separately for noncancer (by target organ/critical effect) and for cancer risks. The COCs were identified using the maximum detected concentration for each COPC at any of the ISM locations and not by individual ISM location.

COCs Unrestricted Residential/Commercial Industrial Land Uses in Surface Soil

Only arsenic was identified as a COC based on noncancer effects for the child Resident Receptor for the Unrestricted (Residential) Land Uses in surface soil (**Table ES-1**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC for the Unrestricted (Residential) Land Use.

No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in surface soil (**Table ES-1**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene for the Commercial Industrial Land Use. These COCs were based on the maximum detected concentration for each COPC at any of the ISM locations and not by ISM location.

COCs Military Training Land Use in Deep Surface Soil

Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. Samples from this interval include the ISM surface soil samples from 0 to 1 foot and the subsurface samples from the 1- to 5-foot interval were also used.

No COCs based on noncancer effects were identified for the Military Training Land use in the surface samples using ISM maximum sample concentrations in the 0- to 1 foot interval (**Table ES-1**). Three COCs were identified based on cancer risks and using the SOR. These were arsenic, cobalt, and benzo(a)pyrene for the Military Training Land Use.

In the discrete samples from the 1 to 5-foot interval, the 95% UCL was estimated and used in the calculations. No COCs based on noncancer effects were identified for the Military Training Land Use in the deep surface samples (1-to 5-foot interval) using the 95% UCL (**Table ES-1**). Four COCs were identified based on cancer risks and using the SOR for this interval. These were arsenic, cobalt, benzo(a) pyrene, and benzo(b)fluoranthene for the Military Training Land Use.

COCs Unrestricted (Residential) Land Use in Subsurface Soil

Based on the results of this HHRA, there are several COCs identified in the subsurface soil for the Unrestricted (Residential) Land Use. These were identified using the 95% UCL or the MDC (if it was larger than the 95% UCL) for each COPCs regardless of location. No COCs based on noncancer effects were identified for the Unrestricted (Residential) Land Use receptors in subsurface soil. ISM DU from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet (**Table ES-1**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC.

COCs in Subsurface Soil for the Commercial Industrial Land Use

No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in subsurface soil. Four COCs were identified based on cancer risks and using the SOR. These were arsenic, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene. These COCs were derived using the 95% UCL for each COC at any of the ISM locations and not for each individual ISM locations. This type of re-assessment should be completed in the FS, so that the minimum area to be evaluated can be focused where there is the most contamination. This would help focus the FS so that only the contaminated areas are evaluated.

COCs in Subsurface Soil for the Military Training Land Use

Subsurface soil for the National Guard Trainee is defined as the 4- to 7-foot interval. Samples from the 4- to 7-foot interval include the subsurface samples from 5 to 9 feet since the sample intervals overlap. No COCs were identified for the Military Training Land Use in the subsurface interval for the NGT (should have been only 4-to 7 feet but this also included data from 5-to 9 feet).

COCs in Sediment Summary for all Land Uses

No COCs were identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or Military Training Land Use in the sediment at the AOC. This media does not require further evaluation in an FS. A "No further Action" (NFA) determination is obtained for sediment at the Sand Creek Site.

Surface Water Summary

No COCs were identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or Military Training Land Use in the surface water. This media does not require further evaluation in an FS. An NFA determination is obtained for surface water at the Sand Creek Site.

Conclusions

Results of the HHRA indicate the presence of several COCs in surface soil and subsurface soil for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use. Arsenic and benzo(a)pyrene are the primary risk drivers. These COCs should be further evaluated in an FS to determine the appropriate remedial actions for soil at this AOC.

No COCs were identified in sediment or surface water at the Sand Creek Disposal Road Landfill. An NFA determination is indicated for both sediment and surface water and an FS is not warranted.

ES.7 Summary of Ecological Risk Assessment

A screening level ecological risk assessment (SLERA) was conducted to evaluate the potential for adverse ecological effects to ecological receptors from SRCs at the Sand Creek Site and to determine if any ecological receptors need to be recommended for further evaluation in the FS. The SLERA included characterizing the ecological communities near the site, determining the contaminants present, identifying pathways for receptor exposure, and estimating the magnitude of the likelihood of potential adverse effects to identified receptors. Site-specific analyte concentration data for surface soil, sediment, and surface water from the Sand Creek Site were included in the SLERA. The ecological receptor species selected for evaluation in the SLERA were identified in the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003).

The SLERA was prepared in accordance with the Ohio Environmental Protection Agency (2008) *Ecological Risk Assessment Guidance Document* Level I Scoping through Level III Baseline. The Level I Scoping is designed to efficiently determine whether further ecological risk should be evaluated at a site. The Level II Screen is to be completed after the full nature and extent of the site contamination has been determined. The purpose of a Level II Screen is to select the list of detected chemicals per media as appropriate, evaluate aquatic habitats potentially impacted by the site, and if necessary, revise the conceptual site model, complete a list of ecological receptors, identify chemicals of potential ecological concern (COPECs) and nonchemical stressors, and other tasks required for further ecological evaluation of the site and impacted habitats. The purpose of a Level III Baseline is to identify the potential for ecological harm at a site. Specifically, the Level III Baseline is a formal ecological risk assessment process that includes an exposure assessment, toxicity assessment, risk characterization, and an uncertainty analysis. Potential ecological hazards are evaluated by using the COPECs and nonchemical stressors identified in a Level II Screen, generic receptors, direct contact evaluations, and food-web models that are provided in the guidance document.

Mercury in surface soil was the only COPEC recommended to be evaluated under the Level III Baseline evaluation following the Level II Screen. The only species identified as having a hazard quotient (HQ) greater than 1 associated with mercury was the robin, which indicates that potential hazards could exist to omnivorous birds foraging exclusively at the site. It is important to state that the finding of HQs greater than 1 does not necessarily indicate that adverse impacts are occurring. Additionally, the size of the entire AOC would only support one breeding pair of the American robin. The AOC is not large enough to support very many birds, especially as foraging habitat. Therefore, no further evaluation from an ecological risk perspective is warranted.

ES.8 Remedial Investigation Recommendations

Based on the RI results, the Sand Creek Site has been adequately characterized and the project objectives have been achieved. Surface and subsurface soil and sediment samples were collected during the RI field activities to define the nature and extent of contamination and support the preparation of an FS and a subsequent Record of Decision for the AOC. Therefore, the recommended path forward is to proceed to the FS phase of the CERCLA process. The FS will evaluate remedial alternatives to address the COCs identified in surface and subsurface soil only. The FS will include a Risk Management Evaluation to fully assess each COCs before proceeding to the alternative analysis for human health. Since no COPECs in soil were identified in the ERA, no additional remedial actions are warranted at the AOC from an ecological perspective. No COCs or COPECs were identified in sediment or surface water; therefore, an FS is not warranted for sediment or surface water at the Sand Creek Site.

In addition to the FS to assess soils at the AOC, further analysis of the groundwater should be conducted for this AOC. An analysis of remedial alternatives for surface and subsurface soil is recommended based on fate and transport results of the leaching potential to groundwater that is associated with the identified CMCPOCs for these media. Evaluation of groundwater at the AOC should be conducted as part of the Facility Wide Groundwater Investigation (RVAAP-66).

Table ES-1. Summary of COCs identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use for each Exposure Media.

Receptor per Land Use and Exposure Point	COPCs Identified[a]		COCs Identified[b]
SURFACE SOIL			
Surface Soil (0 to 1 foot bgs)			
Unrestricted (Residential) Land Use *-Based on MDC*	*Antimony*	*Benzo(a)anthracene*	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene *All carcinogenic except arsenic which was also from non-carcinogen effects*
	Arsenic	*Benzo(a)pyrene*	
	Cadmium	*Benzo(b)fluoranthene*	
	Copper	*Dibenzo(a,h)anthracene*	
	Mercury	*Indeno(1,2,3-cd)pyrene*	
	Silver	*Thallium*	
Surface Soil (0 to 1 foot bgs)			
Commercial Industrial Land Use *-Based on MDC*	*Arsenic*	*Benzo(a)pyrene*	Arsenic Benzo(a)pyrene *All carcinogenic*
	Thallium		
Deep Surface Soil (0 to 1 feet bgs)			
Military Training Land Use *-Based on MDC ISM results for 0 to 1 feet*	*Arsenic*	*Benzo(a)pyrene*	Arsenic Cobalt Benzo(a)pyrene *All carcinogenic based*
	Barium	*Benzo(b)fluoranthene*	
	Cadmium	*Dibenzo(a,h)anthracene*	
	Cobalt		
Deep Surface Soil (1 to 5 feet bgs)			
Military Training Land Use *-Based on site-wide results for 1 to 5 feet and 95% UCL for Discrete samples*	*Arsenic*	*Benzo(a)pyrene*	Arsenic Cobalt Benzo(a)pyrene *All carcinogenic based*
	Barium	*Benzo(b)fluoranthene*	
	Cadmium	*Dibenzo(a,h)anthracene*	
	Cobalt		

Table ES-1. Summary of COCs identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use for each Exposure Media.

Receptor per Land Use and Exposure Point	COPCs Identified[a]		COCs Identified[b]
SUBSURFACE SOIL			
Subsurface Soil (1 to 13 foot bgs)			
Unrestricted (Residential) Land Use (1 to 13 feet bgs) *Based on site-wide results and 95% UCL for Discrete samples*	*Antimony*	*Benzo(a)anthracene*	Arsenic Benzo(a)pyrene *All carcinogenic based*
	Arsenic	*Benzo(a)pyrene*	
	Copper	*Benzo(b)fluoranthene*	
	Thallium	*Dibenzo(a,h)anthracene*	
	Vanadium		
Commercial Industrial Land Use (1 to 13 feet bgs) *-Based on site-wide results and 95% UCL for Discrete samples*	*Arsenic*	*Benzo(a)anthracene*	Arsenic Benzo(a)pyrene Dibenzo(a,h)anthracene *All carcinogenic based*
	Thallium	*Benzo(a)pyrene*	
		Dibenzo(a,h)anthracene	
Subsurface Soil (4 to 7 foot bgs)			
Military Training Land Use *-Based on site-wide results for 5 to 9 feet and 95% UCL for Discrete samples*	*Arsenic*		Arsenic *Carcinogenic based*
Sediment (0 to 0.5 foot bgs)			
Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use	*Antimony*	*Thallium*	None
	Silver	*Benzo(a)pyrene*	
Surface Water			
Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use	*Arsenic*		None

[a] denotes COPCs identified by screening.
[b] denotes COCs identified by screening.
bgs denotes below ground surface. COC denotes chemical of concern.
COPC denotes chemical of potential concern.
bgs denotes below ground surface.
COC denotes chemical of concern.
mg/kg denotes milligrams per kilogram.

1.0 PROJECT DESCRIPTION

1.1 Introduction

This *Remedial Investigation (RI) Report* was completed to document the results of the field activities performed for Area of Concern (AOC) RVAAP-34 Sand Creek Disposal Road Landfill (herein, referred to as the "Sand Creek Site"). The Sand Creek Site is located at the former Ravenna Army Ammunition Plant (former RVAAP) in Ravenna, Ohio. This work was completed in accordance with the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA). This RI Report was originally prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) a CB&I company, under Delivery Order 0002 for Architectural/Engineering Environmental Services at the former RVAAP under the *Indefinite Delivery/Indefinite Quantity Contract No. W912QR-08-D-0013*. The Delivery Order was issued by the United States (U.S.) Army Corps of Engineers (USACE), Louisville District on September 22, 2008.

Work described herein was conducted under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). Due to delays in the overall cleanup program at the former RVAAP that were unrelated to Shaw's performance, Shaw could not complete this document before the Contract ended and it was left as a Draft. Therefore, USACE has revised and completed this document. Revisions to the human health risk assessment were necessary before the Army could re-issue this RI. The human health risk assessment that was originally completed in the RI by Shaw, did not include the modifications to the human health risk assessment process as required in the *"Final Technical Memorandum: Land Uses and Revised Risk Assessment Process for the Ravenna Army Ammunition Plant (Risk Assessment Technical Memo) (RVAAP Installation Restoration Program, Portage/Trumbull Counties, Ohio* (Army National Guard Directorate, 2014)." Because the human health risk assessment was the only portion that needed updated in the RI, the primary work for this RI is unchanged. For example, no new samples were taken by the USACE. No new laboratory analysises were completed by USACE.

The human health risk assessment section of this RI was fully updated and revised by USACE. Certain information depicted on figures and contained in this RI may not reflect current conditions since this document was originally completed in 2013. Species lists and other natural resources were updated in the 2014 Integrated Natural Resource Management Plan (INRMP). Please refer to this document for a current species list. However, additions and changes to the current species list do not affect the results and findings of this RI. Future documents such as the Proposed Plan (PP), will be updated as necessary. None of these updates or modifications such updated species lists alter the findings and recommendations presented in this RI.

1.2 Purpose

This document summarizes the results of the RI field activities conducted at the Sand Creek Site between September and November 2010. Data from previous studies were also considered in this RI Report that included the following:

- Surface soil, sediment, and surface water samples collected during a removal action (RA) and sampling investigation documented in the *Remedial Design/Removal Action Plan for RVAAP-34 Sand Creek Disposal Road Landfill* (MKM Engineers, Inc. [MKM], 2004) (hereafter referred to as the Remedial Design [RD]/RA Report).
- A sediment sample and surface water samples collected adjacent to the site during a facility-wide investigation of surface water and sediment conditions at the former RVAAP and documented in the 2003 Facility-Wide Biological and Water Quality Study (FWBWQS) (USACE, 2005a).
- Results from the subsurface digital geophysical mapping (DGM) survey performed at the site and documented in the *Final Digital Geophysical Mapping Report for the former RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site* (Shaw, 2011).

1.3 Scope

Environmental cleanup decision making under CERCLA follows a prescribed sequence: (1) RI, (2) Feasibility Study (FS), (3) Proposed Plan, and (4) Record of Decision (ROD). The RI serves as the mechanism for collecting data to characterize site conditions, determining the nature and extent of the contamination, and assessing risks to human health and the environment from this contamination.

The scope of this investigation is to complete the assessment of the extent of contamination and the potential impact to human health and the environment for reaching a remedial action decision. The primary objectives of the RI are as follows:

- To conduct surface and subsurface soil and sediment sampling to define the nature and extent of contamination to support preparation of a FS at the Sand Creek Site
- To collect data to support a ROD at the Sand Creek Site

To meet the primary project objectives, investigation-specific data quality objectives (DQOs) were developed using the approach presented in the Facility-Wide Sampling and Analysis Plan (FWSAP) (Science Applications International Corporation [SAIC], 2001). The DQOs specific to the Sand Creek Site are presented in the *Final Data Quality Objectives Report for the*

RVAAP-34 Sand Creek Disposal Road Landfill, herein referred to as the DQO Report (Shaw, 2009) and are summarized in later in this RI.

The investigation approach to the RI at the Sand Creek Site involved a combination of field and laboratory activities to characterize the AOC. Field investigation techniques included the incremental sampling method (ISM) for surface soil and sediment and modified ISM at subsurface soil boring locations. A DGM survey was conducted prior to the RI activities to confirm potential impacted areas and to refine the sampling program (Shaw, 2011). The RI field activities were conducted in accordance with the FWSAP (SAIC, 2001) and the *Final Sampling and Analysis Plan Addendum No. 1 for Environmental Services at RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site* (Shaw, 2010), herein referred to as the Sampling and Analysis Plan (SAP) Addendum No. 1.

The future Land Use for the Sand Creek Site is Military Training. The Representative Receptor is the National Guard Trainee (NGT); per the RVAAP Facility-Wide Human Health Risk Assessor Manual, Amendment 1 (FWHHRAM; USACE, 2005a) and the Risk Assessment Technical Memo. However, since this RI is being finalized and updated per the Final Risk Assessment Technical Memo, the Unrestricted (Residential) Land Use is evaluated first in the human health risk assessment in the RI. If no Chemicals of Concern (COCs) are identified, then the other two Land Uses (Commercial/Industrial and Military Training) do not need to be evaluated further. Since the original RI prepared by Shaw included an evaluation for Military Training using the National Guard Training (NGT) Receptor, the Army determined it would expedite future remedial decisions and limit revisions if the nature and extent and other information for the NGT are retained. Since this document is being updated, an additional Land Use scenario (Commercial Industrial Land Use) was also added to the human health risk assessment. Based on the findings presented in the RI originally prepared by Shaw in 2013, the Army decided to evaluate the three Land Uses as required in the Risk Assessment Tech Memorandum. In this instance, if COCs are identified for the Residential Receptor, then the Military Training Land Use and Commercial/Industrial Land Use using their Representative Receptors are evaluated in the human health risk assessment. The RI originally prepared by Shaw considered the anticipated future land use as Military Training but also included the evaluation of Unrestricted (Residential) Land Use and associated receptors. This same approach was used in the revised human health risk assessment. As stated previously, Unrestricted (Residential) Land Use, is included to evaluate COCs for unrestricted land use at the AOC, as required by the CERCLA process and as outlined in the FWHHRAM (USACE, 2005a). Additionally, USACE updated the risk assessment for the Residential Receptor and the National Guard Trainee (NGT) Receptor for chemicals that lack Facility-Wide Cleanup Goals (FWCUGs), and the Industrial USEPA Regional Screening Level (RSL) was used to

evaluate the Commercial Industrial Land Use using the Composite Worker Receptor, hereafter referred to as the Industrial Receptor. Since the screening for this RI was completed in 2013, the FWCUGs are the primary criteria for the Resident Receptor and the NGT Receptor.

Surface soil is defined as the 0–1 ft. bgs interval and subsurface soil is defined as the 1–13 ft. bgs interval for the Unrestricted (Residential) Land Use and Commercial Industrial Land Use exposure scenarios for this AOC. For the OHARNG receptors that were originally assessed in the RI, surface soil is defined as the 0–4 feet (ft.) below ground surface (bgs) interval and is referred to as deep surface soil. Subsurface soil defined by the OHARNG is the 4–7 ft. bgs interval. This data was retained in the RI for historical documentation but was not evaluated or included in the human health risk assessment.

The main goal of the RI process is to define the nature and extent of contamination and the potential risks to human health and the environment resulting from the presence of environmental contamination. Where little or no environmental hazards are determined to be present and/or not associated with site-related contamination, a no further action (NFA) decision will be recommended. However, if conditions for an NFA decision are not met (i.e., concentration of a chemical(s) is present and more than the facility-wide background values (inorganics only), FWCUGs, or the USEPA's RSLs, then the site will proceed to a Feasibility Study (FS), and remedial action alternatives will be assessed.

1.4 Report Organization

This RI Report is organized to meet Ohio EPA requirements in accordance with CERCLA guidance (EPA, 1988). The main text of this RI is composed of the following sections:

- Section 2.0, "Physical Characteristics," describes the environmental setting at the site including important site features, soils, geology, hydrology, and ecology and presents the CSM for the site.
- Section 3.0, "Study Area Investigation," presents a discussion of the field investigation activities associated with site characterization.
- Section 4.0, "Nature and Extent of Contamination," presents an analysis of data collected and describes chemical concentration levels found in environmental media in the study area.
- Section 5.0, "Contaminant Fate and Transport," combines the results of the site physical characteristics and the extent of chemical analyses to assess potential transport pathways and rates of migration.
- Section 6.0, "Human Health Risk Assessment," describes the evaluation of potential threat to human health receptors in the absence of any remedial action.

- Section 7.0, "Screening Level Ecological Risk Assessment," evaluates the potential for adverse effects posed to ecological receptors from potential releases at the site.
- Section 8.0, "Summary of Conclusions," summarizes the nature and extent of contamination, the fate and transport of potential contaminants in environmental media at the site, and the results of the screening level risk assessments. Recommendations for future work and recommended remedial action objectives are also discussed.
- Section 9.0, "References," presents the references cited in this document.

The appendices to this RI Report contain supporting data collected during the RI activities. The appendices consist of field documentation data, quality assurance (QA) documentation, laboratory analytical data, investigation-derived waste management characterization reports and supporting data for the fate and transport, human health risk assessments (HHRAs), and ecological risk assessments (ERAs). The appendices included at the end of this RI are as follows:

- Appendix A – Field Documentation
- Appendix B – Quality Assurance Summary Report
- Appendix C – Data Validation Results and Usability Assessment
- Appendix D – Laboratory Analytical Results
- Appendix E – Fate and Transport Modeling Results
- Appendix F – Human Health Risk Assessment Tables
- Appendix G – Ecological Screening Values
- Appendix H – Ecological Risk Assessment Tables
- Appendix I – Investigation Derived Waste Management
- Appendix J – Responses to Ohio EPA Comments

1.5 General Facility Description

The former RVAAP (Federal Facility Identification [ID] No. OH213820736) is in northeastern Ohio within Portage County and Trumbull County, approximately 3 miles east-northeast of the city of Ravenna (**Figure 1-1**). The installation is approximately 11 miles long and 3.5 miles wide. It is bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garrett, McCormick, and Berry Roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (**Figure 1-2**). The installation is surrounded by several communities: Windham on the north, Garrettsville 6 miles to the northwest, Newton Falls 1 mile to the southeast, Charlestown to the southwest, and Wayland 3 miles to the south.

Administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and the property subsequently licensed to the OHARNG for use as a military training site, Camp Ravenna. The restoration program at the former RVAAP involves cleanup of former production/operational areas throughout the facility related to activities that were conducted there.

1.5.1 RVAAP Operational History and Mission

Constructed in 1940, production at the former RVAAP began in December 1941, with the primary missions of depot storage and ammunition loading. The installation was divided into two separate units: the Portage Ordnance Depot and the Ravenna Ordnance Plant. The depot's primary mission was storage of munitions and components, while the mission of the ordnance plant was loading and packing major caliber artillery ammunition and the assembly of munitions-initiating components that included fuzes, boosters, and percussion elements. In August 1943, the installation was re-designated as the Ravenna Ordnance Center, and in November 1945, it was re-designated as the Ravenna Arsenal.

The plant was placed in standby status in 1950 and reactivated during the Korean Conflict to load and pack major caliber shells and components. All production ended in August 1957, and in October 1957 the installation again was placed in a standby condition. In October 1960, the ammonium nitrate line was renovated for demilitarization operations, which involved melting explosives out of bomb casings for subsequent recycling. These operations began in January 1961. In July 1961, the plant was deactivated again. In November 1961, the installation was divided into the Ravenna Ordnance Plant and an industrial section, with the entire Installation designated as the former RVAAP.

In May 1968, loading, assembling, and packing munitions began on three load lines and two component lines to support the Southeast Asia conflict. These facilities were deactivated in August 1972. The destruction of M71A1 90-millimeter (mm) projectiles extended from June

1973 until March 1974. Destruction of various munitions was conducted from October 1982 through 1992.

Until 1993, the former RVAAP maintained the capability to load, assemble, and pack military ammunition. As part of the former RVAAP mission, the U.S. Army maintained inactive facilities in a standby status by keeping equipment in a condition to allow resuming production within prescribed limitations. In September 1993, the U.S. Army placed the former RVAAP in inactive caretaker status, which subsequently changed to modified caretaker status. The load lines and associated real estate were determined to be excess by the U.S. Army.

1.5.2 Current Status

Administrative accountability for the entire 21,683-acre facility has been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and the property subsequently licensed to the OHARNG for use as a military training site, Camp Ravenna. The RVAAP restoration program involves cleanup of former production/operational areas throughout the facility related to former activities conducted under the RVAAP.

The former RVAAP Installation Restoration Program (IRP) encompasses investigation and cleanup of past activities over the 21,683-acre former RVAAP. Therefore, references to the former RVAAP in this document are inclusive of the historical extent of the former RVAAP, which is inclusive of the combined acreages of the current Camp Ravenna and the former RVAAP, unless otherwise specifically stated. The Ohio Environmental Protection Agency (Ohio EPA) is the lead regulatory agency for the investigation and remediation conducted by the U.S. Army under the U.S. Department of Defense (DOD) IRP.

1.6 Sand Creek Disposal Road Landfill Site Description

This section presents a summary of the Sand Creek Site history, previous RAs and investigations, and site-related chemicals (SRCs) in environmental media at the AOC.

1.6.1 Operational History

The Sand Creek Disposal Road Landfill is in the eastern portion of the former RVAAP and was used as an open dump area (**Figure 1-2**). The operational history of disposal activities at the site is incomplete. Construction and debris (C&D) type material were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek. The dump site extended along the embankment for approximately 1,200 feet and varied in width from 20 to 40 feet from the top of the bank to the bottom (**Figure 1-3**). The size of the defined AOC is approximately 1 acre. The bank slopes from east to west towards Sand Creek at 40 to 60 degrees from the horizontal. There are no records indicating the quantities or materials dumped at the site and the dates of operation for the landfill are unknown. Several buildings associated with the former Sand Creek Sewage Treatment Plant are located northeast of the

site. Surface water runoff follows the topography of the site and flows in a westerly direction where it enters Sand Creek. A very narrow floodplain occupies the land between the bottom of the embankment and Sand Creek. A former railroad bed bisects the AOC (MKM, 2004).

Preliminary site assessments found the AOC very overgrown with mature trees and ground level vegetation. The entire site was littered with C&D materials with large piles of debris concentrated mostly in the southern portion of the AOC. Some of the types of C&D materials identified during the preliminary site assessment included the following:

- Asbestos-containing material (ACM) (i.e., large piles of corrugated transite roofing and flat transite siding)
- Rubble (i.e., concrete, brick, and masonry fragments)
- Drywall and plaster
- Glass bottles, fluorescent light tubes, and broken glass
- Scrap metal items including wire fencing
- Wooden debris

1.6.2 Previous Investigations and Removal Actions

Prior to the RI activities, previous investigations and other activities conducted at the Sand Creek Site included a preliminary assessment (PA), RA, confirmatory sampling, a FWBWQS, and a DGM survey. A discussion of these activities is presented further in this section.

1.6.2.1 Preliminary Assessment (1996)

In 1996, SAIC was contracted by the USACE to conduct a PA at various AOCs at the former RVAAP. The purpose of the PA was to collect information concerning conditions at the former RVAAP sufficient to assess the potential threat posed to human health and the environment and to determine the need for additional characterization at areas identified at the former RVAAP containing potentially hazardous materials from former munitions assembly and demilitarization operations at the installation. The scope of the PA included review of available information, interviews with former employees, and field visits to review and identify potential sites. The PA reported that the site contained concrete, wood, several tons of asbestos and spent fluorescent light bulbs. The waste was characterized as containing asbestos and heavy metals (mercury), although no characterization data were available (SAIC, 1996).

1.6.2.2 Relative Risk Site Evaluation (1996)

The U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) conducted a relative risk site evaluation (RRSE) for previously uninvestigated sites at the

former RVAAP in 1996. From the 19 sites that were evaluated, 4 were classified as "high" priority areas of concern and the others were classified as "low" or "medium." The four high-priority AOCs included the Sand Creek Disposal Road Landfill.

The 1996 USACHPPM Report identified surface soil and sediments to be potential media for contaminant migration at the Sand Creek Site due to the lack of any physical barriers/fence around the site and its proximity to Sand Creek. Three shallow soil samples and one sediment sample were collected from the site during the RRSE. The study identified arsenic as exceeding RRSE screening values for sediments and identified the potential for arsenic to migrate into Sand Creek. The RRSE for this AOC was scored "high" since it is the habitat for state-endangered species (Mountain Brook Lamprey and the river otter). Under the CERCLA process, a site which registers a RRSE rating of "high" requires further investigation and/or removal (USACHPPM, 1998).

1.6.2.3 Additional Investigations

Site evaluations following the USACHPPM sampling event showed that the area used for dumping at the Sand Creek Site was larger than originally defined. In addition, observations identified multiple potential sources of chemical contamination, such as solvent drums, gas cylinders, open canisters, broken lab bottles, and construction debris.

Additional surface soil samples were taken to further characterize the dump site. Samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, cyanide, pesticides, polychlorinated biphenyls (PCBs), explosives, and nitroguanidine. These results indicated that metals and SVOCs were present and should be evaluated further.

These sample results indicated that the contaminants had migrated to the sediments of Sand Creek. Additional contamination in soils beneath sediment along the Sand Creek was a concern. However, unexploded ordnance concerns prevented additional sampling before debris removal. As such, an RD/RA was the selected alternative for the Sand Creek Disposal Road Landfill as detailed in the *Final Remedial Design and Removal Action Plan for RVAAP-34 Sand Creek Disposal Road Landfill at Ravenna Army Ammunition Plant* (MKM, 2004).

1.6.2.4 Facility-Wide Biological and Water Quality Study (2003)

In 2003, the USACE performed surface water and sediment sampling and biological monitoring at 26 stream sites at the former RVAAP that included sample location (S-7) at the intersection of the Sand Creek and the former railroad that transects the site (**Figure 1-4**). Biological monitoring included fish and macroinvertebrate community assessments. Two surface water samples from each location at different collection dates during the summer of 2003 (June and September) were analyzed for target analyte list (TAL) metals, pesticides,

PCBs, explosive compounds, SVOCs, and several nutrient parameters. One sediment sample was collected using the ISM at the collocated biological sampling sites. Sediments were analyzed for TAL metals, SVOCs, pesticides, PCBs, explosive compounds, percent solids, and cyanide as well as several nutrient parameters. The collection of the data provided (1) aquatic life use attainment status of streams regarding the Warm Water Habitat or other applicable aquatic life use designation codified in the *Ohio Water Quality Standards* (OWQS), (2) an assessment if chemical contamination within the streams was adversely affecting the biological communities, and (3) an ecological assessment report summarizing the sediment, surface water, and aquatic biological results. The results of the surface water and sediment results collected at sample location S-7 is presented in the 2003 FWBWQS (USACE, 2005a). A summary of the results are as follows:

- Sediment—Cadmium and antimony were the only inorganics in the sediment sample that exceeded the former RVAAP background screening value (BSV) of 0. A low SVOC concentration of di-n-butyl phthalate was also detected. No PCBs, pesticides, cyanide, or explosives compounds were detected in the sediment sample.
- Surface Water—The only detected metal that exceeded an RVAAP-calculated BSV was arsenic in the September 2003 sampling event. Concentrations of chromium, cobalt, silver, and vanadium were detected between the two sampling events and exceeded the BSV of 0. All other detected metals were either essential nutrients (calcium, iron, magnesium, potassium, and sodium), or the maximum detected concentration (MDC) was less than the former RVAAP surface water BSV (aluminum, barium, copper, manganese, and zinc). A low concentration of bis(2-ethylhexyl) phthalate was detected in surface water during the first round of sampling, and di-n-butyl phthalate was detected in the second round of sampling. No PCBs, pesticides, or explosive concentrations were detected in the surface water samples.

A comparison of the results at sample location S-7 indicates that historical activities at the Sand Creek Site have not impacted surface water or sediment quality within the portion of the Sand Creek that is adjacent to the AOC. Furthermore, evaluation of the surface water and sediment data at the nearest downstream sample location (S-9 located approximately 1000 feet downstream of the site) provides support that historical activities at the Sand Creek Site have not impacted downstream conditions. In general, the FWBWQS 2003 Report (USACE, 2005a) concluded that surface water quality throughout the installation was generally good to excellent with very few exceedances of Ohio aquatic life water quality criteria (WQC). Sediment samples generally reflected non-contaminated conditions and stream habitat was good at most sites.

1.6.2.5 Removal Action (2003)

An RA at the Sand Creek Site was conducted by MKM between August and September 2003. The removal effort at the site consisted of removing all existing unconsolidated surface debris, the limited removal of subsurface debris, transportation and disposal of debris and restoration activities. Due to the presence of transite, all debris was disposed of as ACM special waste. Approximately 1,118 tons of ACM material, including the subsurface transite, glass, and miscellaneous debris were removed from the AOC (MKM, 2004).

1.6.2.6 Removal Action Sample Collection (2003)

An RA at the Sand Creek Site was conducted by MKM between August and September 2003. The removal effort at the site consisted of removing all existing unconsolidated surface debris, the limited removal of subsurface debris, transportation and disposal of debris, and restoration activities. Due to the presence of transite, all debris was disposed of as ACM special waste. Approximately 1,118 tons (~799 cubic yards) of ACM material, including soil, the subsurface transite, glass, and miscellaneous debris were removed from the AOC (MKM, *2004).* The areas that had the debris are presented on **Figure 1-5**.

Confirmatory soil, surface water, and sediment samples were collected in and around the site by MKM following the removal efforts to evaluate the success of the RA and characterize potential impact to Sand Creek and the neighboring floodplain (**Figure 1-5**). Prior to sampling, the dump area was divided into 30 sampling grids to facilitate collection of the soil discrete samples. One shallow soil sample (0 to 1 foot), not including duplicates and quality control (QC) samples, was collected from each grid (30 total) measuring approximately 40 feet by 40 feet. Surface water was collected at 3 locations, and sediment samples were collected at 12 locations within the Sand Creek and neighboring floodplains, respectively, to characterize potential impact associated with surface water runoff from the site.

A summary of results for the samples collected during the RA is as follows:

- **Surface Soil**—Multiple inorganics concentrations were detected in the 2003 RA confirmatory surface soil samples as more than the facility-wide BSVs. Although sporadic, numerous SVOCs consisting of polynuclear aromatic hydrocarbons (PAHs), three explosives (2,4-trintrotoluene, 2,4-dinitrotoluene, and 2,6-dinitrotoluene), one propellant (nitrocellulose), and one VOC concentration (chloroethane) were detected at two surface soil sample locations.
- **Sediment**—Multiple inorganics were detected in the RA confirmatory sediment samples in excess of the facility-wide BSVs), and one VOC (acetone) was detected at two sample locations. No SVOCs were detected.

- **Surface Water**—No VOCs, SVOCs, explosives, or propellants were detected during the 2003 RA. All detected metals were either essential nutrients (calcium, iron, magnesium, potassium, and sodium), or the MDC was less than the RVAAP surface water BSVs (arsenic, aluminum, barium, copper, manganese, and zinc).

Initial evaluation of the results indicates that there may be some impact to environmental media at the AOC because of historical activities, in particular surface soil. During confirmation sampling following the RA, two 75-mm projectile shells (i.e. munitions debris [MD]) were discovered at the northern portion of the site.

1.7 DGM Survey

Between April and May 2010, Shaw conducted a DGM survey at and in the immediate vicinity of the Sand Creek Site where historical dumping activities occurred. The primary purpose of the survey was to determine the horizontal extent of potential munitions and explosives of concern (MEC) contamination and other suspected buried anomalies without performing intrusive activities at the site. The secondary objective was to evaluate the data to characterize the anomaly density at the site. Geophysical data were collected south and north of the access road adjacent to the stream, along the steep slopes of the embankment in the central portion of the Sand Creek Site and east of the steep embankment in the open area. During this effort, data were acquired in accessible areas void of thick vegetation and fallen trees and where the embankments and other localized slopes were navigable by the field crew (Shaw, 2011). The areas at and adjacent to the Sand Creek Site that the DGM survey covered are presented in **Figure 1-6**.

The DGM data collected at the Sand Creek Site was able to determine the broader limits of metallic waste materials as well as to define more localized regions within and outside the AOC footprint that contain relatively higher metal content. The survey data indicated that the largest portion of the metal debris at the site is present northeast of the former railroad bed. Several areas characterized by relatively higher density of anomalies are located between the stream and the edge of the eastern plateau. The large oval-shaped area that trends southwest-northeast in the northeastern portion of the survey area (contiguous pink colors on **Figure 1-6**) is approximately 0.8 acres in size. Areas characterized by relatively lower density of anomalies are present throughout the southern portion of the survey area. During the survey of the area, the field crew noticed several relatively large areas where concrete rubble was present along and at the bottom of the embankment at the northern portion of the site.

1.8 Preliminary Evaluation for COPCs

This section presents a discussion of the preliminary evaluation for chemicals of potential concern (COPCs) at the Sand Creek Site based on data collected before the implementation of

the RI field activities. Prior to the RI, the only environmental data available specifically for the Sand Creek Site were from the confirmatory samples collected during the 2003 RA and is the basis for the preliminary conceptual site model (CSM) discussed in this RI. Surface water samples and a sediment sample were collected at the site as part of the 2003 FWBWQS and are also available. Although the samples from the study are not considered "site specific," they are used in this section to supplement the results of the 2003 RA data.

1.8.1 Summary of 2003 Removal Action Sampling Activities

The 2003 RA event included the collection of discrete surface soil (0 to 1 foot), sediment samples (0 to 6 inches) and surface water samples. The results and conclusions of the confirmatory sampling were evaluated and presented in the RD/RA Report (MKM, 2004). At the time the report was issued, the confirmatory results were compared to the former RVAAP BSVs for inorganics and the U.S. Environmental Protection Agency (EPA) Preliminary Remediation Goals (PRGs), which are based on risk-based screening concentrations adjusted to account for additive effects between chemicals and routes of exposure.

The confirmatory soil samples showed elevated concentrations (i.e., greater than the former RVAAP BSVs and/or the PRGs) of heavy metals in the northern third of the site with lower concentrations of heavy metals, SVOCs, explosives, and propellants dispersed over the remainder of the site. The confirmation sediment samples collected from the neighboring floodplain and Sand Creek reported arsenic levels greater than the EPA PRG level. Additionally, low levels of propellants and/or explosives were detected in the full suite sediment and surface water samples.

1.8.2 Summary of 2003 FWBWQS Sampling Activities

Surface water grab samples were collected from the upper 12 inches of stream water and sampled directly into appropriate containers. The stream sampling locations at the former RVAAP were sampled twice with the initial samples collected between June 17 and June 25, 2003. The second round of stream samples was collected between September 15 and September 18, 2003. Initial surface water sampling was concurrent with the sole sediment sampling event.

The stream sampling locations were sampled once for sediment between June 17 and June 25, 2003. To obtain a representative measure of chemical contamination within the sediment, the ISM was performed at each collocated biological sampling site. At each stream sample site, the entire sampling reach (120 to 210 meters [m]) was walked from downstream to upstream, with equal volume sediment subsamples taken randomly at 30 to 50 locations.

The results and conclusions were presented in the FWBWQS 2003 Report (USACE, 2005a) for the former RVAAP. The surface water samples were evaluated using comparisons to

OWQS criteria, reference conditions, or other published literature. Sediment evaluations were conducted using guidelines established in MacDonald et al. (2000), sediment reference values for inorganic chemicals that were included in the 2003 Ohio EPA *Ecological Risk Assessment Guidance Manual*, EPA Region 5 Ecological Screening Levels (ESLs), and published literature. For the purposes of this RI, the surface and sediment sample results from the 2003 FWBWQS will be evaluated as discussed in Section 1.3.3.3.

1.8.3 Screening Process for Preliminary COPCs

Since the submission of the RD/RA Report (MKM, 2004) and the FWBWQS 2003 Report (USACE, 2005a), the U.S. Army has refined the cleanup goal screening process at the former RVAAP and intends to clean up the various AOCs to an unrestricted land use scenario whenever possible. Shaw performed a data gap analysis of the existing data and comparison to the facility-wide cleanup goals (FWCUGs) for the unrestricted land use scenarios as well as to the desired land use by OHARNG (Military Training Land Use) in order to provide an assessment of preliminary COPCs. This evaluation is presented in the DQO Report (Shaw, 2009). The FWCUGs are presented in the *Final Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant* (SAIC, 2010), hereafter, referred to as the FWCUG Report.

Based on a comparison of the 2003 RA confirmatory sample results and the results of the 2003 FWBWQS to the FWCUGs, the preliminary COPCs in surface soil and sediment at the site are inorganics with sporadic concentrations of PAHs, explosives, propellants, and VOCs. The following sections discuss the preliminary COPCs based on the 2003 RA samples.

In order to be conservative, the results were screened against the FWCUGs for the identified receptors for the 10^{-6} (one in a million) excess cancer risk level and hazard quotient (HQ) equal to 0.1 ($^{1}/_{10}$ the noncancer risk) as presented in the FWCUG Report (SAIC, 2010). For organics, the contaminant was retained as a preliminary COPC if it was detected and no FWCUG is available. In the case where no FWCUG is available for an inorganic, it was retained as a preliminary COPC if it was detected, exceeded the former RVAAP BSV, and is not considered an essential nutrient (calcium, iron, magnesium, potassium, or sodium).

Surface Soil

Detected organics from the 2003 RA that do not have FWCUGs for surface soil include one propellant (nitrocellulose), three SVOCs (benzo(ghi)perylene, bis(2-ethylhexyl)phthalate, and phenanthrene), and one VOC (chloroethane). These were all retained as preliminary COPCs in surface soil. Arsenic was the only inorganic contaminant that exceeded the FWCUG for all receptors. Beryllium, lead, and selenium are inorganics that were detected in surface soil samples from the 2003 RA, but do not have FWCUGs; therefore, they were retained as preliminary COPCs for all receptors.

The unrestricted land use scenario applies for the Resident (Adult and Child) receptors. In addition to the aforementioned preliminary COPCs identified above for all receptors, additional preliminary COPCs identified in surface soil for the Adult Resident Receptor consist of five inorganics (antimony, cadmium, manganese, mercury, and silver) and seven SVOCs [benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo- (a,h)anthracene]. The preliminary COPCs for the Child Resident Receptor were similar to the Adult Resident Receptor with the exception that copper and barium were identified as noncancer risk preliminary COPCs for this receptor. Arsenic was the most pervasive inorganic preliminary COPC that was identified as a potential cancer risk for both unrestricted land use receptors.

Sediment

The FWCUG Report (SAIC, 2010) provides sediment screening values. The Child Resident Receptor was the only unrestricted land use receptor identified with additional preliminary COPCs (aluminum and silver) in sediment. No additional preliminary COPCs were identified in sediment for the Adult Resident Receptor. The only additional preliminary COPC identified in sediment for the National Guard Trainee was aluminum.

Surface Water

The FWCUG Report (SAIC, 2010) provides surface water screening values. Arsenic, cobalt, and lead were inorganics detected in the surface water sample collected during the 2003 FWBWQS and were identified as preliminary COPCs for the Resident Receptor (Adult and Child) and National Guard Trainee receptors. Arsenic was identified as a preliminary COPC since the concentration exceeded the FWCUG excess cancer risk values for these receptors. Cobalt and lead were retained as preliminary COPCs since there are no final FWCUG screening values for these inorganics. One SVOC (di-n-butyl phthalate) was detected in the June 2003 surface water sample collected adjacent to the site for the FWBWQS. This SVOC was identified as a preliminary COPC for the National Guard Trainee and the Resident Receptor (Adult and Child) since no FWCUG screening values were available for this chemical.

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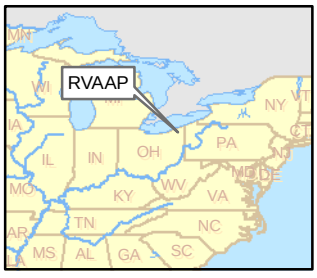
Project Number: 133616



Note:
The Scale is for the Upper Map Only
Showing the RVAAP Location

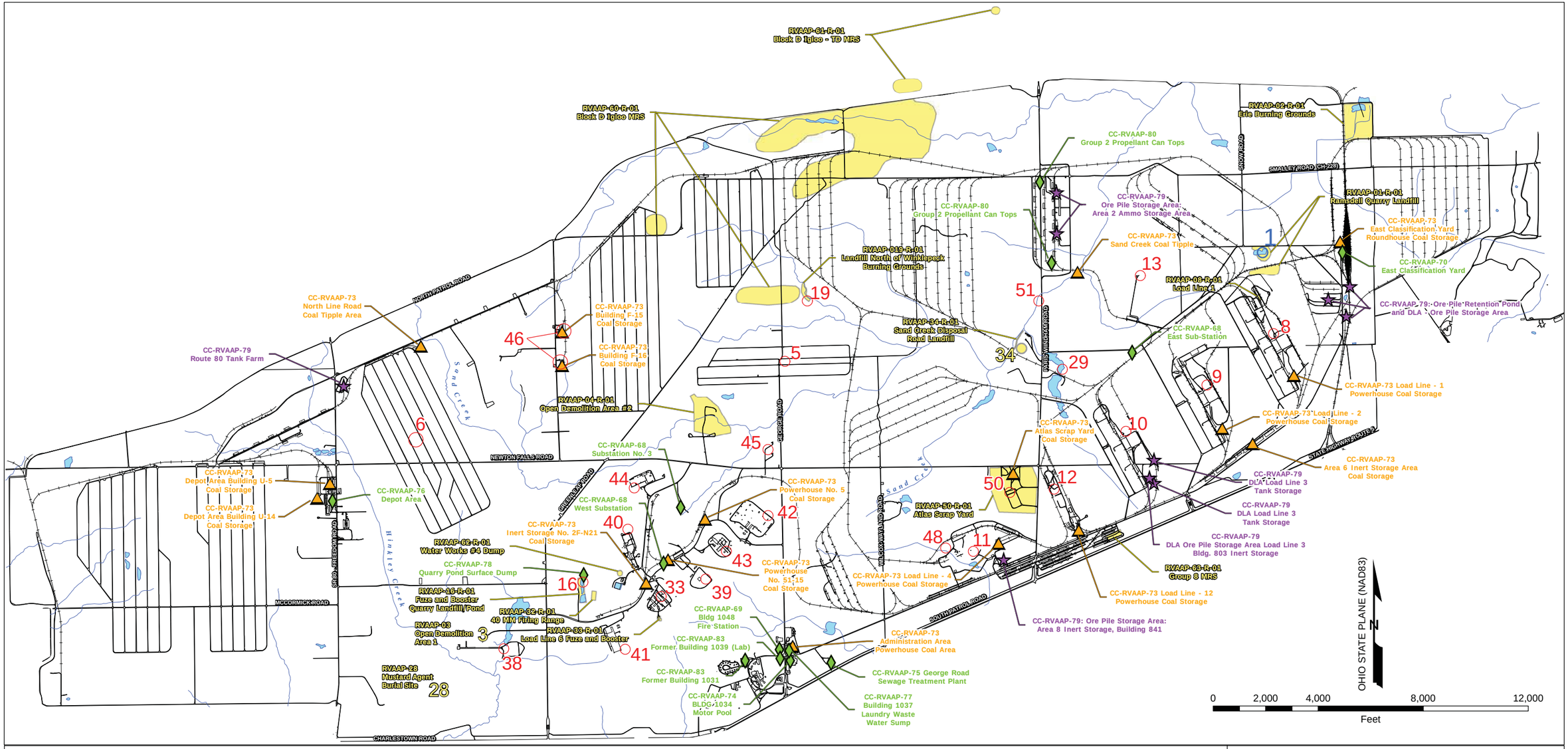


U.S. ARMY
CORPS OF ENGINEERS
LOUISVILLE DISTRICT

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

Figure 1-1 Location Map



LEGEND OF SITES

IRP SITES (29 SITES)

- RVAAP-01 ..... RAMSDELL QUARRY LANDFILL
- ~~RVAAP-03~~ ..... OPEN DEMOLITION AREA 1
- RVAAP-05 ..... WINKLEPECK BURNING GROUNDS
- RVAAP-06 ..... C BLOCK QUARRY
- RVAAP-08 ..... LOAD LINE 1
- RVAAP-09 ..... LOAD LINE 2
- RVAAP-10 ..... LOAD LINE 3
- RVAAP-11 ..... LOAD LINE 4
- RVAAP-12 ..... LOAD LINE 12
- RVAAP-13 ..... BLDG 1200 AND DILLUTION/SETTLING POND
- RVAAP-16 ..... FUZE AND BOOSTER QUARRY LANDFILL/PONDS
- RVAAP-19 ..... LANDFILL NORTH OF WINKLEPECK BURNING GROUND
- ~~RVAAP-28~~ ..... MUSTARD AGENT BURIAL SITE
- RVAAP-29 ..... UPPER AND LOWER COBBS POND
- RVAAP-33 ..... LOAD LINE 6
- RVAAP-34 ..... SAND CREEK DISPOSAL ROAD LANDFILL
- RVAAP-38 ..... NACA TEST AREA
- RVAAP-39 ..... LOAD LINE 5
- RVAAP-40 ..... LOAD LINE 7
- RVAAP-41 ..... LOAD LINE 8
- RVAAP-42 ..... LOAD LINE 9
- RVAAP-43 ..... LOAD LINE 10
- RVAAP-44 ..... LOAD LINE 11
- RVAAP-45 ..... WET STORAGE AREA
- RVAAP-46 ..... BUILDINGS F-15 AND F-16
- RVAAP-48 ..... ANCHOR TEST AREA
- RVAAP-50 ..... ATLAS SCRAP YARD
- RVAAP-51 ..... DUMP ALONG PARIS-WINDHAM ROAD
- RVAAP-66 ..... FACILITY-WIDE GROUNDWATER
- RVAAP-67 ..... FACILITY-WIDE SEWERS

COMPLIANCE RESTORATION SITES (13 SITES)

- CC-RVAAP-68 ..... ELECTRIC SUBSTATIONS (E,W,No.3)
- CC-RVAAP-69 ..... BUILDING 1048 - FIRE STATION
- CC-RVAAP-70 ..... EAST CLASSIFICATION YARD
- CC-RVAAP-72 ..... FACILITY-WIDE USTS (45 SITES)
- CC-RVAAP-73 ..... FACILITY-WIDE COAL STORAGE
- CC-RVAAP-74 ..... BUILDING 1034 MOTOR POOL HYDRAULIC LIFT
- CC-RVAAP-75 ..... GEORGE ROAD SEWAGE TREATMENT PLANT
- CC-RVAAP-76 ..... DEPOT AREA
- CC-RVAAP-77 ..... BUILDING 1037 LAUNDRY WASTE WATER SUMP
- CC-RVAAP-78 ..... QUARRY POND SURFACE DUMP
- CC-RVAAP-79 ..... DLA ORE STORAGE SITES
- CC-RVAAP-80 ..... GROUP 2 PROPELLANT CAN TOPS
- CC-RVAAP-83 ..... FORMER BUILDINGS 1031 AND 1039

MMRP SITES (14 SITES)

- RVAAP-001-R-01 ..... RAMSDELL QUARRY LANDFILL MRS
- RVAAP-002-R-01 ..... ERIE BURNING GROUNDS MRS
- RVAAP-004-R-01 ..... OPEN DEMOLITION AREA #2 MRS
- RVAAP-008-R-01 ..... LOAD LINE 1 MRS
- RVAAP-016-R-01 ..... FUZE AND BOOSTER QUARRY MRS
- RVAAP-019-R-01 ..... LANDFILL NORTH OF WINKLEPECK MRS
- RVAAP-062-R-01 ..... 40MM FIRING RANGE MRS
- RVAAP-063-R-01 ..... FIRESTONE TEST FACILITY MRS
- RVAAP-034-R-01 ..... SAND CREEK DUMP MRS
- RVAAP-050-R-01 ..... ATLAS SCRAP YARD MRS
- RVAAP-060-R-01 ..... BLOCK D IGLOO MRS
- RVAAP-061-R-01 ..... BLOCK D IGLOO -TD MRS
- RVAAP-062-R-01 ..... WATER WORKS #4 DUMP MRS
- RVAAP-066-R-01 ..... GROUP 8 MRS

- ..... CERCLA
- ..... RCRA
- ..... MMRP SITES
- ..... COMPLIANCE RESTORATION SITES - APPROVED
- ..... DLA ORE STORAGE AREAS (7 SITES)
- ..... COAL STORAGE AREAS (17 SITES)

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Figure 1-2
RVAAP
Facility Map

US Army Corps of Engineers
Louisville District



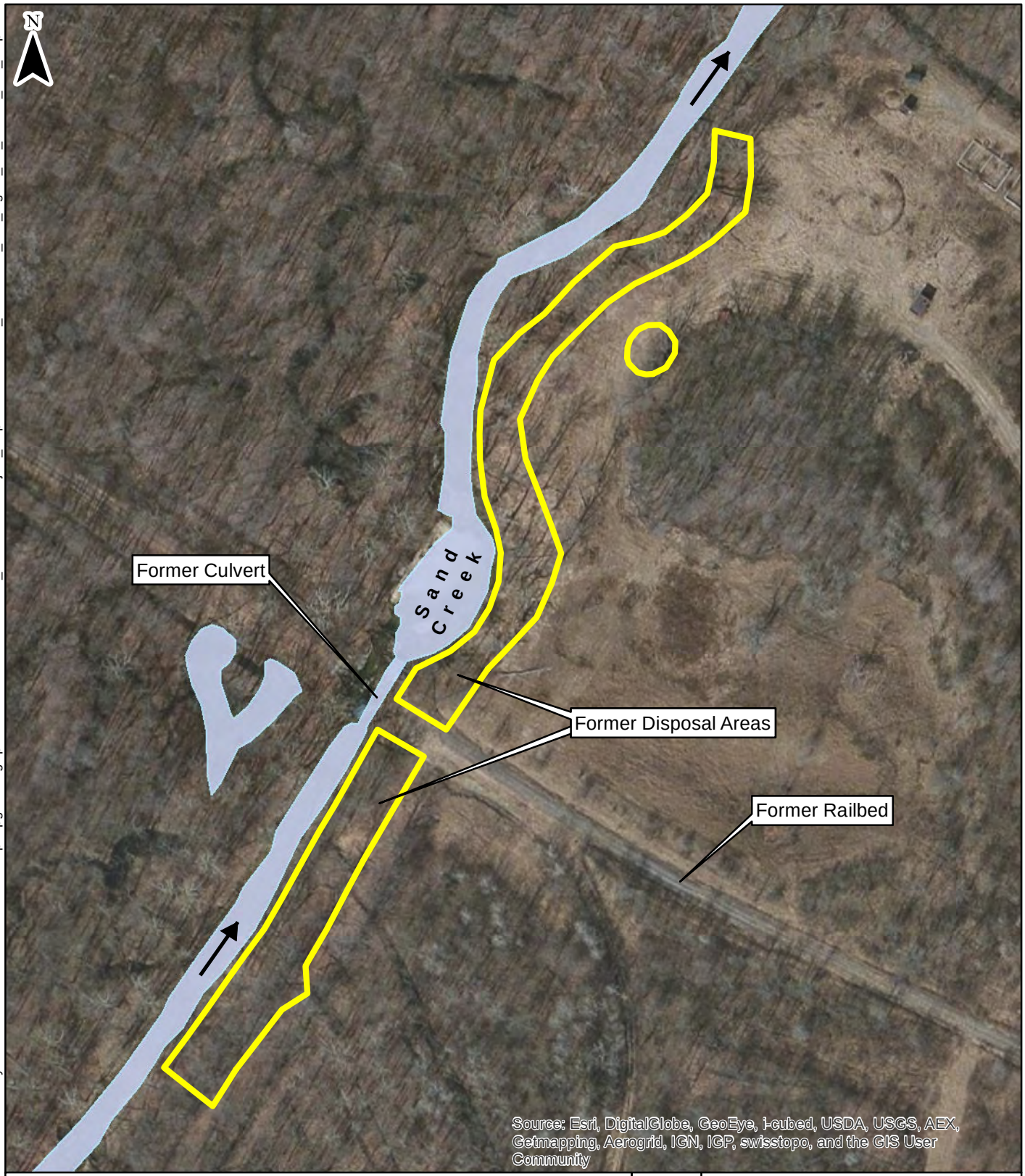


Figure 1-3 Site Map

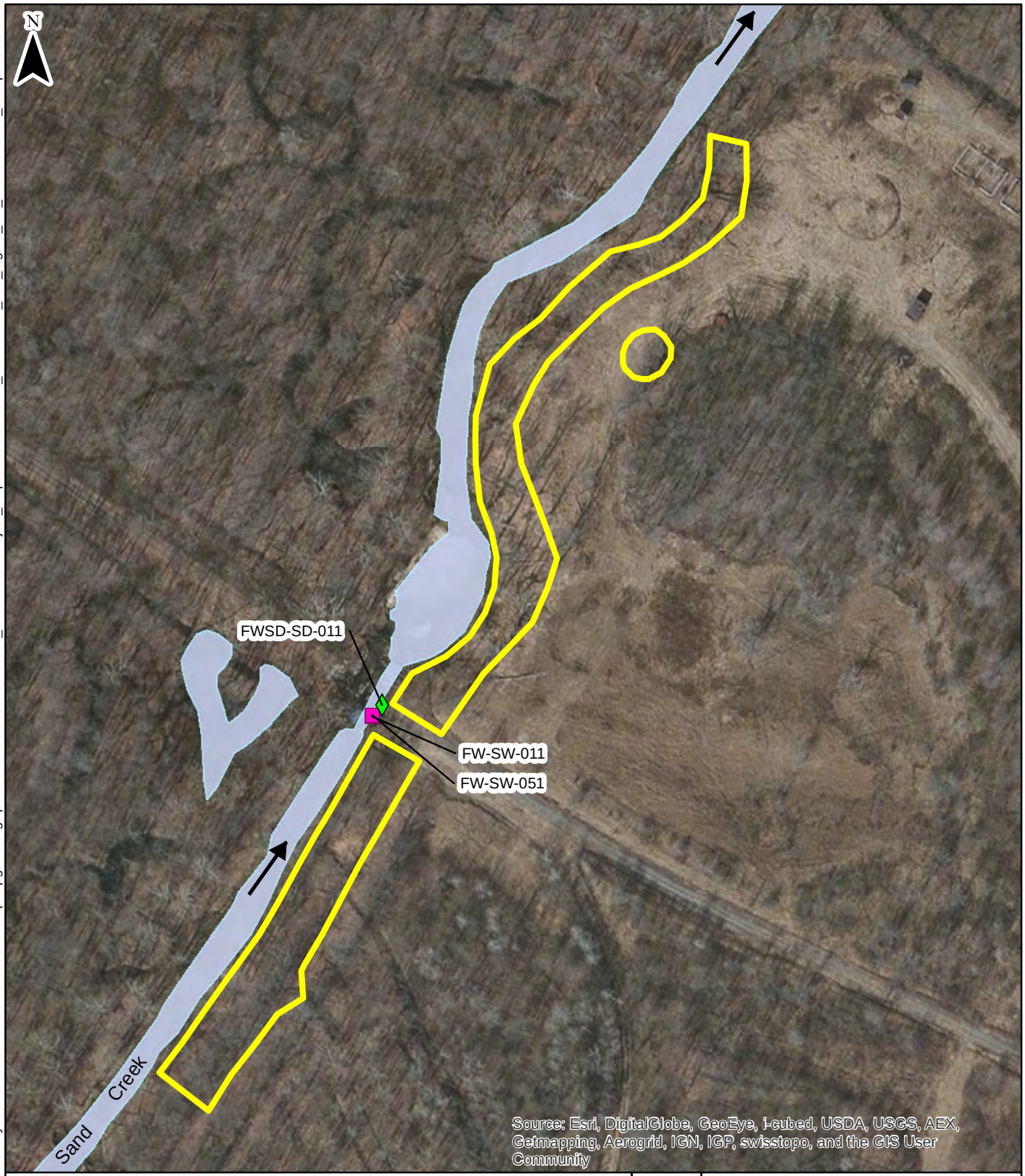


Figure 1-4 2003 Facility-Wide Biological and Water Quality Study Sample Locations

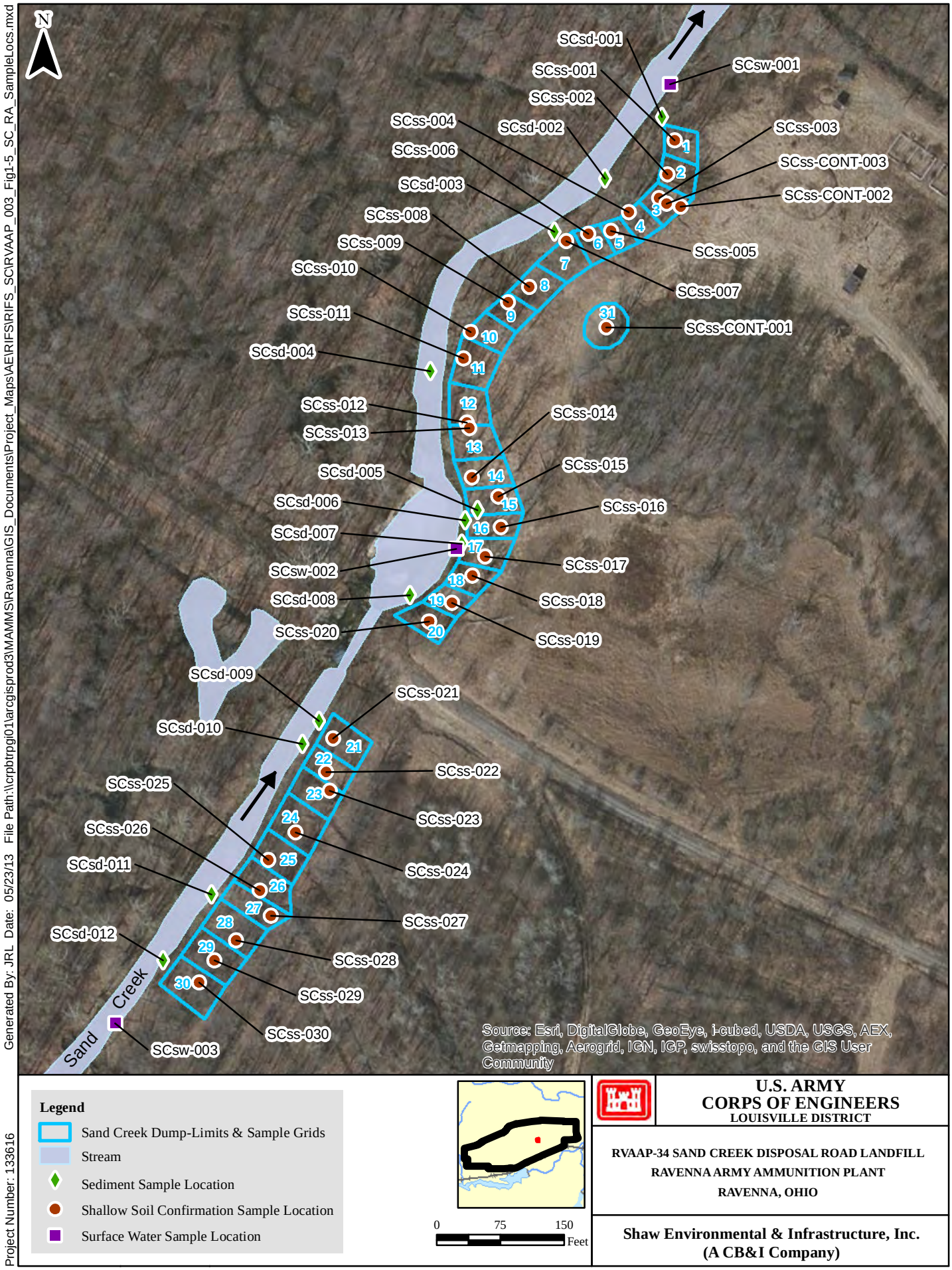


Figure 1-5 2003 Removal Action Sample Locations

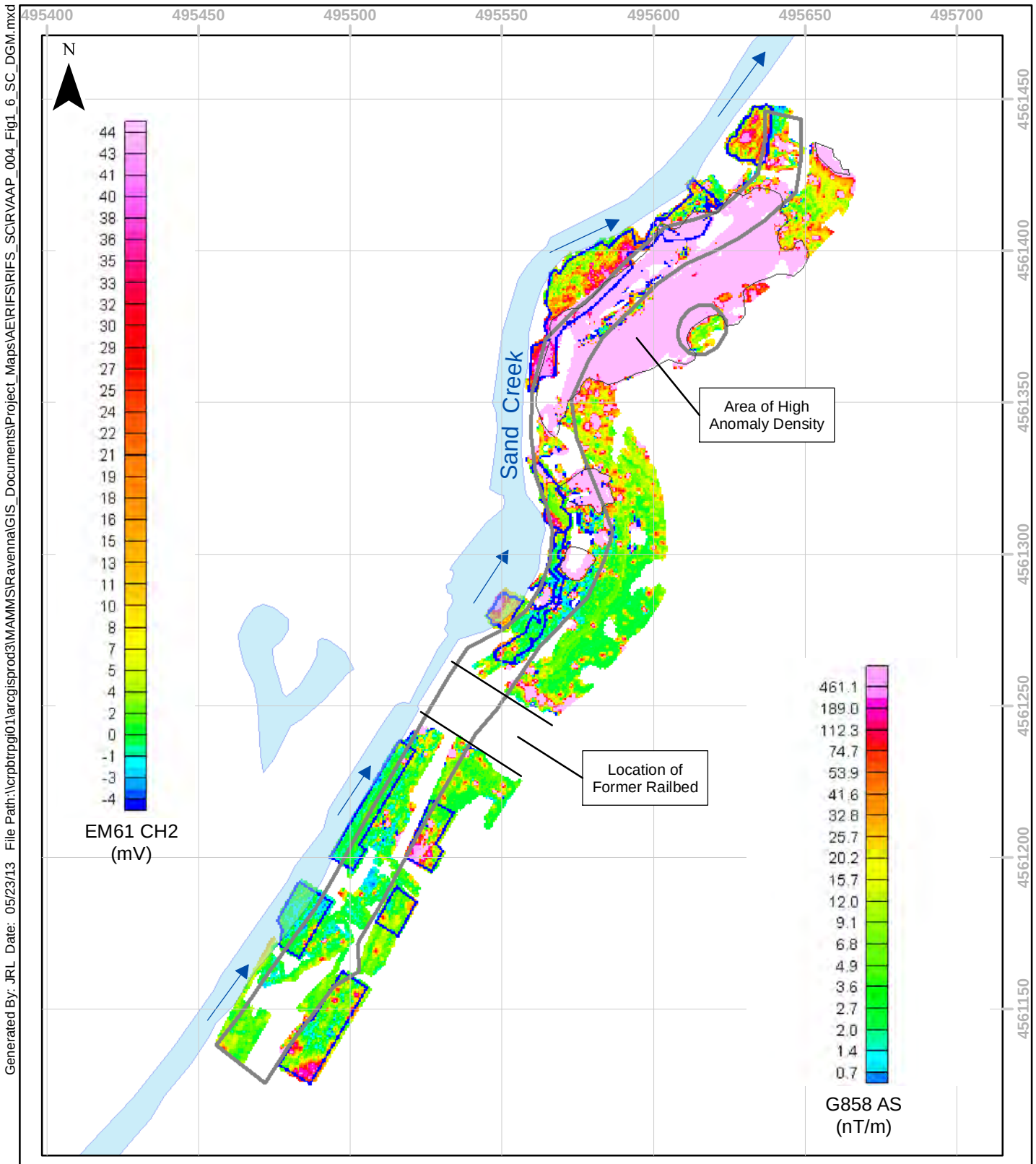


Figure 1-6 Geophysical Investigation Boundary

2.0 PHYSICAL CHARACTERISTICS

This chapter presents the physical characteristics of the former RVAAP and the Sand Creek Site and the surrounding environment that are factors in understanding potential contaminant transport pathways, receptors, and exposure scenarios for human health and ecological risks. The physiographic setting, hydrology, climate and ecological characteristics of the former RVAAP were primarily compiled from information originally presented in the *Phase I Remedial Investigation Report for the High-Priority Areas of Concern at the Ravenna Army Ammunition Plant* (USACE, 1998) that included the Sand Creek Site, the *Updated Integrated Natural Resources Management Plan at the Ravenna Training Logistics Site* (AMEC Earth and Environmental, Inc. [AMEC], 2008), and the *Facility-Wide Groundwater Monitoring Program Plan for the Ravenna Army Ammunition Plant* (USACE, 2004). The CSM for the Sand Creek Site at the end of this section is based on site-specific data from the RI field investigation and local and regional information.

2.1 Physiographic Setting

The former RVAAP is located within the southern New York section of the Appalachian Plateaus physiographic region of northeastern Ohio. Although the land within this region was uplifted as part of the Appalachian Mountain building 2.2 process, the glaciers were able to override the gentle hills of the plateau. Huge ice blocks broke free from the glaciers, and kettle lakes formed as the blocks melted. Eventually, these lakes filled with sediment leaving boggy wetlands with unique assemblages of plants. Ridges and flat uplands, which are covered with thin drift and dissected by steep valleys, occur gently about 1,200 feet above mean sea level (amsl). Valley segments, ranging in elevation from 600 to 1,500 feet amsl, alternate between broad drift-filled and narrow rock-walled reaches (USACE, 1998).

The former RVAAP is in the Mahoning River Basin. Three major streams that include the South Fork Eagle Creek, Sand Creek, and Hinkley Creek drain approximately 65 percent of the facility. The northern and central portions of the former RVAAP, including the site, are drained by Sand Creek. Sand Creek subsequently drains to South Fork Eagle Creek and runs into Eagle Creek and finally the Mahoning River. The western portions of the former RVAAP drain to Hinkley Creek and subsequently to the West Branch of the Mahoning River. The easternmost portion of the installation drains to the West Branch of the Mahoning River near its confluence with the main trunk of the Mahoning River. The southern areas drain directly into the Michael J. Kirwan Reservoir. Several smaller, unnamed creaks drain other areas of the installation (USACE, 1998).

Overall, the former RVAAP can be considered flat land, although there are occasional steep slopes. Many of the steep slopes are due to modifications of the landscape from cut and fill

operations during the construction of the ammunition plant in the 1940s. The topographic relief across the installation is approximately 290 feet, with the elevation high point located in the northwest portion of the former RVAAP at approximately 1,220 amsl. The lowest point elevation of the installation is at the southeast corner, at approximately 930 amsl (AMEC, 2008).

2.1 Climate

The general climate of the former RVAAP area is continental and is characterized by moderately warm and humid summers, reasonably cold and cloudy winters, and wide variations in precipitation from year to year. The following climatological data were obtained from the Midwest Regional Climate Center at the Youngstown-Warren Regional Airport located in Trumbull County and are based on a 30-year average between 1971 and 2000 (Midwest Regional Climate Center, 2000).

Total annual rainfall in the former RVAAP area is approximately 38.2 inches, with the greatest monthly average occurring in July (4.10 inches) and the lowest monthly average occurring in February (2.03 inches). Average annual snowfall totals approximately 55 inches with the greatest monthly average occurring in January (14.3 inches). Due to the influence of lake-effect snowfall events associated with Lake Erie, located approximately 35 miles to the northwest of the former RVAAP snowfall totals vary widely throughout northeastern Ohio.

The average annual daily temperature in the former RVAAP area is 48.3 degrees Fahrenheit (ºF), with an average daily high temperature of 58.2ºF and an average daily low temperature of 38.8ºF. The prevailing wind direction at the former RVAAP is from the southwest. Severe weather, in the form of thunder and hail in summer and snowstorms in winter is common. Tornadoes are infrequent in Portage County. However, minor structural damage to several buildings on facility property occurred as the result of a tornado in 1985.

2.2 Surface Features and Site Topography

The Sand Creek Site is in the eastern portion of the former RVAAP and encompasses approximately 1 acre along the eastern bank of the Sand Creek. The bank slopes from east to west towards Sand Creek 40 to 60 degrees from horizontal. Topographic relief between the top of embankment and the surface of Sand Creek varies across the AOC, but ranges from approximately 15 to 25 feet, representing the former extent of the dump area (**Figure 2-1**). There are no records indicating the quantities or materials dumped at the site and the dates of operation for the landfill are unknown. Therefore, the depth of the original unconsolidated glacial material overlying bedrock is unknown along the slopes of the dumpsite. Some visible surface debris, primarily large pieces of concrete construction debris, remains along and at the bottom of the embankments of the former disposal area. This surface debris is mostly situated at the northern portion of the site. A former rail bed bisects the site and the only nearby

structures include the former sewage treatment plant buildings located adjacent to the northeast end of the site. The site is overgrown with mature trees and ground level vegetation. A narrow floodplain occupies the land between the bottom of the AOC embankment and the Sand Creek. The bottom of the embankment represents the lowest elevation at the AOC.

2.3 Geology

This section presents the regional geology at the former RVAAP and the local geology identified at the Sand Creek Site.

2.3.1 Regional Geology

The regional geology at the former RVAAP consists of horizontal to gently dipping bedrock strata of the Mississippian- and Pennsylvanian-age overlain by varying thickness of unconsolidated glacial deposits. The bedrock and unconsolidated geology at the former RVAAP and the geology specific to the Sand Creek Site are presented in this section.

2.3.1.1 Soils and Glacial Deposits

Two Wisconsinan-age glacial advances resulted in the disposition of a mantle of glacial till throughout the area that comprises the former RVAAP in the late Pleistocene. The first glacial advance deposited the Lavery Till. This till consists mostly of clayey silt with sparse cobbles and pebbles, and has an average thickness of 4 feet. The second glacial advance deposited the Hiram Till on top of the Lavery, over the eastern two-thirds of the former RVAAP. The Hiram Till consists of silty clay with some sand, and occurs from 5 to 15 feet below ground surface (bgs), although it may be locally thicker based on the results of the soil borings advanced at the site during the RI activities. In the far northeastern corner of the former RVAAP, the Hiram Till overlies thin beds of sandy outwash. Field observations indicate that overall thickness of glacial deposits at 2 feet or less in some parts of the installation. This may be the result of natural erosion or construction grading rather than the nondeposition of till.

The primary soil type that can be found at the Sand Creek Site consists of Mahoning silt loam with 0- to 2-percent and 2- to 6-percent slopes. Mahoning silt loam is a deep, somewhat poorly drained soil formed in silty clay loam or clay loam glacial till, generally where bedrock is greater than 5 feet bgs. Surface water runoff is medium to rapid, and soil is seasonally wet. Permeability is slow or very slow. This soil warms and dries slowly in spring. Rooting depth is influenced by the upper 15 to 20 inches. It is moderately deep over glacial till. Available water capacity is moderate. Organic matter content is moderately low. The surface layer is very strongly acid to neutral, and the subsoil is very strongly acid to mildly alkaline (USACE, 1998). **Figure 2-2** presents a geologic map of unconsolidated deposits at the former RVAAP.

2.3.1.2 Bedrock

Mississippian- and Pennsylvanian-age sandstones and conglomerates make up the stratigraphy underlying the Hiram and Lavery Tills at the former RVAAP. The Mississippian Cuyahoga Formation, consisting of blue-gray silty shale with interbedded sandstone, crops out in the far northeastern corner of the facility. The Cuyahoga Formation has a gentle southward regional dip of 5 to 10 feet per mile. The remainder of the facility is underlain by the Pottsville Formation of Pennsylvanian age. The Pottsville rests uncomformably on the eroded Cuyahoga Formation, and dips 5 to 10 feet per mile.

The Connoquenessing, Mercer, and Homewood members of the Pottsville Formation are present beneath the western half of the former RVAAP. The Connoquenessing is coarse gray sandstone with thin interbeds and partings of sandy shale. The Mercer, overlying the Connoquenessing, consists of silty to carbonaceous shale with thin, discontinuous sandstone lenses. The Homewood Member lays uncomformably on the Mercer and consists of coarse-grained cross-bedded sandstones.

The Sharon member of the Cuyahoga Formation is the primary formation that underlies the eastern half of the former RVAAP where the AOC is located. The Sharon Conglomerate is porous, coarse-grained, gray-white sandstone, commonly with white quartz pebbles and locally thin shale lenses. The Sharon shale overlies the conglomerate and consists of sandy, gray-black, fissile shale with plant fragments and thin flagstone beds.

Bedrock beneath the Sand Creek Site consists of the Berea Sandstone that is present at a very small area at the eastern portion of the former RVAAP. The Berea Sandstone formation is surrounded by the Sharon Conglomerate which underlies much of the eastern portion of the former RVAAP. The Berea Sandstone is generally 50 to 100 feet throughout its extent and consists predominantly of light gray sandstone that is fine grained in the lower and upper parts of the formation but medium to coarse grained in the middle. It is silty and pyritic in its lower part (USACE, 1998). A geologic map of bedrock at the former RVAAP is presented in **Figure 2-3**.

2.3.2 Sand Creek Disposal Road Landfill Geology

This section presents the site-specific geologic setting at the Sand Creek Site and is based on the observations made during subsurface borings advanced during the RI field activities. A total of 22 borings were advanced at the Sand Creek Site during the RI field activities to a maximum depth of 20 feet bgs. The methods used to advance the borings consisted of direct push technology (DPT) and manual hand augers. The locations of the borings at the Sand Creek Site are presented on **Figure 2-4**. A cross-section of that depicts the observations made at the AOC during the RI field work is presented in **Figure 2-5**. The boring logs for the RI

field activities are presented in **Appendix A**. Additional information can be found in Section 2.3.2. and Figure 1-5.

2.3.2.1 Soils

As a former landfill and disposal site, it is expected that much of the native soil at the site was reworked, removed, or used as cover material during dumping activities. Evidence of fill material that included coal ash and glass debris was encountered in the borings advanced along the top of the embankment as deep as 8 feet bgs, primarily at the northern portion of the site (soil boring locations SCsb-035, SCsb-036, and SCsb-037). Evidence of this debris was also visibly observed along the surface of the slope at the northern portion of the site as well. The depth of fill material along the top of the slopes appeared to decrease as the borings were advanced towards the southern portion of the site. Between boring locations SCsb-039 and SCsb-042, fill material was encountered at depths of less than 2 feet. At boring location SCsb-043, the only boring to be advanced to 20 feet bgs south of the former rail bed, only native glacial materials were observed. Glacial materials encountered in the borings were consistent with the deposits associated with the Mahoning silt loam that include light brown to dark brown, gray, and mottled silt with sand. Associated sediments were observed below the till and consisted of well-sorted, saturated gray silt with clay lenses and unconsolidated fine- to medium-grained sands. The depth to sediments ranged from 13 to 15 feet bgs across the site, which was the approximate depth where groundwater was encountered in three borings (SCsb-035, SCsb-036, and SCsb-037) at the northern portion of the site (**Appendix A**).

Evidence of fill material consisting of construction debris, slag, glass, and plastic materials were identified at various locations at the central portions of the Site (SCsb-045 through SCsb-051) along the slopes of the embankment. Refusal associated with buried debris was encountered at borings SCsb-045 at 4.25 feet bgs, SCsb-047 at 3 feet bgs, and SCsb-048 at 3.5 feet bgs. Glacial materials consistent with the till were penetrated in the remaining borings located to the extreme north of the site (SCsb-044) and to the south of SCsb-051 (SCsb-052 through SCsb-056) (**Appendix A**).

2.3.2.2 Bedrock

Bedrock is not visible at the site and was not encountered during boring activities which were advanced a maximum of 20 feet bgs at nine locations at the site.

2.4 Hydrogeology

This section presents the regional hydrogeology at the former RVAAP and a discussion of the local hydrogeologic setting at the Sand Creek Site based on observations made during the RI field activities.

2.4.1 Regional Hydrogeology

A buried glacial valley, oriented southwest-northeast, is located at the central portion of the former RVAAP. This valley is filled with glacial outwash consisting of poorly sorted clay, till, gravel, and silt sand. The depths of the deposits in this valley range from 100 to 200 feet bgs. Generally, these saturated zones in this glacial valley are too thin and localized to provide large quantities of water for industrial or public water supplies. However, yields are sufficient for residential water supplies.

Lateral continuity of these aquifers is not known. Recharge of these units comes from surface water infiltration of precipitation and surface streams. Specific groundwater recharge and discharge areas at the former RVAAP have not been delineated. However, extensive upland areas, such as north of the Winklepeck Burning Grounds and in the western portion of the facility, are presumed to be regional recharge zones. The major perennial surface water drainages (i.e., Sand Creek, Hinkley Creek, and Eagle Creek) are presumed to be the major groundwater recharge areas (USACE, 1998).

2.4.1.1 Unconsolidated Sediment

The thickness of the unconsolidated interval ranges from thin to absent in the southeastern portion of the former RVAAP to an estimated 150 feet in the central portion of the installation. The groundwater table occurs within the unconsolidated zone in many areas of the former RVAAP. Because of the very heterogeneous nature of the unconsolidated glacial materials, groundwater flow patterns are difficult to determine with a high degree of accuracy. Vertical recharge from precipitation likely occurs via infiltration along root zones and desiccation cracks and partings within the soil column. Laterally, most groundwater flow likely occurs along preferential pathways (i.e., sand seams, channel deposits, or other stratigraphic discontinuities) having higher permeabilities than surrounding clay or silt-rich materials (SAIC, 2005).

2.4.1.2 Bedrock Hydrogeology

The most significant bedrock sources of groundwater near the former RVAAP are the sandstone/conglomerate members of the Pottsville Formation. These aquifers, together with two other deeper Mississippian/Devonian sandstone aquifers, represent the most important bedrock sources of groundwater in Northeastern Ohio.

The Sharon Conglomerate is the primary source of groundwater at the former RVAAP and maintains the most significant well yields of the Pottsville Formation members with hydraulic conductivity (K) values of 5 to 2,000 gallons per day per foot (gpd/ft). Past studies of the Sharon Conglomerate indicate that the greatest yields are associated with the true conglomerate phase (coarse-grained sandstone with abundant quartz pebbles), and with joints and factures in the bedrock. Where present, the overlying Sharon Shale acts as a relatively

impermeable confining layer for the Sharon Conglomerate. This is evidenced by several flowing artesian production wells that have been installed at the former RVAAP.

The Connoquenessing Sandstone and the Homewood Sandstone are the remaining aquifers of the Pottsville Formation and exhibit hydraulic conductivities of 5 to 300 gpd/ft and 5 to 200 gpd/ft, respectively. Well yields in the Connoquenessing and Homewood sandstones, although lower in the Sharon Conglomerate, are high enough to provide significant quantities of water. Several wells at the former RVAAP have penetrated both the Sharon Conglomerate and the Connoquenessing Sandstone and reportedly produced water from both units.

In general, hydraulic conductivities for the shales of the Sharon and Mercer members of the Pottsville Formation are low and result in significant groundwater yields. The porosity of the shales is likely secondary, in the form of joints and fractures in the bedrock. However, there is no facility-specific information available regarding occurrence of joints and fractures in these units (SAIC, 2005).

2.4.1.3 Groundwater Flow Directions

Groundwater in both the unconsolidated and bedrock aquifers at the former RVAAP predominantly flows in an eastward direction. The unconsolidated aquifer, however, also shows numerous local flow variations that are influenced by topography and site drainage patterns. The local variations in flow direction suggests groundwater in the unconsolidated deposits is generally in direct hydraulic communication with surface water, and that surface water drainage ways may also act as groundwater discharge locations. In addition, topographic ridges between surface water drainage features act as groundwater divides for groundwater found in the unconsolidated deposits (SAIC, 2005).

2.4.1.4 Surface Water

The entire former RVAAP facility is situated within the Mahoning River Basin, with the West Branch of the Mahoning River representing the major surface stream in the area. The West Branch flows adjacent to the west end of the facility, generally in a north to south direction, before flowing into the Michael J. Kirwan Reservoir, which is located to the south of State Route 5. The West Branch flows out of the reservoir along the southern facility boundary before joining the Mahoning River east of the former RVAAP.

The western and northern portions of the former RVAAP facility display low hills and a dendritic surface drainage pattern. The eastern and southern portions are characterized by an undulating to moderately level surface, with less dissection of the surface drainage. The facility is marked with marshy areas and flowing and intermittent streams whose headwaters are located in the facility's hills. Three primary water courses drain the former RVAAP: (1)

the South Fork of Eagle Creek, (2) the Sand Creek, and (3) the Hinkley Creek. These water courses have many associated tributaries.

Sand Creek, with a drainage area of 13.9 square miles, flows generally in a northeast direction to its confluence with the South Fork of Eagle Creek. In turn, the South Fork of Eagle Creek then continues in a northerly direction for 2.7 square miles to its confluence with Eagle Creek. The drainage area of the South Fork of Eagle Creek is 26.2 square miles, including the area drained by Sand Creek. Hinkley Creek originates just southeast of the intersection between State Routes 88 and 303 to the north of the facility. Hinkley Creek, with a drainage area of 11.0 square miles, flows in a southerly direction through the installation to its confluence with the West Branch of the Mahoning River south of the facility.

Approximately 50 ponds are scattered throughout the installation. Many were built within natural drainage ways to function as settling ponds or basins for process effluent and runoff. Others are natural in origin, resulting from glacial action or beaver activity. All water bodies at the former RVAAP support an abundance of aquatic vegetation and are well stocked with fish. None of the ponds within the installation are currently used as a potable water supply source.

Storm water runoff is controlled primarily by natural drainage except in facility operations areas where an extensive storm sewer network helps to direct runoff to drainage ditches and settling ponds. In addition, the storm sewer system was one of the primary drainage mechanisms for process effluent during the period that production facilities were in operation (USACE, 1998).

2.4.2 Sand Creek Disposal Road Landfill Hydrogeology

There are currently no potentiometric data for the Sand Creek Site since no monitoring wells have been installed at the AOC. However, based on the significant topographic features at the site and the presence of the continuously flowing Sand Creek adjacent to the west of the AOC, it is assumed that groundwater at the site flows in a westerly to northwesterly direction towards the creek.

There are various depressions and several areas of standing water at the top of the embankment which is indicative of the silt-clay soils that are present in the subsurface. However, in general surface water runoff follows the topography of the site and flows in a westerly direction where it enters Sand Creek.

Throughout the facility, average depth to groundwater is as deep as 50 feet bgs with static water levels occurring between 958 and 1,184 feet amsl (Kammer, 1982). However, groundwater has been encountered at much shallower depths in the upper unconsolidated

aquifer across the former RVAAP. The latter is most likely the case at the Sand Creek Site where the top of the embankment ranges from 15 to 25 feet above the surface of Sand Creek, and saturated soil was encountered in the soil borings at the northern portion of the site (SCsb-035, SCsb-036, and SCsb-037), where the embankment is the shortest, at depths of approximately 13 feet bgs (**Appendix A**). The depth at which saturated soil was encountered in the soil borings advanced at the AOC during the RI field activities is presented in **Figure 2-4**.

2.5 Demography and Land Use

The 2010 Census (U.S. Census Bureau, 2010) lists the total populations of Portage County and Trumbull County as 161,419 and 210,312, respectively. Population centers closest to the former RVAAP are Ravenna, Ohio, with a population of 11,724, and Newton Falls, Ohio, with a population of 4,795.

The former RVAAP facility is in a rural area and is not close to any major industrial or developed areas. Approximately 55 percent of Portage County, in which much of the former RVAAP is located, consists of either woodland or farm acreage. The Michael J. Kirwan Reservoir (also known as West Branch Reservoir) is the closest major recreational area and is located adjacent to the western half of the former RVAAP, south of State Route 5.

The OHARNG is licensed to use the facility as a military training site, Camp Ravenna. The restoration program for the former RVAAP is managed by the ARNG and OHARNG. This program involves cleanup of former production/operational areas throughout the facility related to former activities conducted there. Training and related activities at Camp Ravenna include: range operations, field operations and bivouac training, convoy training, equipment maintenance, C-130 aircraft drop zone operations, helicopter operations, and storage of heavy equipment."

The Sand Creek Site is in the eastern central portion of the facility. The AOC is not currently used for military training activities but may receive periodic foot traffic during maintenance, restoration, and security activities. Future land use at the AOC is the Military Training Land Use. The Representative Receptor for this Land Use is the NGT per the *USACE's Facility-Wide Human Health Risk Assessment Manual* (HHRAM - USACE, 2005b) and the 2014 Risk Assessment Tech Memo. This anticipated future Land Use, in conjunction with the evaluation of Unrestricted (Residential) Land Use form the basis for identifying chemicals of concern (COCs) in this RI. Residential land use, specifically the Resident Receptor (Adult and Child) scenario, is included to evaluate COCs for Unrestricted (Residential) Land Use at the AOC as required by the CERCLA process and as outlined in the HHRAM (USACE, 2005b).

A third Land Use was also included in this revised RI. The third Land Use, Commercial Industrial Land Use was identified in the Risk Assessment Tech Memo as a means to evaluate the site to determine if the site is suitable for full-time, permanent employees. Per the Risk Assessment Tech Memo (NGB, 2014), if the criteria for the Commercial Industrial Land Use is met, then no additional remedial actions are required except for the development of Land Use Controls through the CERCLA process (FS, PP, ROD, etc.). The Commercial Industrial Land Use is evaluated using the USEPA's generic Composite Worker Receptor referred to herein as the Industrial Receptor. The Military Training Land Use is the primary Land Use and is protective of all activities that the OHARNG may conduct on the site except for full-time, permanent occupational occupancy. Evaluation of the three Land Uses in the RI will allow better risk management decisions in the FS if needed.

2.6 Potential Receptors

This section presents the potential human health and ecological receptors that may be impacted in the absence of a remedial action.

2.6.1 Human Receptors

The facility is in a rural area and is not near any major industrial or developed areas. Public access to Camp Ravenna is limited. The facility is fenced and Camp Ravenna staff oversee and manage access when permitted and in accordance with safety and security requirements. Military trainees utilize the facility for various training purposes and operations and there are some full time OHARNG staff as well. There are also contractor staff that work at the facility for varying periods of time to complete construction projects, maintenance work, or remediation projects.

The AOC is located at the eastern central portion of the facility. It is not currently used for specific OHARNG training activities but receives periodic foot traffic during maintenance, restoration, and security activities. Human receptors evaluated in this RI include the following: Resident Receptor, NGT, and Industrial Receptor (for USEPA Composite Worker using Industrial RSLs). The generic Composite Worker Receptor is called the "Industrial Receptor" for RVAAP risk assessments per the Risk Assessment Technical Memorandum (NGB, 2014).

2.6.2 Ecological Receptors

Descriptions in this section and items such as the list of species are based on the 2008 Integrated Natural Resource Management Plan (INRMP) and have not been updated to reflect any changes noted in the 2014 INRMP. However, information presented in this section is still relevant and adequately describes general-current ecological conditions and does not affect the analysis completed in this RI. Ecological receptors that were to be included in the ecological risk assessment were presented in the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003). These selected receptors have not changed and should be considered

with completing an ecological risk assessment. The former RVAAP has a diverse range of vegetation and habitat resources. The majority of lands within the facility are post-successional agricultural lands, with the exception of a few areas of large mature forest and areas that were considered too wet to farm. Approximately 90 percent of the former RVAAP, apart from wet woods, had historically been cleared and used for agriculture or otherwise disturbed. Habitats currently present within the installation include large tracts of closed-canopy hardwood forest, scrub/shrub open areas, grasslands, wetlands, open-water ponds and lakes, and semi-improved administration areas.

Vegetated land at the former RVAAP can be divided into three broad vegetation categories: herb dominated, shrub dominated, and tree dominated. Tree-dominated areas are the most widespread form of vegetation across the facility. The remaining acres at the former RVAAP that are not dominated by vegetation include areas previously developed or disturbed through the emplacement of structures, roads, and other development.

Available estimates indicate that approximately one-third of the former RVAAP facility property meets the regulatory definition of a wetland, with most the wetland areas located in the eastern portion of the facility. Wetland areas at the former RVAAP include seasonal wetlands, wet fields, and forested wetlands. Many of the wetland areas are the result of natural drainage or beaver activity. However, some wetland areas are associated with anthropogenic settling ponds and drainage areas. The potential for impacts on wetland areas at the facility is real due to the amount of process effluent discharged to settling ponds and the natural drainage of the area in the past (AMEC, 2008).

Federal status as a candidate, threatened, or endangered species is derived from the *Endangered Species Act* (ESA) (16 USC § 1538, et seq.) and is administered by the U.S. Fish and Wildlife Service. State-listed plant and animal species are determined by the Ohio Department of Natural Resources (ODNR). There are currently no federally listed species or critical habitats on Camp Ravenna property. There are species under federal review for listing but none are listed. Information regarding endangered, threatened, and candidate species at the facility was obtained from the *Camp Ravenna Joint Military Training Center Rare Species List* (CRJMTC, 2010). **Table 2-1** presents state-listed species that have been confirmed to be on the facility by biological inventories and confirmed sightings.

2.7 Preliminary Conceptual Site Model

The preliminary CSM for the Sand Creek Site was developed in the DQO Report (Shaw, 2009) and included available information for the facility-wide CSM for the former RVAAP as presented in the FWSAP (SAIC, 2001), site-specific operational information, and data collected during the 2003 RA (MKM, 2004). Data from the 2003 FWBWQS (USACE, 2005a) were not included in the DQO Report but has been evaluated for the purposes of this

preliminary CSM. This preliminary CSM has been refined in this RI Report (Section 8.6) to integrate the results of the evaluation of contaminant nature and extent, fate and transport modeling, and the HHRA and SLERA sections as these sections are developed and present a summary of available knowledge for the AOC.

2.7.1 Surface Soils

Surface soils at the site, characterized as 0 to 1 foot bgs at the former RVAAP, consist primarily of fill material most likely used for landfill cover. The surface soil is covered with thick vegetation consisting of primarily tall grass and overgrown brush. Surface soil sampling was conducted in 2003 as part of the RA confirmatory sampling activities. Additional surface soil sampling was performed during the RI field activities using ISM to evaluate data gaps identified in the preliminary CSM.

Thirty confirmation surface soil samples and three contingency soil samples were collected at the site as part of the 2003 RA. As discussed in Section 1.3.3, "Preliminary Evaluation for COPCs," the preliminary COPCs identified for the future land use receptors in surface soil during the 2003 RA included primarily metals (arsenic, antimony, barium, beryllium, cadmium, copper, lead, manganese, mercury, selenium, and silver) and SVOCs [benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, and phenanthrene] with concentrations greater than the final FWCUGs and/or the RVAAP BSVs. The sample locations where metals were detected above the final FWCUGs and the RVAAP BSVs were located primarily in the northern third of the site. The soil sample where the SVOCs were detected above the final FWCUGs is located approximately 120 feet north of the former railroad bed. Further discussion regarding the nature and extent of contamination of the surface soil samples results from the 2003 RA and inclusion of the RI sample results that will aid in refining the CSM is presented in Section 4.2.

2.7.2 Subsurface Soils

Limited geologic and analytical data existed for subsurface soils at Sand Creek prior to the RI field activities. Therefore, an accurate assessment has previously not been possible. A DGM investigation was performed in 2010 with the primary objective for the Sand Creek Site of characterizing the anomaly density in the subsurface. Subsurface soil sampling was performed during the RI field activities using a modified ISM. Locations were biased based on elevated surface soil confirmatory analytical results identified during the 2003 RA and the DGM results for the site as presented in the DGM Report (Shaw, 2011). Further discussion regarding the nature and extent of contamination in subsurface soils based on the RI field sampling results is presented in Section 4.3.

2.7.3 Sediment

Twelve discrete sediment samples were collected from the neighboring floodplain to characterize potential impact associated with site runoff as part of the 2003 RA. One ISM sediment sample was collected in the portion of the Sand Creek adjacent the site for the 2003 FWBWQS to assess if chemical contamination within the streams was adversely affecting the biological communities. The preliminary COPCs identified for sediment in Section 1.3 include five inorganics (aluminum, beryllium, cobalt, lead, and silver), one explosive (2,6-dinitrotoluene), two propellants (nitrocellulose and nitroguanidine), one SVOC (di-n-butyl phthalate), and one VOC (acetone). Except for aluminum and silver, these analytes were only retained as preliminary COPCs since no final FWCUGs are available for them. Although relatively few preliminary COPCs were identified in the sediment samples collected for the 2003 RA, the detected results were primarily inorganics above the BSVs and were mostly found along the northern floodplain adjacent to the site. The one SVOC identified as a preliminary COPC was detected in the ISM sediment sample collected for the 2003 FWBWQS.

Erosion transport of soil contaminants and deposition as stream sediment is a potential migration mechanism and resuspension of sediment within Sand Creek during storm events provides a potential mechanism for downstream transport over time. The RI field activities targeted additional samples for sediment along the banks of the Sand Creek Site using ISM. Further discussion regarding the nature and extent of contamination of the sediment sample results from the 2003 RA and the 2003 FWBWQS and inclusion of the RI sample results that will aid in refining the CSM is presented in Section 4.4.

2.7.4 Surface Water

Three surface water samples were collected from Sand Creek during the 2003 RA to assess surface water quality and characterize potential impact associated with site runoff. Two surface water samples were collected adjacent to the site during the 2003 FWBWQS, at separate times during that summer, to assess if chemical contamination within the streams was adversely affecting the biological communities. Inorganic concentrations of arsenic, cobalt, lead, and one SVOC were identified as preliminary COPCs between the separate surface water samples collected at the same location during the 2003 FWBWQS event—the intersection of the former railroad culvert and Sand Creek adjacent to the central portion of the site.

Potential contaminants along the site would be expected to leach or erode from source areas during rainfall events, become entrained in storm runoff and discharge directly to Sand Creek. However, the site is currently covered with mature trees and scrub vegetation, which somewhat reduces the potential for erosional transport processes to occur. Sand Creek is a constant flowing stream and it is unlikely that any contaminants that could be originating from the site

would still be detected in surface water. The surface water was believed to be adequately characterized; therefore, no additional surface water sampling was considered necessary for the RI. Further discussion regarding the nature and extent of contamination of the surface water sample results of the 2003 RA and the 2003 FWBWQS is presented in Section 4.5.

2.7.5 Preliminary Conceptual Site Model Summary

The nature and types of chemicals to be expected from the former Sand Creek Site are largely unknown due to incomplete operational records and minimal environmental media samples collected prior to the RI field activities. Elevated metals and detected concentrations of SVOCs, explosives and propellants are consistent with past activities performed at the former RVAAP and would be expected because of historical dumping activities conducted at the site. The current potential for human exposure to potential chemicals migrating from the site is mitigated by inactivity at the site, the absence of permanent residents, and the low population density on adjacent private properties. The future potential for human exposure to potential chemicals migrating from the site based on additional sample investigation identified future use and anticipated human receptors will be evaluated further in this RI Report.

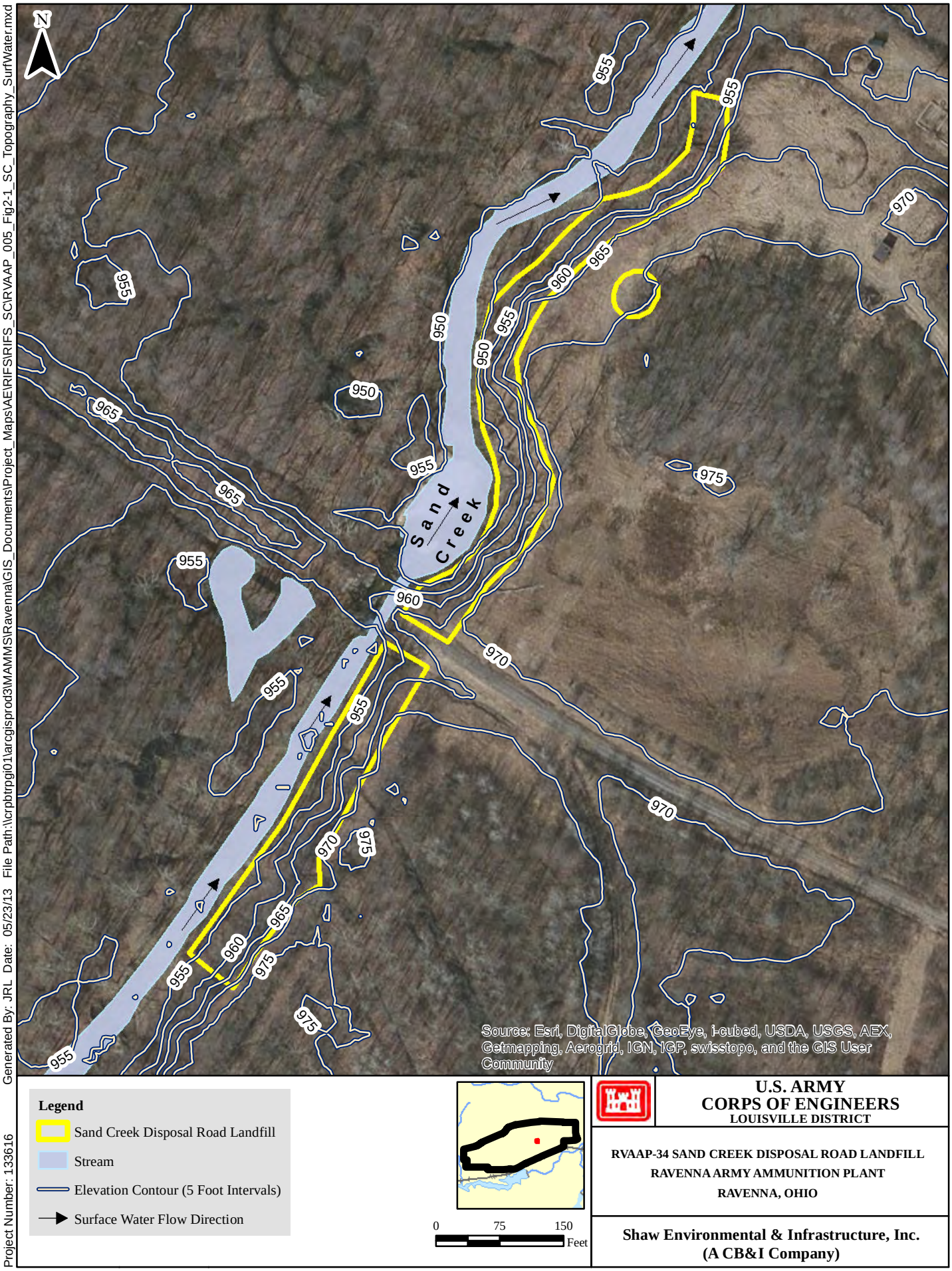


Figure 2-1 Topography and Surface Water Flow

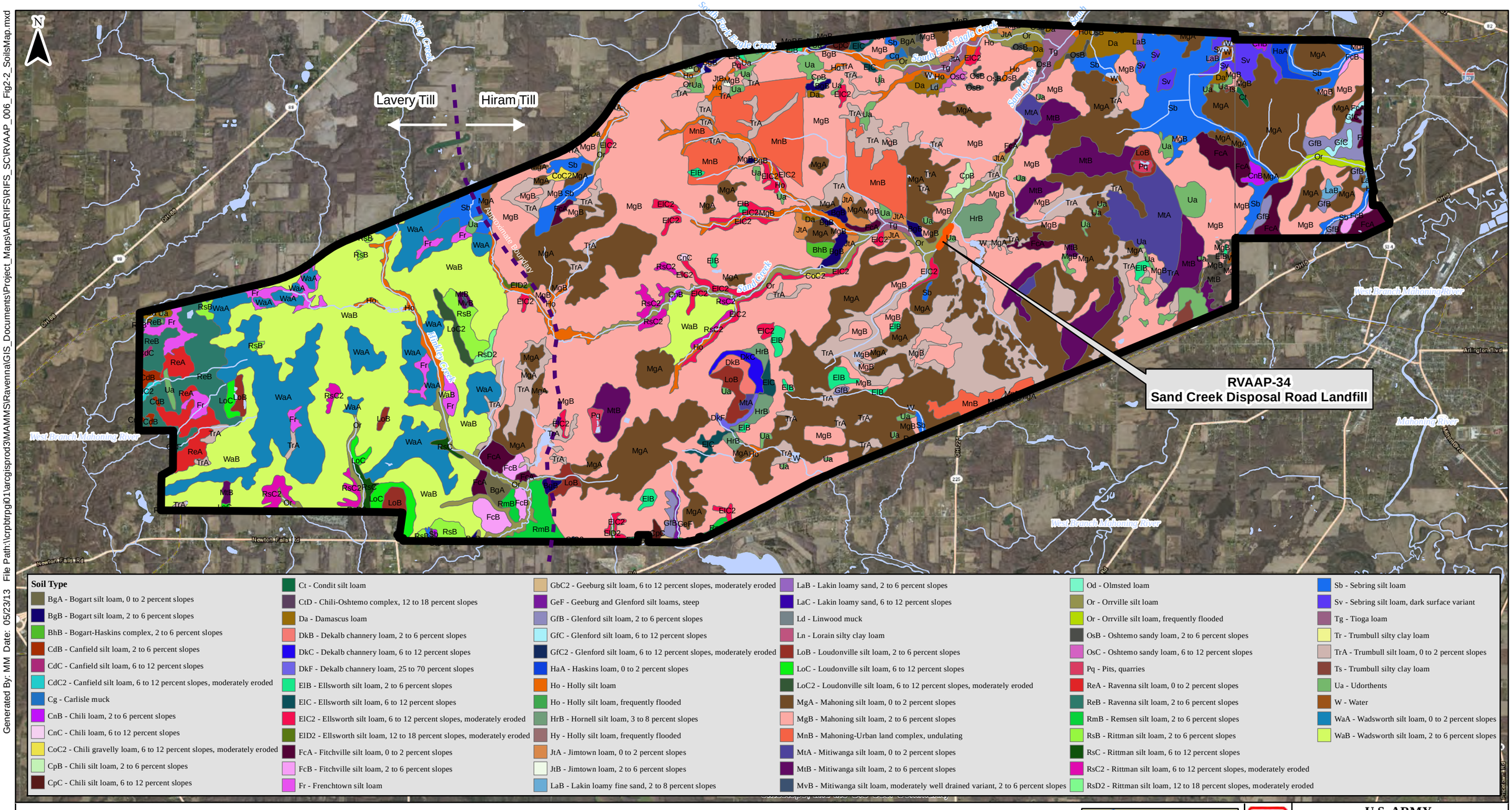


Figure 2-2 Soils Map

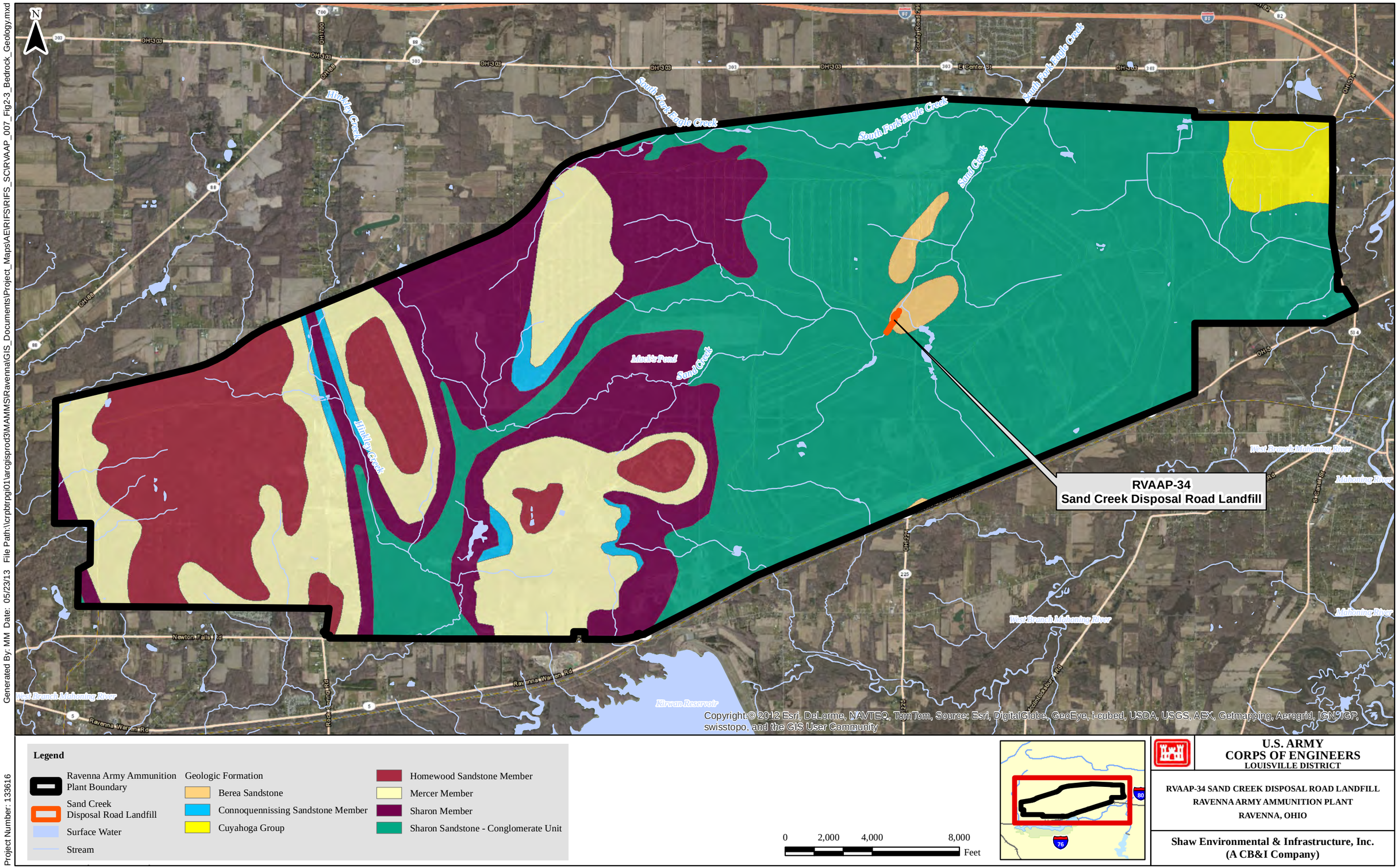


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Figure 2-3 Bedrock Geology

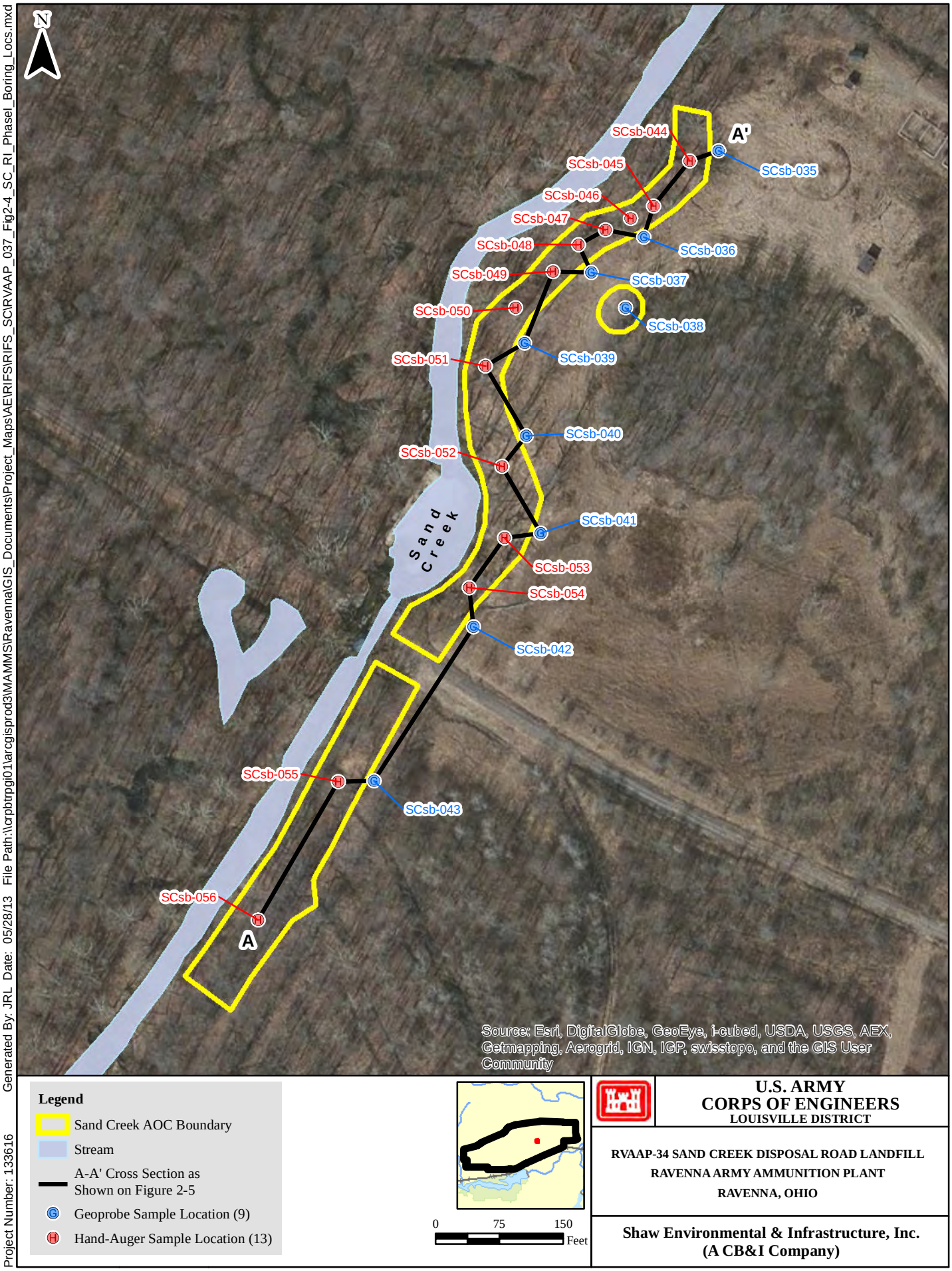

Figure 2-4 Phase I Remedial Investigation Boring Locations

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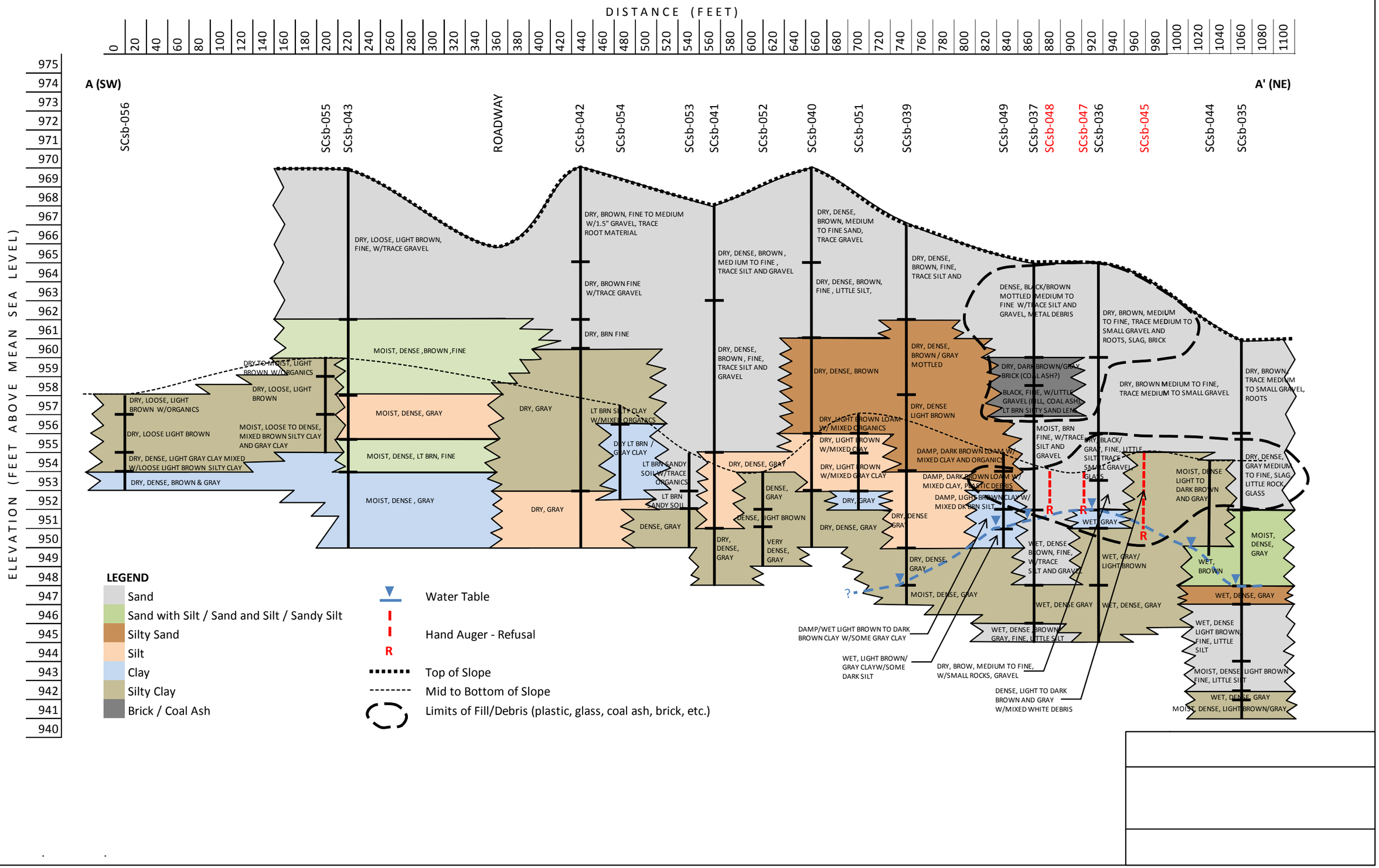

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Figure 2-5 Cross Section of the AOC

Table 2-1. Rare species list for Camp Ravenna Joint Military Training Center.

Common Name	Scientific Name
State Endangered	
American bittern	*Botaurus lentiginosus*
Northern harrier	*Circus cyaneus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
Golden-winged warbler	*Vermivora chrysoptera*
Osprey	*Pandion haliaetus*
Trumpeter swan	*Cygnus buccinators*
Mountain brook lamprey	*Ichthyomyzon greeleyi*
Graceful underwing	*Catocala gracilis*
Tufted moisture-loving moss	*Philonotis Fontana var. caespitosa*
Bobcat	*Felis rufus*
Narrow-necked Pohl's moss	*Pohlia elongate car. Elongate*
Sandhill crane (probable nester)	*Grus Canadensis*
Bald eagle (nesting pair)	*Haliaetus leucocephalus*
State Threatened	
Barn owl	*Tyto alba*
Dark-eyed junco (migrant)	*Junco hyemalis*
Hermit thrush (migrant)	*Catharus guttatus*
Least bittern	*Ixobrychus exilis*
Least flycatcher	*Empidonax minimus*
Caddisfly	*Psilotreta indecisa*
Simple willow-herb	*Epilobium strictum*
Woodland horsetail	*Equisetum sylvaticum*
Lurking leskea	*Plagiiothecium latebricola*
Pale sedge	*Carex pallescens*
State Potentially Threatened Plants	
Gray birch	*Betula populifolia*
Butternut	*Juglans cinerea*
Northern rose azalea	*Rhododendron nudiflorum var. roseum*
Hobblebush	*Viburnum alnifolium*

Table 2-1. Rare species list for Camp Ravenna Joint Military Training Center (continued).

Common Name	Scientific Name
Long beech fern	*Phegopteris connectilis*
Straw sedge	*Carex straminea*
Tall St. John's wort	*Hypercium majus*
Water avens	*Geum rivale*
Shining ladies-tresses	*Spiranthes lucida*
Swamp oats	*Sphenopholis pensylvanica*
Arbor vitae	*Thuja occidentalis*
American chestnut	*Castanea dentate*
State Species of Concern	
Pygmy shrew	*Sorex hovi*
Woodland jumping mouse	*Napaeozapus insignis*
Star-nosed mole	*Condylura cristata*
Sharp-shinned hawk	*Accipiter striatus*
Marsh wren	*Cistothorus palustris*
Henslow's sparrow	*Ammodramus henslowii*
Cerulean warbler	*Dendroica cerulean*
Prothonotary warbler	*Protonotaria citrea*
Bobolink	*Dolichonyx oryzivorus*
Northern bobwhite	*Colinus virginianus*
Common moorhen	*Gallinula chlorpus*
Great egret (migrant)	*Ardea alba*
Sora	*Porzana Carolina*
Virginia rail	*Rallus limicola*
Creek heelsplitter	*Lasmigona compressa*
Eastern box turtle	*Terrapene Carolina*
Four-toed salamander	*Hemidactylium scutatum*
mayfly	*Stenonema ithica*
Coastal plain apamea	*Apamea mixta*
Willow peasant	*Brachylomia algens*
Sedge wren	*Cistothorus platensis*

Table 2-1. Rare species list for Camp Ravenna Joint Military Training Center (continued).

Common Name	Scientific Name
State Special Interest	
Canada warbler	*Wilsonia Canadensis*
Little blue heron	*Egretta caerula*
Magnolia warbler	*Dendroica magnolia*
Northern waterthrush	*Seiurus noveboracensis*
Winter wren	*Troglodytes*
Back-throated blue warbler	*Dendroica caerulescens*
Brown creeper	*Certhia Americana*
Mourning warbler	*Oporornis philadelphia*
Pine siskin	*Carduelis pinus*
Purple finch	*Carpodacus purpureus*
Red-breasted nuthatch	*Sitta Canadensis*
Golden-crowned kinglet	*Regulus satrapa*
Blackburnian warbler	*Dendroica fusca*
Blue grosbeak	*Guiraca caerulea*
Common snipe	*Gallinago*
American wigeon	*Anas Americana*
Gadwall	*Anas strepera*
Green-winged teal	*Anas crecca*
Northern shoveler	*Anas clypeata*
Redhead duck	*Aythya Americana*
Ruddy duck	*Oxyura jamaicensis*

Source: Camp Ravenna Joint Military Training Center Rare Species List, April, 27, 2010.

3.0 STUDY AREA INVESTIGATION

This chapter presents the methodology for the development of the DQOs for this RI. The facility-wide CSM, operational history, historical data and records, and confirmatory data collected following the 2003 RA were used to design the RI sampling effort using the DQO approach presented in the FWSAP (SAIC, 2001). The DQOs for the RI are presented in detail in the DQO Report (Shaw, 2009). Furthermore, this section presents the locations of, the rationale for, samples collected during the RI field effort, and provides a description of the sampling methods implemented during the investigation.

3.1 Data Evaluation for Previous Investigations

The evaluation of data collected during the 2003 RA was performed as part of the DQO Report (Shaw, 2009) for the Sand Creek Site. The data evaluated was on all the samples taken after the removal action had occurred. In general, the evaluation and screening methods initially compared constituents present at background concentrations from those present at concentrations that indicated potential impacts related to historical operations at the site. The identified constituents were then screened against the then most current version of the FWCUGs for unrestricted land use scenarios for the Resident Receptor (Adult and Child) and the National Guard Receptors based on the desired use of the land for the 10^{-6} excess cancer risk level and HQ equal to 0.1 ($^1/_{10}$ the noncancer risk). A summary of chemicals detected above the screening criteria for the 2003 RA is presented in **Table 3-1**.

The 2003 FWBWQS surface water and sediment samples were compared to OWQCs and ecological screening criteria to evaluate aquatic biological life impacts and if chemical contamination was adversely impacting life in the streams at the former RVAAP. The data were not included in the DQO Report (Shaw, 2009) since they were not considered to be site specific. However, the data are used in this section to supplement the results of the 2003 RA data. These data have been evaluated in the same manner as discussed above for the 2003 RA data. A summary of chemicals detected above the screening criteria for the 2003 FWBWQS is presented in **Table 3-1**.

The RI field activities conducted at the Sand Creek Site between September and November 2010 included the collection of surface soil and sediment samples using ISM and subsurface soil samples using a modified version of the ISM. Sampling locations for these activities were based on data gaps identified in the DQO Report (Shaw, 2009). Surface water samples were not collected during the RI based on the recommendations made in the DQO Report. Groundwater sampling is performed on a facility-wide basis and was not included in Shaw's scope of work for the RI at the Sand Creek Site. Specific notation is made where site conditions required a departure from planned activities detailed in the SAP Addendum No. 1

(Shaw, 2010) for the Sand Creek Site RI. Information regarding standard field decontamination procedures, sample container types, preservation techniques, sample labeling, chain of custody, and packaging and shipping requirements implemented during the field investigation can be found in the FWSAP (SAIC, 2001) and SAP Addendum No. 1 (Shaw, 2010).

Proposed RI sample locations were reviewed by representatives of the Ohio EPA and the USACE as part of the approval process for the SAP Addendum No. 1 (Shaw, 2010). The rationale for each component of the field investigation is described in the following sections.

3.2 Surface Soil Characterization

Surface soil samples were collected during the RI field activities to evaluate the potential for contaminant migration via leaching or erosional processes from surface soils to receptor media such as sediment. Surface soil samples were collected at 18 sampling units from 0 to 1 foot bgs to further characterize the areas where COPCs consisting of inorganics, SVOCs, one propellant, and one VOC were identified during the 2003 RA. In all, a total of 24 surface soil samples, including field duplicates and QC samples, were collected at the Sand Creek Site. All surface soil samples were collected using ISM except for samples to be analyzed for VOCs which were collected as a discrete sample from within the designated sampling unit. **Figure 3-1** presents the ISM sampling units and discrete sample locations where the surface soil samples were collected. **Table 3-2** summarizes the media sampled for the RI and the rationale for the sample strategy.

Methods used for the collection of surface soil samples during the RI are summarized below. The collection methodology for ISM is presented in the SAP Addendum No. 1 (Shaw, 2010) and is based upon the procedures presented in the *Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program, Interim Guidance 09-02* (USACE, 2009).

3.2.1 Sampling Approach

Surface soil samples were collected at 18 sampling units using the ISM approach. The purpose of collecting, preparing, and analyzing an ISM sample is to provide a repeatable and accurate measure of the average concentrations of chemicals within a previously defined sample area or sampling unit. The selected sampling units are locations where contamination associated with the historical dumping activities are expected to be the greatest in surface soil. The combined sampling units are considered the decision unit for the AOC and are the area in which a decision regarding SRCs in surface soil will be made. A sufficient amount of sample material must be collected from each sampling unit to account for compositional heterogeneity and additionally, a sufficient number of aliquots (sub samples) utilizing a stratified random methodology must be taken to account for distributional heterogeneity. For the purposes of

this RI, the accurate, average values derived from the ISM samples were used to evaluate (1) exposure point concentration (EPC) within human health or ERAs and (2) delineation of nature and extent of contamination.

Each ISM surface soil sample consisted of 30 random aliquots collected from each sampling unit across the entire 1-foot interval from 0 to 1 foot bgs using a systematic-random approach, where the collection of aliquots within a sampling unit is considered more reproducible. The stratification assures coverage over the entire sample area and the randomness provides repeatability and accuracy. The key steps performed for collection of a systematic random sample were (1) subdivide the ISM sampling unit into a uniform grid, (2) randomly select a single aliquot sample location in the first grid, and (3) collect aliquot samples from the same relative location within each of the other grids (USACE, 2009). **Figure 3-2** presents an example of how a systematic random sample is collected and is from the *Implementation of Incremental Sampling (IS) of Soil for the Military Munitions Response Program, Interim Guidance 09-02* (USACE, 2009). The sampling unit in the figure depicts a sampling unit with 100 grid cells, whereas the actual sampling units at the Sand Creek Site consisted of 30 grid cells.

The sampling units were established by placing wood stakes at the corners of each sampling unit at the predetermined coordinates. The coordinates were verified using a Trimble Pro XRS Global Positioning System (GPS) with submeter accuracy. The ISM samples were collected from the predetermined number of aliquot sample locations using a $^{7}/_{8}$-inch stainless steel step probe sample collection device. The aliquots of soil were placed into a plastic lined bucket and combined to make a single sample weighing between 1 to 2 kilograms (kg).

Each 1- to 2-kg sample was submitted to the contracted laboratory for processing and analysis. Processing consisted of drying out the sample and sieving the sample through a #10 sieve. Any material larger than the #10 sieve was discarded. The remaining air-dried, sieved material was then ground using a puck mill to better homogenize the sample.

The QC samples collected included field duplicate samples and matrix spike (MS)/matrix spike duplicate (MSD) samples. The field duplicates and the MS/MSDs were collected from the ISM sampling units at the frequency of 10 and 20 percent, respectively. The collection of the QC samples required similar portions of soil as the original sample. Therefore, at each ISM sampling unit where a QC sample was required, additional ISM samples were collected from within the same sampling unit consisting of at least 30 aliquots of soil each. The field duplicates were labeled with different sample numbers and submitted to the laboratory for processing as a blind field duplicate. The QA samples were collected for the USACE only at a frequency of 10 percent using the same methods as for the collection of the QC samples.

The QA samples were submitted to the specified USACE-contracted laboratory for processing and analysis.

Each ISM surface soil sample was analyzed for TAL metals, SVOCs, and explosives. In addition, five samples were submitted for hexavalent chromium analysis. Approximately 10 percent of the samples were analyzed for the RVAAP full suite that included pesticides, PCBs, total cyanide, and propellants.

3.2.2 Discrete VOC Surface Soil Samples

The ISM sampling method was not utilized for samples to be analyzed for target compound list (TCL) VOC analysis which comprised approximately 10 percent of the sample locations collected as part of the RVAAP full suite. For samples designated for VOC analysis, one discrete sample was collected from within the ISM sampling unit using a disposable terra core sampler. The specific location of the discrete sample was intended to be biased toward the area most likely to contain VOCs. However, no such locations were identified during the field sampling activities and the locations were randomly chosen within each ISM sampling unit. Soil portions designated for VOC analysis were placed directly in the sample container with a methanol preservative and were not composited or further processed in the field.

The QC samples collected for VOC analysis included field duplicate samples and MS/MSDs at the same frequency as the RVAAP full suite ISM samples. The collection of the QC samples required similar portions of soil as the original sample. The field duplicates were labeled with different sample numbers and submitted to the laboratory for processing as a blind field duplicate. The QA samples for VOC analysis were collected for the USACE at a frequency of 10 percent of the VOC samples collected using the same methods as for the collection of the QC samples. The QA samples were submitted to the specified USACE-contracted laboratory for processing and analysis.

3.3 Sediment Characterization

The sediment samples collected at the Sand Creek Site represent floodplain and other types of soil that are intermittently wet throughout the year. These types of media samples are collected similar to the surface soil samples discussed in Section 3.2.1 using ISM. However, the sample depth for sediment is from 0 to 6 inches instead of from 0 to 1 foot for surface soils. The rationale for collecting sediment samples is to evaluate the true average concentrations of the contaminants in the sediment in the floodplain along the reach of the Sand Creek adjacent to the disposal area using the ISM technique. Sediment samples were collected at two sampling units in the floodplain between Sand Creek and the AOC. The combined sediment sampling units are considered the decision unit for sediment and are the location in which a decision regarding SRCs in sediment adjacent to the AOC will be made. **Figure 3-1** presents the ISM

sampling units and discrete sample locations where the sediment samples were collected. **Table 3-2** summarizes the media sampled for the RI and the rationale for the sample strategy.

3.3.1 Sampling Approach

Sediment samples were collected at two sampling units using ISM as discussed in Section 3.2.1. Each ISM sediment soil sample consisted of 30 random aliquots collected from each sampling unit across the entire 6-inch interval from 0 to 6 inches bgs using a systematic-random approach.

The ISM samples were collected from the predetermined number of aliquot sample locations using a $^{7}/_{8}$-inch stainless steel step probe sample collection device. The aliquots of sediment were placed into a plastic lined bucket and combined to make a single sample weighing approximately 1 kg. Each 1-kg sample was submitted to the contracted laboratory for processing and analysis as discussed in Section 3.2.1. Due to the limited number of sediment samples (two), each of the samples was analyzed for the full RVAAP suite to include TAL metals, hexavalent chromium, SVOCs, explosives, pesticides, PCBs, cyanide, and propellants.

3.3.2 Discrete VOC Sediment Sample

The ISM was not utilized for the collection of the dry sediment sample to be analyzed for TCL VOC analysis. For the sample designated for VOC analysis, one discrete sample was collected from within one of the sediment ISM sampling units using a disposable terra core sampler. The specific location of the discrete sample was intended to be biased toward the area most likely to contain VOCs. However, no such locations were identified during the field sampling activities and the location was randomly chosen within the designated sediment ISM sampling unit. The portions designated for VOC analysis were placed directly in the sample container with methanol preservative and were not composited or further processed in the field.

3.4 Subsurface Soil Characterization

Subsurface samples were collected near the areas of subsurface anomalies identified during the 2010 DGM investigation and at biased locations identified as a result of the data evaluation for surface soil in the RD/RA Report (MKM, 2004). The rationale for collecting subsurface samples at the site was to provide additional information to whether historical dumping activities at the site impacted transport pathways to deeper soil horizons for the contaminants identified in the RD/RA Report (MKM, 2004). In addition, subsurface sampling was intended to verify the depths of residual contamination (if any) at the surface soil locations requiring further evaluation.

Subsurface soil borings were advanced at 22 locations at the Sand Creek Site during the RI field activities that included 13 hand-auger borings and 9 DPT soil borings. The DPT borings were advanced along the level areas adjacent to the top of slope, and the hand augers were

advanced along the slopes of the site where the steep conditions limited the ability of the DPT to collect samples. The subsurface soil samples for both sampling methods were collected using a modified ISM as discussed below. A total of 78 subsurface soil samples, including duplicates and QC samples, were collected at the intervals described in Section 3.4.1 to a maximum depth of 20 feet bgs.

Figure 3-1 presents the subsurface soil boring locations. **Table 3-2** summarizes the media sampled for the RI and the rationale for the sample strategy.

3.4.1 Sampling Approach

Subsurface soil samples were collected by means of a hydraulic DPT sampler (i.e., Geoprobe®) to a maximum sampling depth of 20 feet bgs at the Sand Creek Site. The manual bucket hand-auger method was used at areas of steep slopes to a maximum depth of 5 feet bgs. Subsurface borings for both methods were performed in accordance with the procedures presented in the FWSAP (SAIC, 2001).

Subsurface samples were collected at a maximum of 4-foot intervals using the modified ISM approach presented in the SAP Addendum No. 1 (Shaw, 2010). In general, the modified ISM approach consisted of collecting 30 aliquots of soil from each soil column for each sample interval using a stainless-steel spoon. The subsurface soil sample intervals began at 1 foot bgs as surface soil at the former RVAAP is considered to be the 0- to 1-foot interval. For the bucket hand-auger samples, subsurface soil samples were collected from the entire 1- to 5-foot. The DPT samples were collected at the following intervals: 1 to 5 feet bgs, 5 to 9 feet bgs, 9 to 13 feet bgs, 13 to 17 feet bgs, and 17 to 20 feet bgs.

If possible, a 1- to 2-kg ISM sample was collected from each boring interval and submitted to the contracted laboratory for processing and analysis. However, factors that sometimes decreased the amount submitted included (1) minimal recovery from the soil probe and (2) additional sample volume needed to fulfill QA and QC sample requirements. In all instances, the minimal amount of soil needed by the laboratory to adequately process the ISM samples (100 grams) was submitted. Processing consisted of the same methodology for sieving and drying as discussed for ISM surface soil samples in Section 3.2.1.

The QC samples included field duplicate samples and MS/MSDs. The field duplicates and the MS/MSDs were collected from the subsurface soil borings at the frequency of 10 percent and 20 percent, respectively. The collection of the QC samples required similar portions of soil as the original sample from the same soil probe or bucket auger sample interval. Where multiple QA/QC samples were required from a single sample interval, a similar amount was collected for the original sample and the QA/QC samples. The field duplicates were labeled with different sample numbers and submitted to the laboratory for processing as a blind field

duplicate. The QA samples were collected for the USACE at a frequency of 10 percent using the same methods as for the collection of the QC samples. The QA samples were submitted to the specified USACE-contracted laboratory for processing and analysis.

Borehole logs, including estimates of Unified Soil Classification System classification, were prepared at the time of sampling in accordance with the FSAP (SAIC, 2001). Organic vapor screening using a photoionization detector (PID) was performed on soil cores, and results were noted on the borehole logs that are presented in **Appendix A**.

Subsurface soil samples were submitted for TAL metals, SVOCs, and explosives. An additional five samples were submitted for hexavalent chromium analysis. A minimum of 10 percent were analyzed for the RVAAP full suite that includes pesticides, PCBs, cyanide, and propellants.

3.4.2 Discrete VOC Subsurface Soil Samples

Modified ISM was not utilized for subsurface samples to be analyzed for VOC analysis which comprised approximately 10 percent of the sample locations collected as part of the RVAAP full suite. For samples designated for VOC analysis, one discrete sample was collected at the designated depth interval from the DPT soil probe or the bucket hand-auger sample interval using a disposable terra core sampler. The specific location of the discrete sample was intended to be biased toward stained soils or soils that exhibited volatile compounds. However, no such locations were identified during the field sampling activities and the locations were randomly chosen within the designated sample interval. Soil portions designated for VOC analysis were placed directly in the sample container with methanol preservative and were not composited or further processed in the field.

The QC samples for VOC analysis of subsurface soil samples included field duplicate samples and MS/MSD samples at the same frequency as the RVAAP full suite modified ISM samples. The collection of the QC samples required similar portions of soil as the original sample. The field duplicates were labeled with different sample numbers and submitted to the laboratory for processing as a blind field duplicate. The QA samples for VOC analysis were collected for the USACE at a frequency of 10 percent of the VOC samples collected using the same methods as for the collection of the QC samples. The QA samples were submitted to the specified USACE-contracted laboratory for processing and analysis.

3.5 Deviations from the Work Plan

No field change requests were submitted for the RI fieldwork. Deviations in the field based on site conditions are documented in the field sampling logs in **Appendix A**. Deviations from the work plan consisted of the following:

- The SAP Addendum No. 1 (Shaw, 2010) stated that headspace readings for VOCs using a PID would be conducted for soil samples to be collected for VOCs. However, the soils submitted for VOC analysis were placed into vials containing methanol, a liquid preservative. Therefore, headspace readings for VOCs were not able to be collected.
- Sampling equipment decontamination procedures were performed in accordance with the SAP Addendum No. 1 (Shaw, 2010) with the exception that hydrochloric acid was removed from the decontamination process due to observations in the field that the acid was corroding the outer coating of the stainless-steel step probes.
- Due to lack of adequate soil recovery in sample SCsb-038m-005-SO, analysis for pesticides, PCBs, total cyanide, and propellants was conducted at the same interval for nearby sample SCsb-039m-005-SO instead.
- Samples SCsb-037m-0001-SO, SCsb-039m-0005-SO, SCsb-040m-0002-SO, SCsb-042m-0003-SO, and SCss-076-0001-SO were analyzed for pesticides, PCBs, total cyanide, and propellants past the laboratory holding time due to a QC error in filling out the chain-of-custody form that was noticed after field activities were completed.

3.6 Analytical Program Overview

All analytical procedures and data validation processes were completed in accordance with applicable professional standards, EPA requirements, government regulations and guidelines, the *Quality Systems Manual for Environmental Laboratories*, Final Version 4.1 (herein referred to as the Quality Systems Manual [QSM] 4.1) (DOD, 2009), the Louisville Chemistry Guideline (LCG) (USACE, 2002), and specific project goals and requirements, as defined in the SAP Addendum No. 1 (Shaw, 2010). An evaluation of Shaw's ability to meet the project QA/QC objectives for the RI is presented in the QA Summary Report in **Appendix B**.

3.6.1 Field Analyses

No field laboratory or test kit screening analyses were conducted at the Sand Creek Site during the RI field activities. Organic vapor screening using a PID was conducted on soil cores, and results were noted on the borehole logs presented in the field documentation data in **Appendix A**.

3.6.2 Laboratory Analyses

The sampling and analysis program conducted during the RI for Sand Creek Site involved the collection and analysis of surface soil, sediment, and subsurface soil. Field screening for organic vapors was conducted at each subsurface sampling location using a PID. Headspace readings were not performed.

Samples collected during the investigation were analyzed by CT Laboratories of Baraboo, Wisconsin—an Environmental Laboratory Accreditation Program and a National Environmental Laboratory Accreditation Conference–certified laboratory. The QA split samples collected for surface soil, sediment, and subsurface soils were analyzed by USACE's contracted QA laboratory, Severn Trent Laboratories of North Canton, Ohio. Laboratories involved in this work have statements of qualifications including organizational structures, QA manuals, and standard operating procedures (SOPs), which are available upon request.

Samples were collected and analyzed per the FWSAP (SAIC, 2001) and the SAP Addendum No. 1 (Shaw, 2010). The FWSAP and associated addenda were prepared in accordance with USACE and EPA guidance, and outline the organization, objectives, intended data uses, and QA/QC activities to achieve the desired DQOs and to maintain the defensibility of the data. Project DQOs were established in accordance with the *Guidance for the Data Quality Objectives Process* (EPA, 1994). Requirements for sample collection, handling, analysis criteria, target analytes, laboratory criteria, and data validation criteria for the RI are consistent with EPA requirements for National Priorities List sites. The DQOs for this project included analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity for the measurement data. The Shaw and third party data validation results are presented in **Appendix C** and provide an assessment of those objectives as they apply to the analytical program.

Strict adherence to the requirements set forth in the FWSAP (SAIC, 2001) and the SAP Addendum No. 1 (Shaw, 2010) was required of the analytical laboratory so that conditions adverse to quality would not arise. The laboratory was required to perform all analyses in compliance with EPA SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Analytical Protocols* (EPA, 2007). SW-846 chemical analytical procedures were followed for the analyses of TAL metals, hexavalent chromium, VOCs, SVOCs, pesticides, PCBs, explosives, propellants (nitroguanidine, nitroglycerine, and nitrocellulose), and cyanide. The contracted laboratory was required to comply with all methods as written; recommendations were considered requirements.

The QA/QC samples for this project included field blanks, trip blanks, QA field duplicates, QC split samples, laboratory method blanks, laboratory control samples (LCSs), laboratory duplicates, and MS/MSDs. Field blanks, consisting of potable water used in the

decontamination process, equipment rinsate blanks, and trip blanks were submitted for analysis, along with field duplicate samples, to provide a means to assess the quality of the data resulting from the field sampling program. **Table 3-3** presents a summary of QA/QC samples utilized during the RI field activities. Evaluation of these QA/QC samples and their contribution to documenting the project data quality is provided in **Appendix C**.

Shaw is the custodian of the project file and will maintain the contents of the files for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, and chain-of-custody forms. These files will remain in a secure area under the custody of Shaw until they are transferred to USACE, Louisville District and the former RVAAP. CT Laboratories retain all original raw data in a secure area under the custody of the laboratory project manager.

3.6.3 Data Review, Validation, and Quality Assessment

Samples were properly packaged for shipment and dispatched to CT Laboratories for ISM processing and analysis. A separate signed custody record with sample numbers and locations listed was enclosed with each shipment. When transferring the possession of samples, the individuals relinquishing and receiving signed, dated, and noted the time on the record. All shipments followed applicable U.S. Department of Transportation regulations for environmental samples.

Data were produced, reviewed, and reported by the laboratory in accordance with specifications outlined in the FWSAP (SAIC, 2001), the SAP Addendum No. 1 (Shaw, 2010), the QSM 4.1 (DOD, 2009), the LCG (USACE, 2002), and the laboratory's QA manual. Laboratory reports included documentation verifying analytical holding time compliance.

The in-house analytical data reduction was performed by CT Laboratories under the direction of the laboratory project manager and QA officer. These individuals were responsible for assessing data quality and informing Shaw of any data that are considered "unacceptable" or required caution on the part of the data user in terms of its reliability. Data were reduced, reviewed, and reported as described in the laboratory QA manual and SOPs. Data reduction, review, and reporting by the laboratory were conducted as follows:

- Raw data produced by the analyst were turned over to the respective area supervisor.
- The area supervisor reviewed the data for attainment of QC criteria, as outlined in the established methods and for overall reasonableness.
- Upon acceptance of the raw data by the area supervisor, a report was generated and sent to the laboratory project manager.
- The laboratory project manager completed a thorough review of all reports.

- Final reports were generated by the laboratory project manager.

Data were then delivered to Shaw for data validation. CT Laboratories prepared and retained full analytical and QC documentation for the project in electronic storage media (i.e., compact disc), as directed by the analytical methods employed. CT Laboratories provided the following information to Shaw in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis
- Tabulated results of inorganic and organic compounds identified and quantified
- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, method blanks, and LCS information

A systematic process for data verification and validation was performed by Shaw to ensure that the precision and accuracy of the analytical data were adequate for their intended use. This verification also attempted to minimize the potential of using false-positive or false-negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach was consistent with the DQOs for the project and with the analytical methods, and was appropriate for determining contaminants of concern and calculating risk. Samples were identified through implementation of "definitive" analytical methods. These definitive data were then verified through the review process outlined in the SAP Addendum No. 1 (Shaw, 2010).

Following receipt of the analytical data packages, Shaw performed data validation to ensure that the precision and accuracy of the analytical data were adequate for their intended use. The review constituted (1) comprehensive validation of 100 percent of the primary data set; (2) comprehensive validation of the QA split sample data set; and (3) a comparison of primary sample, field duplicate sample, and field QA split sample information. This validation also attempted to minimize the potential of using false-positive or false-negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach was consistent with the DQOs for the project and with the analytical methods, and was appropriate for determining contaminants of concern and calculating risk. The Shaw *Final Data Validation Report* for data collected for this RI is presented in **Appendix C**.

The USACE-Louisville District contracted MEC^{x} to perform third party validation of the data collected at the Sand Creek Site. This evaluation included a review of the same QC elements as Shaw's review in addition to an in-depth look into the verification of sample results, target

compound identification, and raw data. The intent of the MEC^{x} data validation efforts was to verify the quality and the reliability of the primary data for its intended use. The associated MEC^{x} *Final Data Validation Report* presented in **Appendix C** details the MEC^{x} findings from the Level IV validation of ten percent of the primary sample data, analysis of field duplicate results, and the determination of data usability.

3.7 Munitions and Explosives of Concern Avoidance

A qualified Senior Unexploded Ordnance Supervisor (SUXOS) from Shaw provided on-the-ground support for all phases of intrusive activities performed during the RI field activities at the Sand Creek Site to implement the MEC avoidance activities presented in the SAP Addendum No. 1 (Shaw, 2010). The SUXOS performed initial ground clearance of potential MEC with a Schonstedt Model GA-52Cx magnetometer prior to conducting any intrusive activities at the site. During subsurface sampling activities, the SUXOS screened the boreholes using the Schonstedt as a downhole sensor until the field geologist determined that the boring has reached undisturbed soil.

The SUXOS led an initial safety briefing on MEC avoidance to train all field personnel to recognize and stay away from potential MEC items. The briefing provided a description of MD previously identified at the site that included two 75-mm projectiles within the AOC and one 105-mm projectile in the Sand Creek downstream of the site. Daily tailgate safety briefings included reminders regarding MEC avoidance.

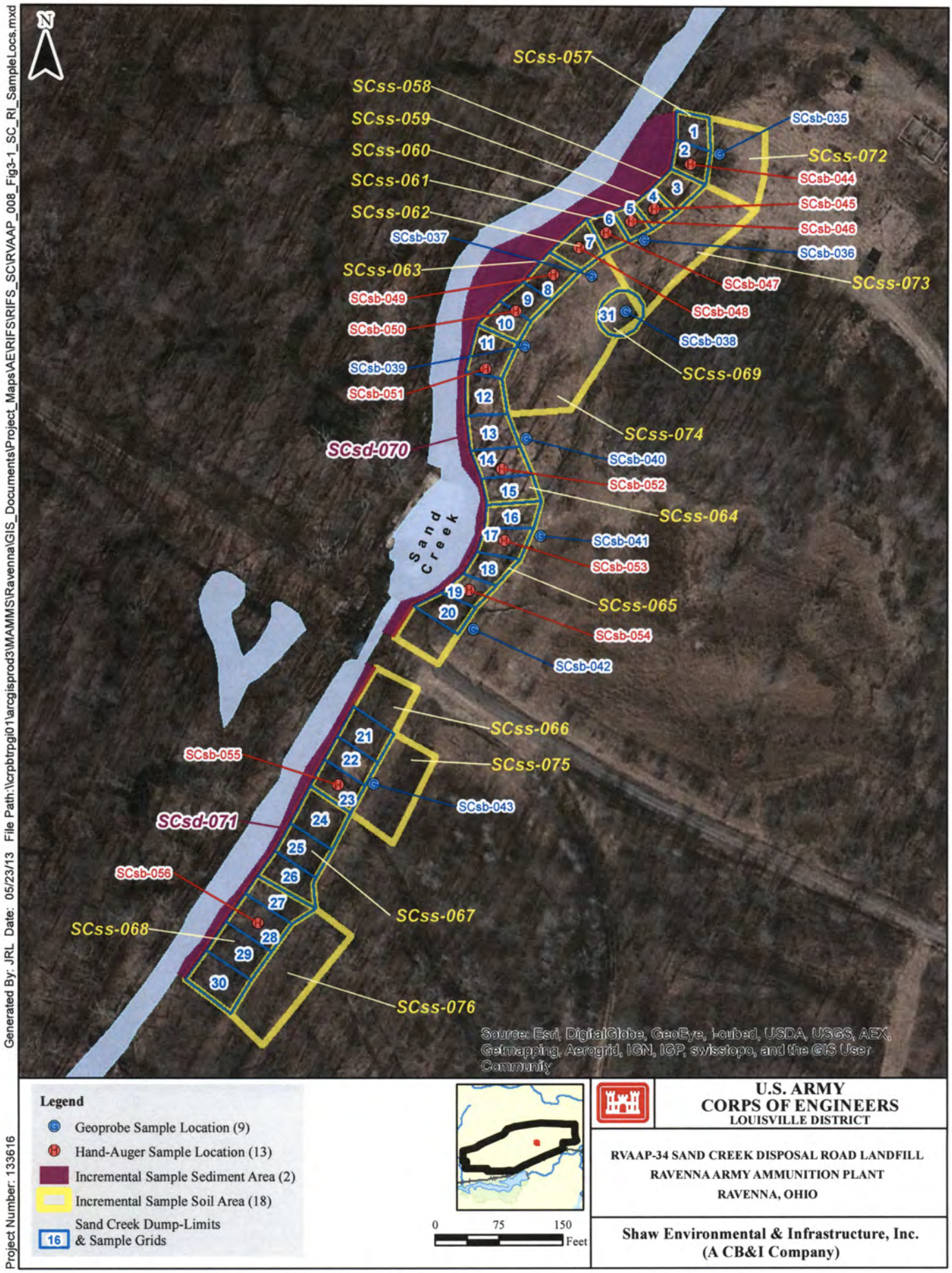


Figure 3-1 Phase I Remedial Investigation Sample Locations

Figure 3-2
Example of Systematic Random Sampling

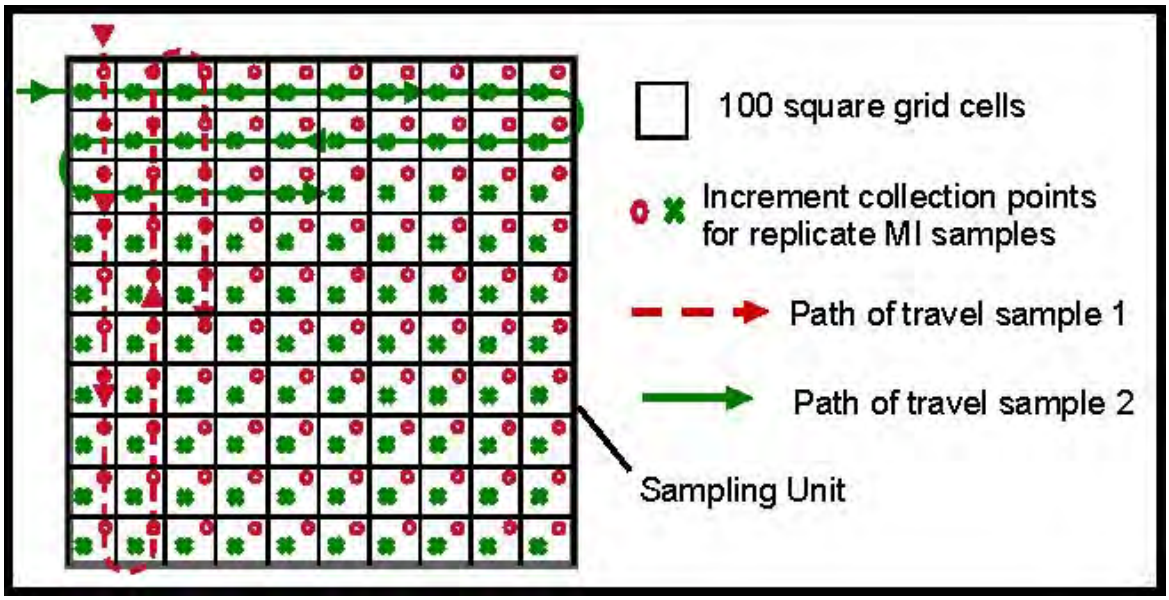


Table 3-1. Chemical data from previous investigation that exceed screening criteria.

Medium	Analyte	Frequency of Detection	Units	MDC	Screening Criteria[a]
Surface Soil	Antimony	11/31	mg/kg	25	2.82
	Arsenic	31/31	mg/kg	100	0.425
	Barium	31/31	mg/kg	1,600	351
	Beryllium	31/31	mg/kg	1.2	0.88[b]
	Cadmium	12/31	mg/kg	40	6.41
	Cobalt	31/31	mg/kg	26	7.03
	Copper	31/31	mg/kg	470	311
	Lead	31/31	mg/kg	1,600	26.1[b]
	Manganese	31/31	mg/kg	5,100	35.1
	Mercury	30/31	mg/kg	130	2.27
	Selenium	8/31	mg/kg	3.2	1.4[b]
	Silver	9/31	mg/kg	630	38.6
	Nitrocellulose	2/3	mg/kg	5	---[c]
	Chloroethane	1/3	mg/kg	0.091	---[c]
	Phenanthrene	1/3	mg/kg	0.089	---[c]
	Bis(2-ethylhexyl)phthalate	2/3	mg/kg	0.09	---[c]
	Benzo(a)anthracene	2/3	mg/kg	0.31	0.221
	Benzo(a)pyrene	2/3	mg/kg	0.29	0.022
	Benzo(b)fluoranthene	2/3	mg/kg	0.3	0.221
	Benzo(g,h,i)perylene	1/3	mg/kg	0.13	---[c]
	Dibenzo(a,h)anthracene	1/3	mg/kg	0.69	0.022
Subsurface Soil	Not Sampled	NA	NA	NA	NA
Sediment	2,6-Dinitrotoluene	1/3	mg/kg	0.11	---[c]
	Aluminum	13/13	mg/kg	14,000	3,496

Table 3-1. Chemical data from previous investigation that exceed screening criteria (continued).

Medium	Analyte	Frequency of Detection	Units	Maximum Detect	Screening Criteria[a]
Sediment (continued)	Beryllium	12/13	mg/kg	0.67	0.38[b]
	Cobalt	13/13	mg/kg	13	9.1[b]
	Lead	13/13	mg/kg	40	27.4[b]
	Silver	2/13	mg/kg	40	38.6
	Nitroguanidine	1/2	mg/kg	0.5	---[c]
	Nitrocellulose	2/2	mg/kg	0.98	---[c]
	Acetone	1/2	mg/kg	0.011	---[c]
	Di-n-butyl phthalate	1/1	mg/kg	120 J	---[c]
Groundwater	Not Sampled	NA	NA	NA	NA
Surface Water	Arsenic	4/5	µg/L	6.6	1.1
	Cobalt	1/5	µg/L	0.4	0[b]
	Lead	1/5	µg/L	2.9	0[b]
	Di-n-butyl phthalate	1/2	µg/L	3.85 J	---[c]

[a] denotes screening criteria is the lowest of the FWCUGs for the Residential Receptor (Adult and Child) and the identified National Guard receptors (National Guard Trainee and the Range Maintenance Soldier).

[b] denotes a FWCUG has not been calculated for this analyte. However, the detected concentration exceeds the available BSV.

[c] denotes a FWCUG has not been calculated for this analyte and no BSVs are available. Report due to low concentration and no toxicity values.

µg/L denotes micrograms per liter.

BSV denotes background screening value.

J denotes estimated value.

MDC denotes maximum detected concentration

mg/kg denotes milligrams per kilogram.

NA denotes not applicable.

Table 3-2. Summary and rationale for Remedial Investigation samples.

Medium	Sample Type	Depth (feet bgs)	No. of Samples[1]	Rationale
Surface Soil	ISM	0–1	18	To further characterize the areas where SRCs consisting of inorganics, SVOCs, one propellant and one VOC were identified during the 2003 RA. Additional sampling of surface soils for the RI further illustrates the potential for contamination migration via leaching or erosional processes from surface soils to media such as sediment.
Subsurface Soil	Modified ISM	1–5	13	To characterize subsurface soils based on the distribution of SRCs identified in surface soil. Hand augers were used at locations where site conditions consisting of steep slopes, saturated conditions and/or overgrown vegetation prevented the advancement of DPT samples.
		1–20	45	To characterize subsurface soils based on the distribution of SRCs identified in surface soil. DPT borings were advanced within 5 feet adjacent to the top of slope when site conditions limited the ability of the DPT sample rig to collect samples. The proposed modified ISM samples were for a maximum of 4-foot intervals (1–5, 5–9, 9–13, 13–17, and 17–20 feet bgs).
Sediment	ISM	0–0.5	2	Sediment samples were collected in the floodplain between the Sand Creek and the AOC to evaluate the true average concentration of SRCs detected in sediment during the 2003 RA.

[1] denotes number of samples does not include duplicates or other QA/QC samples.

AOC denotes area of concern.

bgs denotes below ground surface.

DPT denotes direct-push technology.

ISM denotes incremental sampling method.

QA denotes quality assurance.

QC denotes quality control.

RA denotes removal action.

RI denotes remedial investigation.

SRC denotes site-related chemical

SVOC denotes semivolatile organic compound.

VOC denotes volatile organic compound.

Table 3-3. Quality Assurance/Quality Control samples taken for the RI.

Sample Type	Rationale
Field Duplicate	Analyzed to determine sample heterogeneity and sampling methodology reproducibility
Equipment Rinsate	Analyzed to assess the adequacy of the equipment decontamination processes for soil and groundwater
Laboratory Method Blanks	Analyzed to determine the accuracy and precision of the analytical method as implemented by the laboratory
Laboratory Duplicate Samples	Analyzed to assist in determining the analytical reproducibility and precision of the analysis for the samples of interest and provide information about the effect of the sample matrix on the measurement methodology
Matrix Spike/Matrix Spike Duplicate	
Trip Blank	Analyzed to assess the potential for contamination of samples due to contaminant interference during sample shipment and storage

4.0 NATURE AND EXTENT OF CONTAMINATION

This section presents results of the RI data screening process to identify SRCs indicative of impacts from historical operations conducted at the site, and to evaluate occurrence and distribution of SRCs in environmental media at the AOC. The data evaluated in this section are inclusive of the results from the RI sampling as well as previous samples collected during the 2003 RA after the removal action was completed and the 2003 FWBWQS.

Section 4.1 presents the data reduction and screening process that describes the statistical methods and facility-wide BSV screening criteria used to distinguish constituents present at ambient concentrations from those present at concentrations that indicate potential impacts related to historical operations within the AOC. Sections 4.2 through 4.6 present the nature and extent of identified SRCs within each environmental media and spatial data aggregates (surface soil, subsurface soil, sediment, and surface water) established for this RI Report. Summary of the detected analytical results for the previous investigations and removal action and the current RI data used in the data screening process are presented in tabular formats at the end of this section. A summary of the complete laboratory data results and the laboratory data packages for the RI data are in **Appendix D**.

4.1 Data Evaluation Method

Data evaluation methods for the Sand Creek Site are consistent with those established in the USACE Position Paper and the FWCUG Report (SAIC, 2010). These methods consist of three general steps: (1) define data aggregates; (2) data verification, reduction, and screening; and (3) data presentation.

4.1.1 Definition of Aggregates

The data from the Sand Creek Site were grouped (aggregated) in two ways for evaluation of contaminant nature and extent, fate and transport, and to determine potential hazards and risks to likely human and environmental receptors. The initial basic aggregation of data was by environmental media: soil (surface and subsurface), sediment, and surface water. For each media aggregate, an evaluation was conducted to determine if further aggregation was warranted with respect to site characteristics, historical operations, ecological habitat, and potential future remedial strategy and land use (i.e., spatial aggregates). Data for soil and sediment were further aggregated based on depth and sample type for consistency with the human health and ecological risk exposure units (EUs) and guidance established in the HHRAM (USACE, 2005b), the FWCUG Report (SAIC, 2010), and the *RVAAP Facility-Wide*

Ecological Risk Assessment Work Plan (USACE, 2003). The data aggregates for each of the environmental media evaluated in this RI are as follows:

- **Surface Soil (0 to 1 foot bgs) -** The surface soil sampling units are evaluated as an AOC-wide aggregate considered as the decision unit for surface soil. Both discrete and ISM data are available for these media. It is inappropriate to combine data from these two sample types; therefore, these two samples types are evaluated separately. The spatial aggregates of the sampling units were designed based on elevated concentrations in data from the 2003 RA, results of buried anomalies from the DGM investigation, and known historical dumping operations at the AOC.
- **Sediment (between 0 and 1 foot bgs)** – The sediment sampling units are evaluated as an AOC-wide aggregate considered as the decision unit for sediment. The ISM and discrete data, as well as data from different sample intervals (0 to 0.5 foot and 0 to 1 foot), are available for these media. Although samples from various depths may be comparatively evaluated, it is inappropriate to combine data from these ISM and discrete sample types; therefore, these two sample types are evaluated separately.
- **Subsurface Soil (>1 foot bgs)**—The subsurface soil medium is evaluated as an AOC-wide aggregate on the same basis as surface soil. The subsurface soil samples were aggregated based on sample depth intervals of 1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet.
- **Surface Water** — Due to the size of the creek and fast moving conditions, surface water is not considered to be representative of past disposal activities at the Sand Creek Site. No surface water samples were collected at Sand Creek during the RI field activities; however, the surface water samples that were collected during previous activities are conservatively evaluated as an AOC-wide aggregate in this RI to support the assertion that there are no impacts to the waterway as a result of the historical dumping activities.

Discussion of the nature and extent of contamination is discussed further in this section following the RVAAP data screening process for SRCs. Fate and transport of identified SRCs is discussed in Section 5.0, "Contaminant Fate and Transport." For risk assessment purposes, the identified data aggregates will be used to define human health and ecological exposures as discussed in Section 6.0, "Human Health Risk Assessment" and Section 7.0, "Screening Level Ecological Risk Assessment," respectively.

4.1.2 Data Review, Validation, and Quality Assessment Results

Data validation was performed by Shaw on all 28 surface soil, 3 sediment, and 78 subsurface soil samples (including field duplicates and QC samples) collected during the RI field activities

at the Sand Creek Site to ensure that the precision and accuracy of the analytical data were adequate for their intended use. The review constituted (1) comprehensive validation of 100 percent of the primary data set; (2) comprehensive validation of the QA split sample data set; and (3) a comparison of primary sample, field duplicate sample, and field QA split sample information.

Analytical results were reported by the laboratory in electronic format and issued to Shaw on compact disc. Data validation was performed to ensure all requested data were received and completed. Data use qualifiers were assigned to each result based on the criteria provided in the QSM 4.1 (DOD, 2009). Results were qualified as follows:

- "U" - The analyte was not detected or reported less than the level of detection.
- "J" - The reported result is an estimated value.
- "UJ" – The analyte was not detected and the detection limits and quantitation limits are approximate.

In addition to assigning qualifiers, the validation process also selected the appropriate result to use when reanalysis or dilutions were performed. Where laboratory surrogate recovery data or laboratory QC samples were outside of analytical method specifications, the validation chemist determined whether laboratory reanalysis should be used in place of an original reported result. If the laboratory reported results for both diluted and undiluted samples, diluted sample results were used for those analytes that exceeded the calibration range of the undiluted sample. Shaw determined that the Sand Creek Site data were of sufficient quality to make informed decisions for the surface soil, subsurface soil, and sediment samples collected. A complete presentation of the validation process and associated results of the evaluation performed by Shaw is provided in the *Final Data Validation Report* in **Appendix C**.

The MEC^x evaluated the data in the context of the project DQOs and the method quality objectives as specified in the SAP Addendum No. 1 (Shaw, 2010) and the *Facility-Wide Quality Assurance Project Plan* included in the FWSAP (SAIC, 2001). The USACE prepared a *Chemical Data Usability Assessment* following review of the *Final Data Validation Report* prepared by MEC^x and concluded that through the proper implementation of the project data review, verification, and validation process that is outlined in the *Facility-Wide Quality Assurance Project Plan*, the data for the Sand Creek RI are deemed acceptable for use. Based upon this assessment, all analytical results are usable to meet the project DQOs as qualified and presented by Shaw; can withstand scientific scrutiny; are technically defensible; and are of known and acceptable quality in terms of sensitivity, precision, and accuracy. The MECx *Final Data Validation Report* and the *Chemical Data Usability Assessment* prepared by the USACE are presented in **Appendix C**.

4.1.3 Data Reduction and Screening

The data reduction process employed to identify SRCs involves identifying frequency of detection summary statistics, comparison to the facility-wide BSV screening values (BSVs) (inorganics only) and evaluation of essential nutrients. Historical site data were used from the RD/RA Report (MKM, 2004) and QC and field duplicates were excluded from the screening data sets. All analytes having at least one detected value was included in the data reduction process. Summary statistics calculated for each data aggregate included the minimum, maximum and average (mean) detected values and the proportion of detected results to the total number of samples collected. For calculation of mean detected values, nondetected results were included by using one-half of the reported detection limit as a surrogate value during calculation of the mean result for each compound. Following data reduction, the data were screened to identify SRCs using the processes outlined in the following sections. **Figure 4-1** shows data screening process to identify SRCs and COPCs in accordance with the FWCUG Report (SAIC, 2010).

4.1.3.1 Frequency of Detection

Chemicals that are detected infrequently, except explosives and propellants, may be artifacts in the data due to sampling, analytical, or other problems, and therefore, may not be related to the site activities or disposal practices. For sample aggregations, except for explosives and propellants, with at least 20 samples and frequency of detection of less than 5 percent, a weight of evidence approach was used to determine if the chemical is AOC related. The magnitudes and clustering of the detections and the potential source of the chemical were evaluated keeping in mind that the site was used for disposal purposes and various chemicals may be present. For example, if detected results were not clustered, and the chemical was not found in other media at the study area, and the concentrations were not substantially elevated relative to the detection limit, then the chemical may be considered spurious and be eliminated from further consideration. Therefore, chemicals that were detected only at low concentrations in less than 5 percent of the samples from a given medium were dropped from further consideration, unless their presence was expected based on historical information about the site, or it was likely to identify the existence of a "hot spot." Frequency of detection analysis was used for discrete samples only since it is not considered an appropriate criterion for ISM samples.

4.1.3.2 Facility-Wide Background Screen

For each inorganic constituent, concentrations were compared against the established RVAAP facility-wide BSVs. For inorganic constituents, if the detected value exceeded its respective BSV, it was considered to be an SRC. It should be noted that not all inorganic compounds, analyzed as part of the previous investigations or the RI sampling event, have established screening levels or BSVs. Therefore, in the event an inorganic constituent was not detected in

the background data set, the BSV was set to 0, and any detected result for that constituent was considered above background. This conservative process ensures that detected constituents are not eliminated as SRCs simply because they are not detected in the background data set. All detected organic compounds were considered to be above background because these classes of compounds do not occur naturally.

4.1.3.3 Essential Nutrient Screen

Chemicals that are considered to be essential nutrients (calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium) are an integral part of the food supply and are often added to foods as supplements. The EPA recommends that these chemicals not be evaluated as COPCs if they are (1) present at low concentrations (i.e., only slightly elevated above naturally occurring levels) and (2) toxic at very high doses (i.e., much higher than those that could be associated with contact at the site) (USACE, 2005b). For the 2003 RA samples and the RI, analyses were conducted for calcium, iron, magnesium, potassium, and sodium. These five constituents were eliminated as SRCs in all environmental media based on comparison to BSVs.

4.1.4 Data Presentation

Data summary statistics and screening results for SRCs in surface and subsurface soil, sediment, and surface water at the Sand Creek Site are presented for each media in the following sections. The data use summary for the environmental samples collected at the Sand Creek Site during previous activities and during the RI field work are presented in **Table 4-1**. A summary of the analytical results for the environmental media samples and the data screening process for SRCs are presented in **Tables 4-2** through **4-17**. Analytical results for the SRCs are presented by sample location in **Figures 4-2** through **4-19**. The complete data summary tables and the laboratory data report for the samples collected at the Sand Creek Site during the RI field work is presented in **Appendix D**.

4.1.5 Data Use Evaluation

The types of environmental media sampled at the Sand Creek Site during the 2003 RA consisted of surface soil, sediment, and surface water. A sediment sample and surface water samples were also collected for the 2003 FWBWQS. Additional samples were collected for the RI that included surface and subsurface soil and sediment. Available sample data were evaluated to determine suitability for use in the various key RI data screens that include evaluation of nature and extent of contamination, fate and transport modeling, and potential hazards and risks to likely human and environmental receptors. Evaluation of data suitability for use in this RI Report involved two primary considerations: (1) representativeness with respect to current AOC conditions and (2) sample collection methods (i.e., discrete vs. ISM).

Samples collected for the 2003 RA included discrete surface soil, sediment samples from within the Sand Creek and adjacent floodplain, and surface water samples from the Sand Creek and represent existing media that was not removed during the RA. Samples for the 2003 FWBWQS included discrete surface water samples and a sediment sample collected using the ISM. The collection of surface soil and sediment samples using ISM and subsurface soil samples using a modified ISM were conducted for the Phase RI field activities. Site conditions have changed minimally since the 2003 RA. Therefore, all data from these two sampling events were incorporated into the nature and extent of contamination evaluation. Only the samples collected during the RI, apart from surface water from the 2003 RA and the 2003 FWBWQS, were screened for SRCs and carried forward into the risk assessments for likely receptors since the ISM is considered to provide a more representative spatial distribution within a sampling unit. The surface water samples from the 2003 RA and the 2003 FWBWQS were carried forward to the risk assessment to verify that historical site activities have not impacted the Sand Creek. The designated use for available Sand Creek Site samples is presented in **Table 4-1.**

4.2 Contaminant Nature and Extent in Surface Soil

Data from all qualified historical and RI surface soil samples were combined and screened to identify SRCs representing current conditions at the Sand Creek Site. The SRC screening data for surface soil (not including field duplicates or QC samples) included the following samples:

- 2003 RA
  - 33 discrete surface soil samples from 0 to 1 foot bgs
- RI
  - 18 ISM surface soil samples from 0 to 1 foot bgs
  - 2 discrete surface soil samples from 0 to 1 foot bgs for VOC analysis

The ISM samples were collected during the RI to further characterize the areas where SRCs consisting of inorganics, SVOCs, explosives, one propellant, and one VOC were identified from the 2003 RA data. Additional surface soil samples were collected to further illustrate the potential for contamination migration via leaching or erosion processes from surface soils to media such as sediment. All the surface soil samples collected during the RI sampling event were submitted for TAL metals, SVOCs, and explosives. Samples from two of the ISM sampling units were analyzed for the RVAAP full suite that also included VOCs, pesticides, PCBs, cyanide, and propellants. The samples analyzed for VOCs were collected as individual discrete samples collocated with the ISM sampling units.

Tables 4-2 and **4-3** present the results of the SRCs screening for discrete and ISM surface soil samples, respectively. **Tables 4-4** and **4-5** summarize the detected results for each type of surface soil sample. **Figures 4-2** through **Figure 4-6** present the SRC distribution in surface soils for the Sand Creek Site.

4.2.1 Explosives and Propellants

The data presented in **Table 4-3** and shown in **Figure 4-2** identify a total of three explosives and propellant compounds (2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, and nitroguanidine) that are considered as SRCs from the ISM samples collected during the RI field activities. Most of the SRCs were detected at the northern portion of the site at three sampling units (SCss-057, SCss-058, and SCss-069).

Explosives were detected at two discrete surface soil samples (SCss-029 and SCss-CONT-3) that were collected during the 2003 RA; however, the concentrations were below the applicable method reporting limit. The propellant nitrocellulose was detected at two discrete surface soil samples (SCss-017 and SCss-029) during the 2003 sampling event. Discrete sample SCss-029, collected at the southern portion of the site, contained 2,4-dinitrotoluene and 2,6-dinitrotoluene at estimated ("J"-flagged) concentrations of 0.037 milligrams per kilogram (mg/kg) and 0.17 mg/kg, respectively. The "J"-flagged data are considered estimated and are retained as a detected value. Nitrocellulose was detected at this sample location at a concentration of 5 mg/kg. This discrete sample location was resampled during the RI field activities (sampling unit SCss-068) using ISM and no explosives or propellants were detected.

Nitrocellulose was detected at 3.5 mg/kg in discrete sample SCss-017 that was collected during the 2003 RA. The RI sampling unit SCss-065 was collocated over the area where sample SCss-017 was collected and no explosives or propellants were detected.

Discrete sample SCss-CONT-003, collected at the northern portion of the site, contained a 2,4,6-trinitrotoluene concentration at 0.039 J mg/kg. This 2003 RA sample corresponds with RI sampling unit SCss-058 that had a detected 2,4,6-trinitrotoluene concentration of 0.26 J mg/kg.

4.2.2 Inorganics

A total of 15 inorganics was identified as SRCs in surface soil based on the RI data summary presented in **Table 4-3**. These inorganics had a frequency of detection of at least 61 percent (11 detections in 18 samples). The distribution of metals between the 33 discrete surface soil samples collected during the 2003 RA and the 18 surface soil samples collected during the RI are similar in that the most inorganic concentrations were detected at the northern portion of the site and the detections decreased significantly in the samples collected at the southern

portion of the site. The distribution of the surface soil inorganic SRCs identified from the 2003 RA and RI data summaries is shown in **Figures 4-3** and **4-4**, respectively.

Table 4-2 presents the MDCs for inorganic SRCs in the discrete surface soil samples collected during the 2003 RA. These MDCs for the identified SRCs were detected at surface soil sample locations SCss-004 through SCss-008 which were collected at the northern portion of the site. This corresponds with the majority of the MDCs for inorganic in surface soil that were collected during the RI sampling event which were detected primarily in ISM sampling units SCss-057, SCss-059, SCss-061, SCss-062, and SCss-064 also located at the northern portions of the site. The comparison and distribution of the inorganic SRCs identified in the 2003 RA and RI is as follows:

- For the 18 ISM surface soil samples collected for the RI, the inorganic with the most detected concentrations above its BSV was chromium with 17 detections. The MDC for chromium (188 mg/kg) was detected at sampling unit SCss-076 at the southern portion of the site, where the least number of SRCs in general have been identified. The next greatest chromium concentration (187 mg/kg) occurred in sampling unit SCss-064 at the central portion of the AOC where the bulk of the 2003 removal activities took place. The MDC for chromium (230 mg/kg) detected for the 2003 RA discrete surface soil samples are within an approximate order of magnitude of the MDCs from the RI. Based on the results of these two investigations, it appears that chromium concentrations are well distributed throughout the AOC, and no significant trend for chromium contamination is evident.
- Cadmium and thallium were both detected at 16 sampling units for the RI and are retained as SRCs since there are no available BSVs for these metals. The cadmium and thallium concentrations were relatively low with MDCs of 12.8 mg/kg and 3.2 J mg/kg, respectively, and appear to be well distributed across the AOC. Thallium was detected at only one discrete sample location (SCss-007) during the 2003 RA which does not correspond with the RI results for thallium. Cadmium was detected at 13 of 31 locations in discrete surface soil sample locations at a MDC of 40 mg/kg at sample locations SCss-005 at the northern portion of the AOC. The cadmium results detected in the 2003 RA discrete soil samples correlate with the locations for the elevated cadmium concentrations detected in the RI sampling units.
- Nickel exceeded its BSV at 15 sampling units for the RI. The location of the MDC for nickel (264 mg/kg) is situated at the northern portion of the site (sampling unit SCss-059), where the bulk of the elevated inorganic contaminants appear to reside. However, the remainder of nickel concentrations is well distributed throughout the site and is generally less than one order of magnitude above the BSV of 21.1 mg/kg. During the 2003 RA, nickel was detected above the BSV at 18 of 31 sample

locations. The nickel MDC of 110 mg/kg for the 2003 RA is within an approximate order of magnitude of the MDC from the RI further illustrating that nickel appears to be well distributed across the AOC.

- Mercury and silver were detected above the BSVs at 14 locations each for the RI surface soil samples. The MDCs for mercury (24.6 mg/kg) and silver (256 mg/kg) occurred at the northern portion of the site at sampling units SCss-061 and SCss-064, respectively. The detection of these metals correlates closely with the 2003 RA results. The MDCs for mercury (130 mg/kg) and silver (630 mg/kg) in 2003 were detected at discrete sample locations SCss-005 and SCss-007, respectively, which were collected at the same relative location as the RI sampling units.
- Lead and copper had a similar number of detections above the BSVs (12 and 11 detections, respectively). The MDC for lead (405 mg/kg) was detected in sampling unit SCss-061 situated at the northern portion of the site. The MDC of copper (726 mg/kg) was detected at sampling unit SCss-064, also situated in the northern portion of the AOC. The ISM data for copper correspond with the general location for the MDCs of copper detected during the 2003 RA (330 mg/kg) at discrete sample location SCss-005. Lead was not detected above its BSV in any of the 2003 RA samples.
- The remainder of the metal concentrations detected above the BSVs in the samples collected during the RI includes zinc (10), antimony (9), barium (8), selenium (5), arsenic (5), cobalt (4), and beryllium (2). Although these detections are sporadic and are not as well defined as the more frequently detected metals that exceed their respective BSVs, the MDCs trend similar in that they are primarily situated at the northern portion of the AOC. The MDCs for zinc, antimony, arsenic, and barium are found in sampling unit SCss-061. The MDCs of selenium and cobalt are at sampling units SCss-073 and SCss-074 at the top of slope adjacent to sampling unit SCss-061. The MDC for beryllium was detected at sampling unit SCss-062 located along the slope to the south of sampling unit SCss-061.

4.2.3 SVOCs

A total of 29 SVOCs, 18 of which are PAHs, was identified as SRCs from the ISM samples presented in **Table 4-3**. The sample location with the greatest number of detected SVOCs was at sampling unit SCss-060 where the SVOCs consist primarily of PAHs. The detected SVOC concentrations decrease significantly with the sampling units surrounding sampling unit SCss-060 indicating that the area has been bounded.

Only three discrete samples from the 2003 RA were analyzed for SVOCs (SCss-017, SCss-023, and SCss-029). The greatest concentrations were PAHs at SCss-017 located along the

AOC slope at the northern portion of the property which corresponds to the RI results. The distribution of the SVOC SRCs in surface soil is presented in **Figure 4-5**.

4.2.4 VOCs, Pesticides, PCBs, Total Cyanide, and Asbestos

Two discrete samples were analyzed for VOCs (SCss-057D-0001-SO and SCss-068D-0001-SO), and two ISM samples were analyzed for total cyanide, pesticide, and PCBs (SCss-057M-0001-SO and SCss-076M-0001-SO) for the RI. Three discrete samples were analyzed for VOCs, total cyanide, pesticide, and PCBs (SCss-017, SCss-023, and SCss-029) for the 2003 RA. All 31 surface soil samples collected for the 2003 RA were analyzed for asbestos.

A total of six pesticides were identified as SRCs in the ISM samples presented in **Table 4-3**. All six pesticides were detected at sampling unit SCss-076 situated at the top of slope at the southern portion of the AOC. Three of the pesticides SRCs were detected at sampling unit SCss-057, the most northern sample area along the AOC slope. It is suspected that the detected pesticides concentrations are associated with past accepted practices implemented for pest control at the former dump location. The distribution of the pesticides identified as SRCs are shown in **Figure 4-6**.

Total cyanide was identified as an SRC at both RI sample locations. The MDC was 0.39 J mg/kg at sampling unit SCss-076.

One VOC was detected in discrete sample SCss-029 from the 2003 RA. The low VOC concentration of chloroethane was detected at an estimated concentration of 0.091 J mg/kg.

No PCBs or VOCs were identified as SRCs in the surface soil samples collected during the RI. No total cyanide, pesticides, PCB, or asbestos SRCs were identified in surface soil samples collected for the 2003 RA.

4.3 Contaminant Nature and Extent in Subsurface Soil

The 2003 RA at the Sand Creek Site did not include investigation of subsurface soils. Therefore, only the RI samples are available to evaluate the nature and extent of contamination in the subsurface at the AOC. A total of 22 soil borings was completed at the Sand Creek Site during the RI field activities. The SRC screening data for subsurface soil are comprised of the following RI samples:

- 22 modified ISM subsurface soil samples from 1 to 5 feet bgs using DPT and hand-auger sampling methods
- 36 modified ISM subsurface samples from 5 to 20 feet bgs taken from the following intervals: 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet
- 5 discrete sediment samples for VOC analysis only

The subsurface samples were collected during the RI to evaluate and characterize subsurface conditions based on the 2003 RA surface soil data and results of the 2010 DGM investigation. All of the subsurface soil samples collected during the RI sampling event was submitted for TAL metals, SVOCs, and explosives. Samples from five of the subsurface samples, typically one from each interval except two of which were collected for the 1- to 5-foot interval, were analyzed for the full suite that also included VOCs, pesticides, PCBs, cyanide, and propellants. The samples analyzed for VOCs were collected as discrete samples from the pre-designated sample interval.

Table 4-6 presents the results of the SRCs screening for subsurface soil samples, and **Table 4-7** summarizes the detected results. **Figures 4-7** through **4-17** present the SRC distributions in subsurface soils for the Sand Creek Site.

4.3.1 Explosives and Propellants

The data presented in **Table 4-6** identify three explosives compounds (2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, and m-nitrotoluene) that are considered as SRCs from the subsurface samples collected during the RI field activities. The distribution of explosives and propellants is shown in **Figure 4-7**. All three SRCs were detected at the hand-auger subsurface boring location SCsb-049 at the 1- to 5-foot sample interval. This boring location is situated at the northern portion of the site along the slope and is collocated with ISM surface soil sampling unit SCss-063 which did not exhibit detectable concentrations of explosives or propellants. No other explosives or propellants were detected in subsurface soils.

4.3.2 Inorganics

A total of 15 inorganics was identified as SRCs in subsurface soils based on the RI data summary presented in **Table 4-6**. The distribution of inorganic SRCs across the five sample intervals (1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet) is shown in **Figures 4-8** through **4-12**. Nine of the SRCs (barium, beryllium, chromium, copper, lead, mercury, nickel, vanadium, and zinc) were detected in 100 percent of the subsurface samples (58 detections in 58 samples). The inorganic with the least detection was silver with 14 detections out of 58 samples (24 percent).

In general, an evaluation of the subsurface sample results to corresponding surface soil samples identifies distinct vertical trends in the total number of detected inorganics, the types of inorganics detected and the resulting concentrations. Eight of the nine soil borings where the MDCs for inorganics were detected above BSVs (SCsb-036, SCsb-037, SCsb-038, SCsb-44, SCsb-45, SCsb-48, SCsb-49, and SCsb-50) were advanced both along the slope and at the top of slope at the northern portion of the site that correspond to the 2003 RA and RI surface soil sample locations that exhibited the greatest inorganic concentrations.

The sample with the most detected inorganic concentrations (14) above the BSVs was in the 5- to 9-foot sample interval at DPT soil boring SCsb-037 (SCsb-037M-002-SO). This boring was advanced at the top of slope at the northern portion of the AOC adjacent to the ISM sampling units SCss-062 and SCss063 where the greatest number of inorganics (14 at each sampling unit) were detected above the surface soil BSVs. The ISM sampling units for these two surface sample area were along the slope of the AOC which has an approximate vertical drop of 20 feet and corresponds with the 1- to 20-foot sample depth at DPT boring SCsb-037.

4.3.3 SVOCs

A total of 26 SVOCs, 16 of which were PAHs, was identified as SRCs in subsurface soils as presented in **Table 4-6**. The distribution of SVOC SRCs across the five sample intervals (1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet) is shown in **Figures 4-13** through **4-17**. The sample location with the greatest number of detected SVOCs (22) was in the 1- to 5-foot sample interval at boring locations SCsb-050 (SCsb-050M-0001-SO) Other locations with frequent detections of SVOCs include SCsb-037 (SCsb-037M-0001-SO), SCsb-47 (SCsb-047M-0001-SO), and SCsb-49 (SCsb-049M-0001-SO) that were also collected at the 1- to 5-foot sample interval. The subsurface soil sample results for SVOCs correspond with the RI surface sample locations, in particular sampling unit SCss-060, where the greatest numbers of SVOCs were detected in the 0- to 1-foot sample interval at the northern portion of the AOC.

4.3.4 Pesticides and PCBs

Five subsurface samples were analyzed at the various sample depths for the full suite that resulted in 13 pesticides and 1 PCB constituent that were identified as SRCs in subsurface soils as presented in **Table 4-6**. The majority of the pesticides SRCs (12) were detected at the 1- to 5-foot sample interval at boring location SCsb-037 (SCsb-037M-0001-SO). Heptachlor was the most prevalent pesticide, was detected in four of the five subsurface samples analyzed at the various samples depths, and was detected as deep as the 17- to 20-foot interval at boring SCsb-039 (SCsb-039M-0005-SO). The MDC of 0.0058 mg/kg for heptachlor was detected in the 1- to 5-foot sample interval at boring SCsb-037 (SCsb-037M-0001-SO). Heptachlor was the sole pesticide SRC detected at the 9- to 13-foot interval in boring SCsb-042 (SCsb-042M-0003). Endosulfan II, 4,4'-DDT, and 4,4'-DDE were detected at the 1- to 5-foot sample interval in boring SCsb-048 (SCsb-048M-0001-SO). Alpha-BHC, heptachlor, and methoxychlor were detected at the 5- to 9-foot interval in boring SCsb-040 (SCsb-040M-0002).

The PCB constituent, Arochlor-1254, was detected at the 1- to-5-foot interval in boring SCsb-037 (SCsb-037M-0001-SO). No other PCB concentrations were detected in subsurface soil. Both boring locations SCsb-037 and SCsb-048, where the majority of the pesticides and the one PCB concentration were detected at the 1- to 5-foot sample interval, were advanced in the

northern portion of the AOC where contaminant trending for inorganics and SVOCs is observed in surface soils. Boring SCsb-037 was advanced along the top of slope adjacent to ISM sampling units SCss-062 and SCss-063. Boring location SCsb-048 was collocated with ISM sampling unit SCss-062. The distribution of the pesticides and PCB SRCs is shown in **Figure 4-7**.

4.3.5 VOCs and Total Cyanide

Five discrete samples were analyzed for VOCs for the RI subsurface intervals. A total of five VOCs were identified as SRCs in subsurface soils. 1,2-Dimethylbenzene and toluene were detected at the 1- to 5-foot sample interval at boring locations SCsb-037 (SCsb-037D-0001-SO) and SCsb-048 (SCsb-048D-0001-SO). Benzene, ethylbenzene, and total xylenes (i.e., benzene, toluene, ethylbenzene, and xylene compounds) were also detected in sample SCsb-048D-0001-SO.

Five samples were analyzed for total cyanide, one for each of the sample intervals. One total cyanide concentration (0.76 mg/kg) was detected at the 1- to 5-foot sample interval at boring location SCsb-048 (SCsb-048M-0001-SO); therefore, total cyanide is retained as an SRC. Total cyanide was not detected in any of other subsurface samples analyzed.

The data summary for subsurface samples, including VOCs and total cyanide, is presented in **Table 4-6**. The distribution of the VOC and cyanide SRCs is shown in **Figure 4-7**.

4.4 Contaminant Nature and Extent in Sediment

Data from all qualified historical and RI sediment samples were combined and screened to identify SRCs representing current conditions at the Sand Creek Site. The SRC screening data for sediment (not including field duplicates or QC samples) included the following samples:

- 2003 RA
  - 12 discrete sediment soil samples from 0 to 1 foot bgs
- 2003 FWBWQS
  - 1 ISM sediment sample from 0 to 0.5 foot bgs
- RI
  - 2 ISM sediment samples from 0 to 0.5 foot bgs
  - 1 discrete sediment sample from 0 to 5 feet bgs for VOC analysis

Six of the discrete sediment samples (SCsd-002, SCsd-004, SCsd-006, SCsd-008, SCsd-010, and SCsd-011) collected during the 2003 RA were collocated with the surface water samples discussed in Section 4.5. The remaining six samples (SCsd-001, SCsd-003, SCsd-005, SCsd-

007, SCsd-009, and SCsd-012) were collected from the narrow floodplain situated between Sand Creek and the AOC. Two ISM sediment samples were collected during the RI at two sampling units (SCsd-070 and SCsd-071) to further characterize the areas where SRCs consisting of inorganics, explosives and propellants and SVOCs were identified from the 2003 RA data, in particular the sediment along the floodplain adjacent to the AOC.

One ISM sediment sample (FSW-SD-011-0000) was collected along the reach of the Sand Creek adjacent to the AOC during the 2003 FWBWQS. The sediment sample was collocated with surface water samples collected for the study during two separate occasions as discussed in Section 4.5. The sample was submitted for laboratory analysis for metals, explosives, SVOCs, pesticides, PCBs, total cyanide, and several nutrient parameters (ammonia, phosphorus, and nitrate/nitrite).

Both sediment samples collected during the RI sampling event were submitted for metals, explosives, SVOCs, pesticides, PCBs, cyanide, and propellants. A discrete VOC sample was collected and collocated with the sediment sample collected at ISM sampling unit SCsd-071 (SCsd-071D-0001-SO).

Tables 4-8, **4-9**, and **4-10** present the results of the SRCs screening for discrete and ISM sediment samples, respectively. **Tables 4-11**, **4-12**, and **4-13** summarize the detected results for each of the sediment sample types. **Figure 4-18** presents the SRC distribution in sediments for the Sand Creek Site as identified from the data results for the 2003 RA, the 2003 FWBWQS, and the RI sample events.

4.4.1 Explosives and Propellants

The data presented in **Table 4-13** and shown in **Figure 4-18** identify nitroguanidine as the sole propellant detected in both ISM sediment sampling units along the floodplain adjacent to the AOC as part of the RI. The MDC (1.2 J mg/kg) was detected at sampling unit SCsd-071. No other explosives or propellants were detected in sediment samples collected for the RI.

Two of the 12 discrete sediment samples collected during the 2003 RA were analyzed for explosives and propellants (SCsd-007 and SCsd-008). Nitrocellulose was detected in both samples at a MDC of 0.98 mg/kg in sample SCsd-008. 2,6-Dinitrotoluene and nitroguanidine were also detected in sample SCsd-008 at concentrations of 0.11 J mg/kg and 0.05 J mg/kg, respectively. Discrete sample SCsd-007 was collected from sediment in the thin floodplain just north of the former railroad bed that bisects the site. Discrete sample SCsd-008 was collected in the Sand Creek sediment just north of the former railroad culvert that crossed Sand Creek. No explosives or propellants were detected in the sediment sample collected for the 2003 FWBWQS.

4.4.2 Inorganics

A total of 11 inorganics was identified as SRCs based on the RI data presented in **Table 4-13** for the two ISM sediment samples collected. All 11 metals identified as SRCs in sediment were present above the applicable BSVs at sample location SCsd-070 collected in the floodplain along the northern portion of the AOC. Seven of the metals exceeded the BSVs in sediment sample SCsd-071 collected along the southern portion of the AOC. The higher number of SRCs and elevated concentrations that were detected in sediment sample SCsd-070M-0001-SD in comparison to SCsd-071M-0001-SD (antimony [8.4 mg/kg to 0.45 J mg/kg], barium [231 mg/kg to 75.7 mg/kg], cadmium [2.7 mg/kg to 0.19 mg/kg], copper [53.7 mg/kg to 16.6 mg/kg], lead [104 mg/kg to 7.2 mg/kg], mercury [0.3 to 0.049 mg/kg], and silver [116 mg/kg to less than the detection limit of 0.087 mg/kg]) may be attributed to runoff from the slopes at the northern portion of the AOC where concentrated areas of elevated inorganic SRCs were identified in surface soil. Maximum detected concentrations of the remaining SRCs in sediment (beryllium, chromium, nickel, and thallium) varied less than several orders of magnitude between the two sediment sampling units and appeared well distributed throughout the floodplain along the entire reach of the AOC.

The distribution of metals between the 12 discrete sediment samples collected during the 2003 RA and the 2 ISM sediment samples collected during the RI are similar in that most of the inorganic SRCs were detected at the northern portion of the site and the detections decreased significantly in the samples collected at the southern portion of the site. As previously discussed, the majority of the SRCs identified in sediment during the RI were detected in sediment sampling unit SCsd-071 located along the floodplain adjacent to the northern half of the AOC. A total of 10 metal SRCs (aluminum, antimony, beryllium, cadmium, chromium, cobalt, lead, mercury, nickel, and silver) was detected during the 2003 RA and was mostly found at discrete sample locations (SCsd-001 and SCsd-008), both collected along the northern portion of the AOC (**Table 4-8**). Two metals (antimony and cadmium) were identified as SRCs in the sediment sample (FSW-SD-011-0000) collected during the 2003 FWBWQS. The distribution of the inorganic SRCs in sediment for both the 2003 RA and RI sample events is shown in **Figure 4-18**.

4.4.3 SVOCs

A total of 15 SVOCs, 11 of which are PAHs, was identified as SRCs in the sediment samples collected for the RI and is presented in **Table 4-13**. The distribution of the SVOC SRCs in sediment is presented in **Figure 4-18**. All 15 SVOCs were detected at estimated (J-flagged) concentrations at sediment sampling unit SCsd-070 along the northern floodplain area which may be associated with runoff from SVOC-impacted surface soils situated upgradient of the floodplain area. Six of the SVOC SRCs were detected at estimated concentrations in sediment sampling unit SCsd-071 along the southern floodplain area.

SVOCs were analyzed for discrete samples SCsd-007 and SCsd-008 collected during the 2003 RA. However, no SRCs were identified. One SVOC (di-n-butyl phthalate) was identified as an SRC in the ISM sediment sample (FSW-SD-011-0000) collected during the 2003 FWBWQS.

4.4.4 Pesticides and PCBs

Twelve pesticides and two PCB constituents were identified as SRCs in sediment collected for the RI as presented in **Table 4-13**. All 12 pesticides and both PCBs were detected in sediment sampling unit SCsd-070. Four of the pesticide SRCs were identified in the southern floodplain sampling unit SCsd-071. No PCBs were identified as SRCs at sampling unit SCsd-071. Pesticides and PCB analysis was performed for discrete samples SCsd-007 and SCsd-008 collected during the 2003 RA and for ISM sample FSW-SD-011-000 collected during the 2003 FWBWQS. However, no pesticide or PCB SRCs were identified during either investigation. The distribution of pesticide and PCB SRCs in sediment is presented in **Figure 4-18.**

4.4.5 VOCs and Total Cyanide

Total cyanide and VOC analysis was conducted for both sediment samples collected for the RI (**Table 4-13**). Cyanide was detected at concentrations of 0.36 J mg/kg and 0.32 J mg/kg for sediment sampling units SCsd-070 and SCsd-071, respectively, and is retained as SRC in sediment. A discrete sample for VOC analysis (SCsd-071D-0001-SD) was collected within sampling unit SCsd-071. No VOCs were identified as SRCs in sediment.

Total cyanide and VOCs were analyzed in discrete sediment sample locations SCsd-007 and SCsd-008 for the 2003 RA (**Table 4-11**). Acetone was the only VOC detected at a concentration of 0.011 mg/kg at sample location SCsd-008. Cyanide was not identified as an SRC in sediment for the 2003 RA.

Cyanide was analyzed for the ISM sediment sample collected during the 2003 FWBWQS and was not detected (**Table 4-12**). No VOCs were analyzed as part of the study.

The distribution of VOC and cyanide SRCs in sediment is presented in **Figure 4-18.**

4.4.6 Asbestos

All 12 sediment samples collected for the 2003 RA were analyzed for asbestos. No asbestos was detected. Neither of the sediment samples collected for the RI were analyzed for asbestos.

4.4.7 Nutrient Parameters

The sediment sample from the 2003 FWBWQS (FSW-SD-011-0000) was analyzed for nutrient parameters that included ammonia, phosphorus, and nitrate/nitrite to further evaluate ecotoxic effects within the Sand Creek. Concentrations for each of the parameters were detected and are retained as SRCs in sediment (**Table 4-12**).

4.5 Contaminant Nature and Extent in Surface Water

Data from all qualified historical and RI surface soil samples were combined and screened to identify SRCs representing current surface water conditions at the Sand Creek Site. The SRC screening data for surface water (not including field duplicates or QC samples) included the following samples:

- 2003 RA
  - Three surface water samples
- 2003 FWBWQS
  - Two surface water samples

A total of three surface water samples (SCsw-001-0001-SW, SCsw-002-0001-SW, and SCsw-003-0001-SW) was collected from Sand Creek adjacent to the AOC following the 2003 RA to assess surface water quality near the site. One sample each was collected upstream, immediately adjacent and downstream of the site. All surface water samples were collected for analysis of filtered TAL metals and asbestos analysis. One sample that represented a minimum of 10 percent of the surface water samples collected was submitted for the full suite that in addition to TAL metals included total cyanide, VOCs, SVOCs, pesticides, PCBs, explosives, and propellants (nitroglycerine, nitroguanidine, and nitrocellulose).

Two surface water samples (FSW-SW-011-0000 and FSW-SW-051-0000) were collected from the Sand Creek for the 2003 FWBWQS at a sample location adjacent to the AOC. Each sample was collected from the same location at different collection dates during the summer of 2003 and was analyzed for TAL metals, pesticides, PCBs, explosive compounds, SVOCs, cyanide, and several nutrient parameters (ammonia, phosphorus, and nitrate).

Tables 4-14 and **4-15** summarize the results of the surface water samples for the 2003 RA and 2003 FWBWQS, respectively, as well as the SRCs that were identified following the data screening process. **Tables 4-16** and **4-17** summarize the detected surface water results for each of the investigations. **Figure 4-19** presents the surface water sample locations with associated SRC concentrations.

4.5.1 Explosives and Propellants

No explosives or propellants were detected in any of the surface water samples from either sample event.

4.5.2 Inorganics

There were 17 inorganic analytes detected between the five surface water samples from the 2003 RA and 2003 FWBWQS. None of the inorganics detected in the 2003 RA surface water

samples were identified as SRCs. Seven inorganics detected in the 2003 FWBWQS surface water samples were identified as SRCs due to concentration exceedances above the BSVs. These inorganic SRCs include antimony, arsenic, chromium, cobalt, lead, silver, and vanadium. With the exception of arsenic that has a surface water BSV of 3.2 micrograms per liter (µg/L), the surface water BSVs for the other six inorganic SRCs is 0 µg/L. The remaining detected constituents were eliminated as SRCs because they were either considered essential nutrients (calcium, iron, magnesium, potassium, and sodium) or the MDC was less than the surface water BSVs (aluminum, barium, copper, manganese, and zinc).

4.5.3 SVOCs

Only one surface water sample from the 2003 RA (SCsw-001-0001-SW) and both surface water samples from the 2003 FWBWQS (FSW-SW-011-0000 and FWS-SW-051-0000) were analyzed for SVOCs. A total of two SVOCs was identified SRCs in the surface water samples from the FWBWQS. Bis(2-ethylhexyl)phthalate was detected in sample FSW-SW-011-0000, and di-n-butyl phthalate was detected in sample FSW-SW-051-0000. No other SVOCs were identified as SRCs in the surface water samples.

4.5.4 Other Analyses

The surface water samples from the two studies were analyzed for various other parameters that included asbestos, explosives, propellants, VOCs, total cyanide, pesticides, and/or PCBs as follows:

- SCsw-001-0001-SW was analyzed for explosives, propellants, VOCs, total cyanide, pesticides, and PCBs.
- FSW-SW-011-000 was analyzed for total cyanide, pesticides, and PCBs.
- FSW-SW-051-000 was analyzed for total cyanide.
- All surface water samples from the 2003 RA were analyzed for asbestos.

No concentrations of asbestos, cyanide, explosives, propellants, VOCs, pesticides, or PCBs were detected in any of the surface water samples analyzed for these respective parameters.

4.5.5 Nutrient Parameters

Only one of the surface water samples collected for the 2003 FWBWQS (FSW-SW-011-0000) was analyzed for nutrient parameters (ammonia, phosphorus, and nitrate) to further evaluate potential effects within the Sand Creek. Ammonia was not detected in the surface water sample; however, concentrations of the phosphorus and nitrate/nitrite parameters were detected. Phosphorus and nitrate/nitrite were retained as SRCs for further evaluation in surface water.

4.6 Summary of Nature and Extent of Contamination

In general, the majority of the SRCs identified in the environmental media evaluated for nature and extent of contamination (surface soil, subsurface soil, sediment, and surface water) occurred at the northern portion of the AOC. Between the 2003 RA and the RI data sets, a total of 58 SRCs was identified in surface soil (0 to 1 foot). A total of 50 SRCs were identified for sediment (42 SRCs for 0 to 0.5 foot and 17 SRCs for 0 to 1 foot) following evaluation of the sediment data from the 2003 RA, the 2003 FWBWQS, and the RI. A total of 64 SRCs were identified in subsurface soil (>1 foot bgs) for the RI data set. A total of 11 SRCs were identified in surface water for the 2003 RA and the 2003 FWBWQS data sets. The spatial distribution of the SRCs, in particular inorganics, is consistent among the environmental media and the types of methods used to collect the samples as part of the past activities and current investigation (i.e., discrete vs. ISM).

4.6.1 Surface Soil

The greatest concentrations of inorganic, SVOC, and explosive and propellant SRCs in surface soil (0 to 1 foot bgs) occurred at the northern portion of the AOC where historical disposal activities occurred and where the majority of the RA was conducted in 2003. Explosives were detected at two locations (sampling units SCss-058 and SCss-069) at the northern portion of the AOC. One propellant was identified as an SRC at sampling unit SCss-069 as well. The detections of inorganics and SVOCs were well distributed across the site. However, the greatest concentrations in surface soil occurred in the northern third portion of the AOC along the slope. The number of detected inorganics and SVOCs and elevated concentrations generally decreased the further south the samples were collected. These RI results correspond with the results of the 2003 RA where the similar trending of SRCs, in particular inorganics, was observed at the northern portions of the AOC.

4.6.2 Subsurface Soils

A total of 22 soil borings was advanced during the RI field activities and subsurface samples were collected at a maximum depth of 20 feet bgs over five depth intervals (1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet) at nine of the soil boring locations. Bedrock was not encountered at any of the borings. Three explosives concentrations were detected at one soil boring location (SCsb-049) at 1 to 5 feet bgs along the slope at the northern portion of the AOC. The spatial distribution of inorganics and SVOCs was similar to that of surface soil with the greatest concentrations detected along and adjacent to the slope at the northern one-third of the AOC. The greatest number of detects and the greatest concentrations for both inorganics and SVOCs were typically found in the 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet sample intervals at this portion of the AOC. The number of detections and concentrations of SRCs generally decreased with the sample distance to the south and with depth.

For the borings where VOCs, pesticides, and PCBs were analyzed, the boring locations with the greatest number of detects were SCsb-038 and SCsb-048 at the 1- to 5-foot sample intervals. These borings were advanced in the northern portion of the AOC in the vicinity of the soil borings where the concentrated pockets of inorganic and SVOC SRCs were identified.

4.6.3 Sediment

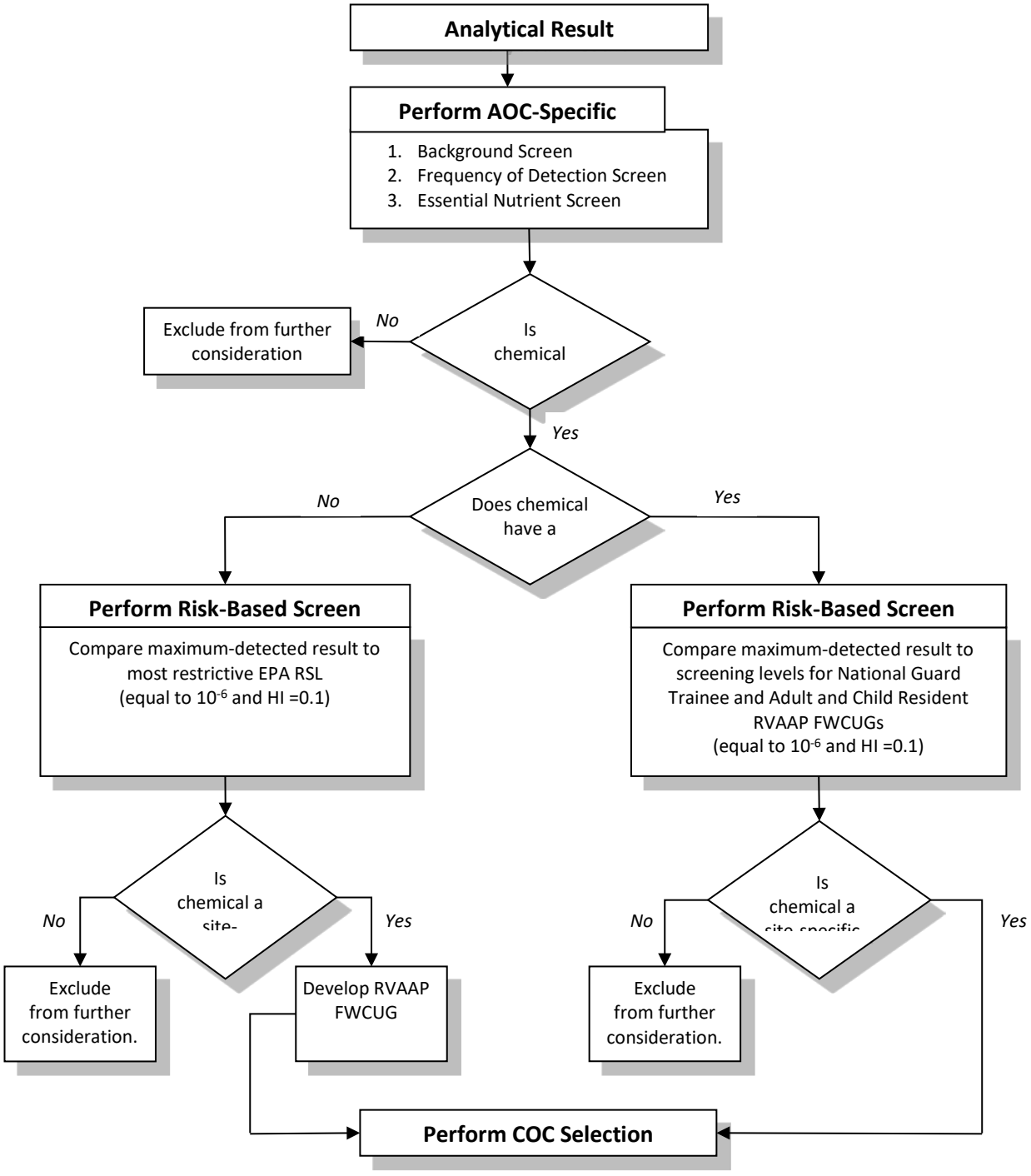
The SRCs identified in sediment consist of 3 explosives and propellants, 13 inorganics, 15 SVOCs, 12 pesticides, 2 PCB constituents, 1 VOC, total cyanide, and the nutrient parameters (ammonia, phosphorus, and nitrate/nitrite). The bulk of the SRCs were identified at sampling unit SCsd-070, the portion of the floodplain located adjacent to the northern portion of the AOC.

The number of SRCs identified for the RI (42) was significantly higher than the SRCs identified during the 2003 RA (14) and may be attributed to the types of samples collected (i.e., ISM versus discrete) or sample intervals (0 to 0.5 foot for the RI versus 0 to 1 foot for the 2003 RA). Five SRCs were identified in the ISM sediment sample collected during the 2003 FWBWQS including three nutrient parameters; however, the exact location that this sample was collected is not known. Sampling using ISM is considered more representative of a defined sampling unit whereas discrete samples are assumed to characterize an isolated location or "hot spot." The shallower sample interval may account for the higher number of SRCs due to contaminant absorption in the surficial organic matter in the top 6 inches and a higher concentrated grouping of chemicals than if spread out throughout the 0- to 1-foot interval.

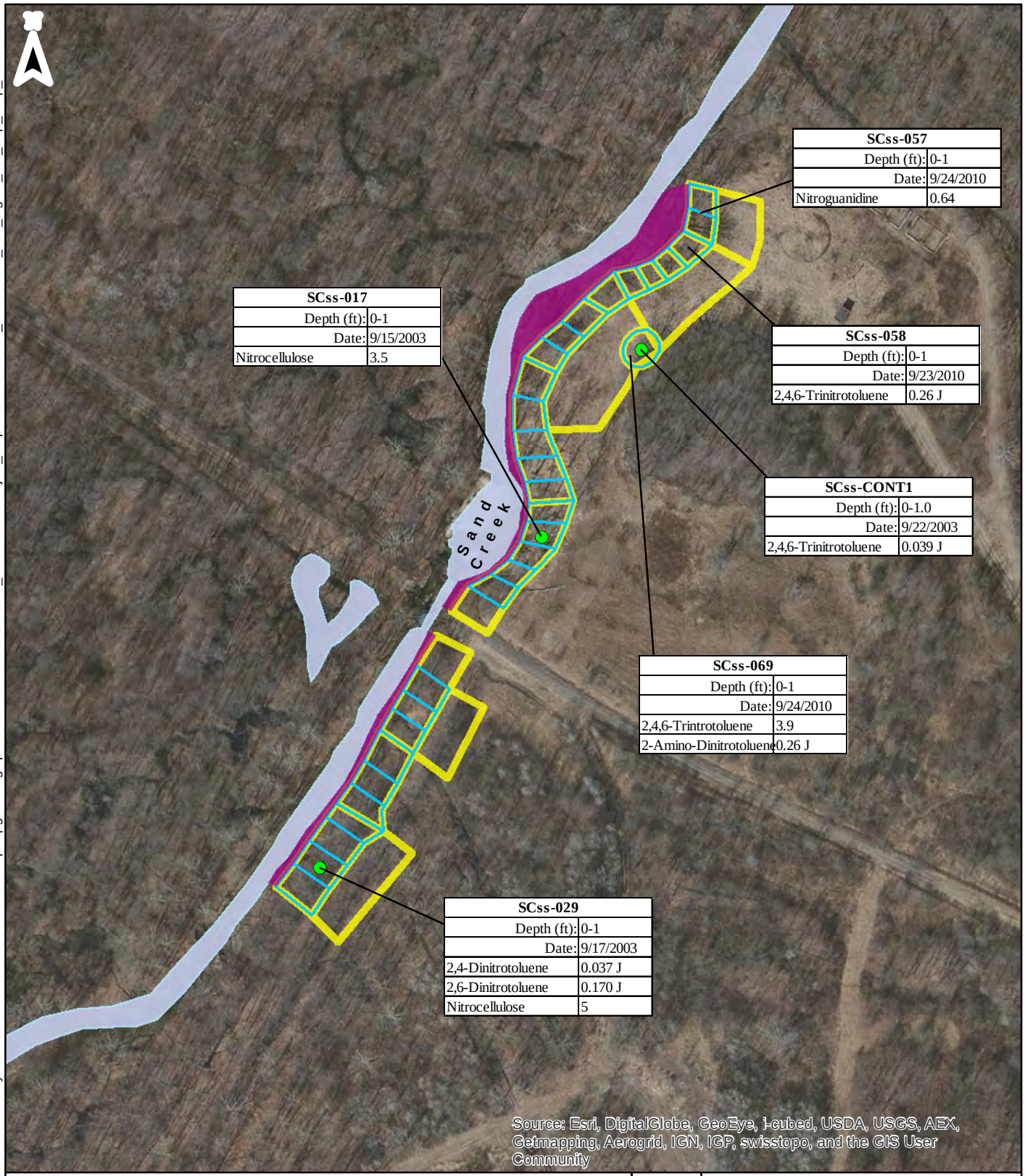
4.6.4 Surface Water

No asbestos, explosives, propellants, VOCs, total cyanide, pesticides, and PCBs were identified as SRCs in any of the surface water samples collected as part of the 2003 RA. Nine inorganics were identified as SRCs in the surface water samples collected for the 2003 FWBWQS; however, six of these inorganics were retained as SRCs because their surface water BSVs are 0 µg/L. The SVOCs bis(2-ethylhexyl)phthalate and di-n-butyl phthalate were identified as SRCs in the surface water samples collected at the site for the 2003 FWBWQS. Two nutrient parameters (phosphorus and nitrate/nitrite) were retained as SRCs in surface water. A cursory review of the overall surface water data collected along the Sand Creek as part of the 2003 FWBWQS indicates that detected analyte concentrations in the samples collected adjacent to the AOC are consistent with the other surface water samples collected both upstream and downstream of the site. Based on these results, it appears that surface water conditions downstream of the AOC have not been impacted by historical disposal activities at the Sand Creek Site.

Figure 4-1 Process to Identify RVAAP Chemicals of Concern



COC denotes chemical of concern.
COPC denotes chemical of potential concern.
EPA denotes U.S. Environmental Protection Agency.
FWCUG denotes Facility-Wide Cleanup Goal.
HI denotes Hazard Index.
RSL denotes Regional Screening Level.
SRC denotes site-related contaminant.



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Project Number: 133616

Legend

- 2003 Removal Action Shallow Soil Confirmation Sample Location
- 2003 Removal Action Sample Grid
- 2010 RI Incremental Sample Sediment Sample Area
- 2010 RI Incremental Sample Soil Sample Area

Notes

1) All results in milligrams per kilogram (mg/kg)
2) Data Qualifiers:
J - The reported result is an estimated value.

0 100 200 Feet

U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

RVAAP-34 SAND CREEK DISPOSAL ROAD LANDFILL
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

Figure 4-2 All Explosives and Propellant SRCs in Surface Soil

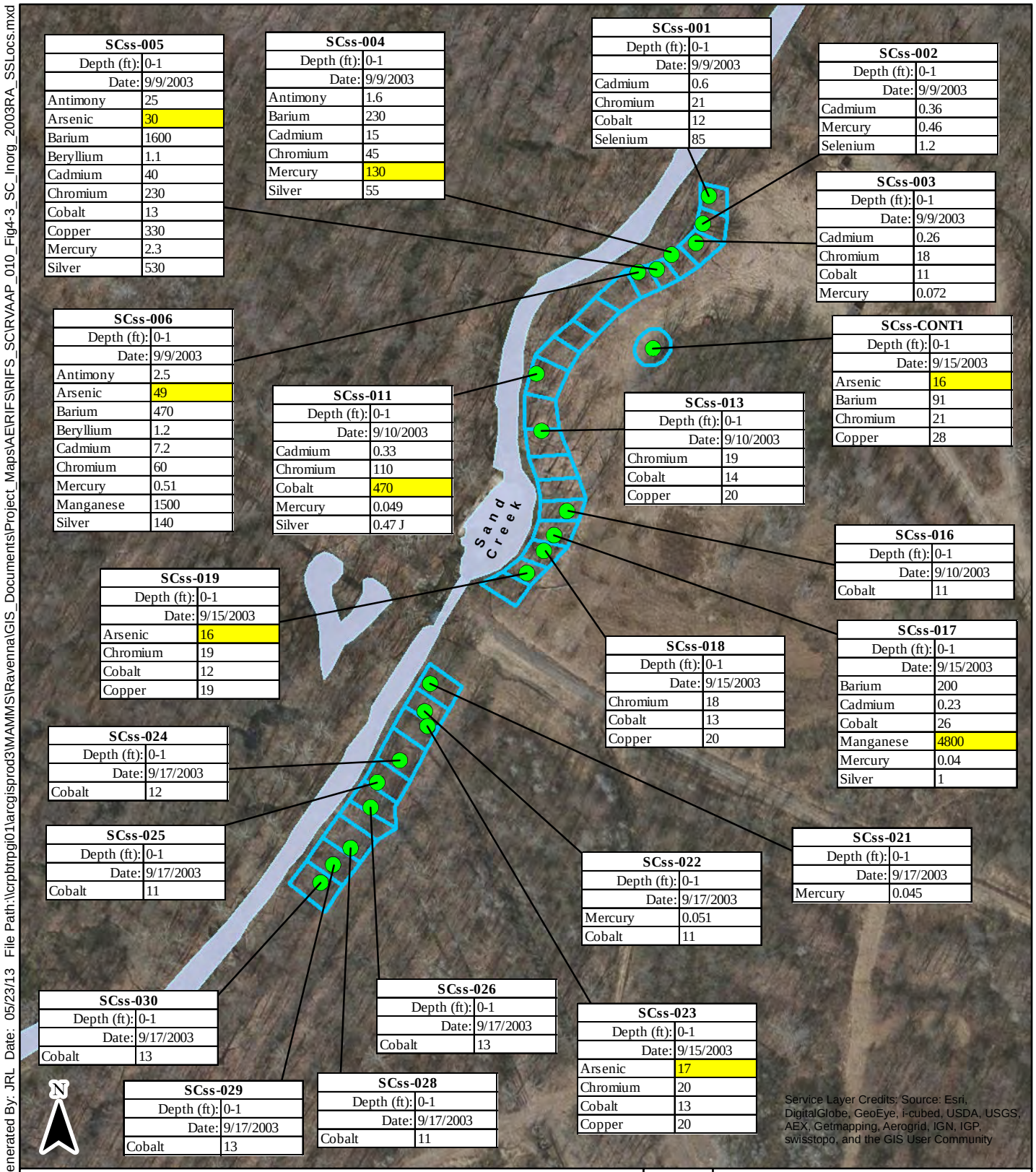


Figure 4-3 Inorganic SRCs in Surface Soil, 2003 Removal Action



Figure 4-4 Inorganic SRCs in Surface Soil, Phase I Remedial Investigation



Figure 4-5 All SVOC SRCs in Surface Soil

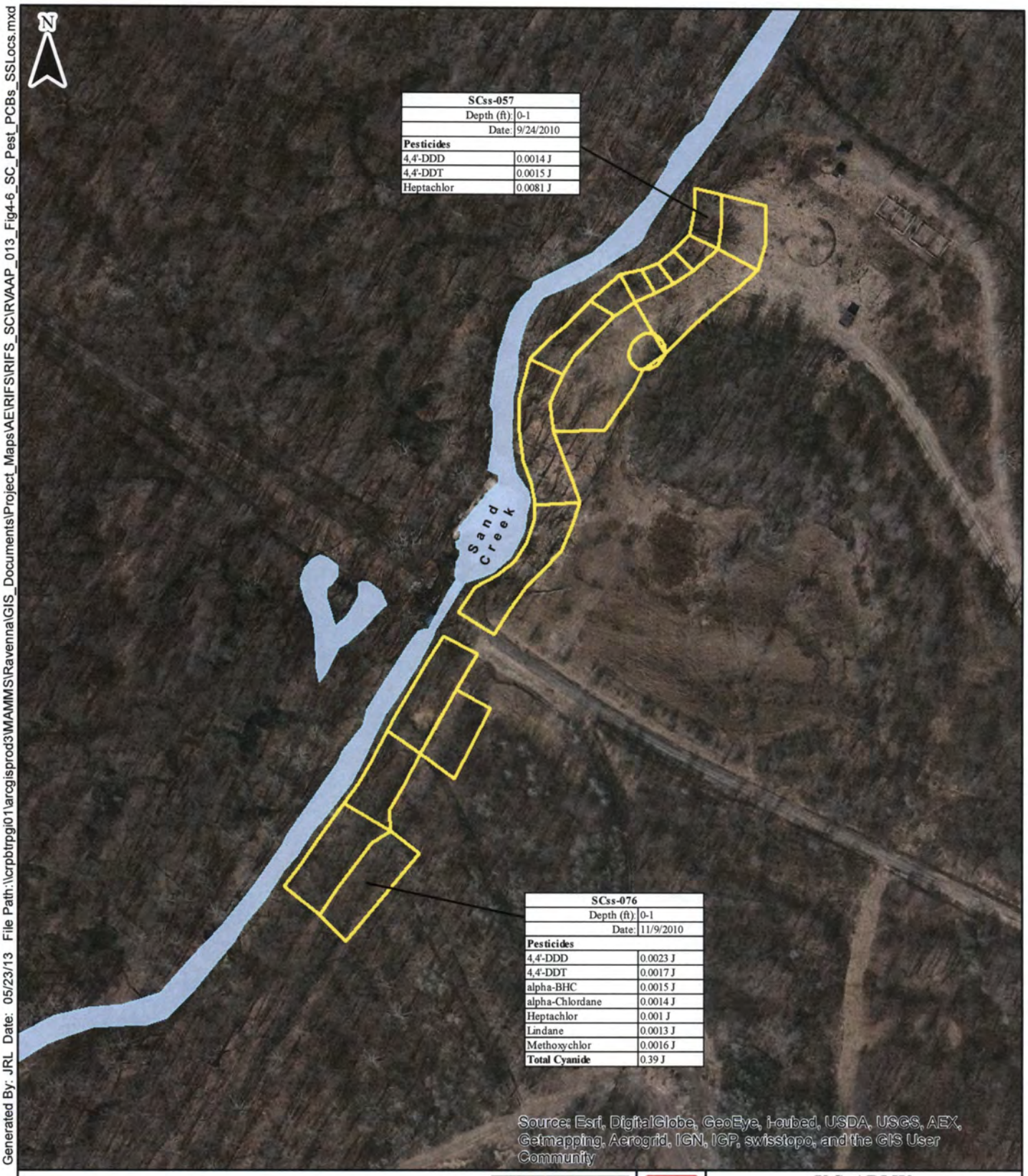


Figure 4-6 Pesticide and Cyanide SRCs in Surface Soil

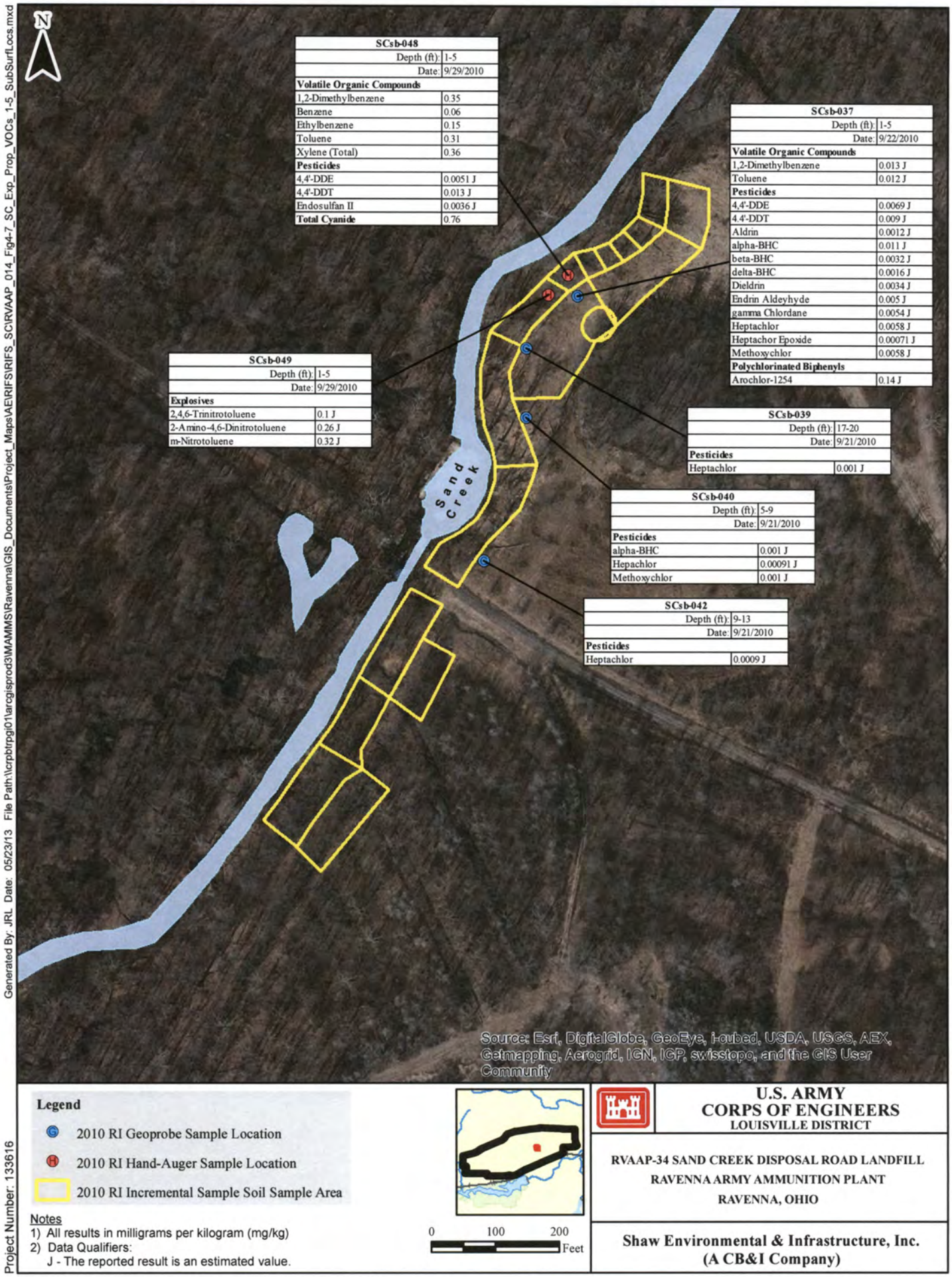


Figure 4-7 Explosives, Pesticides, PCBs, Cyanide, and VOC SRCs in Subsurface Soil

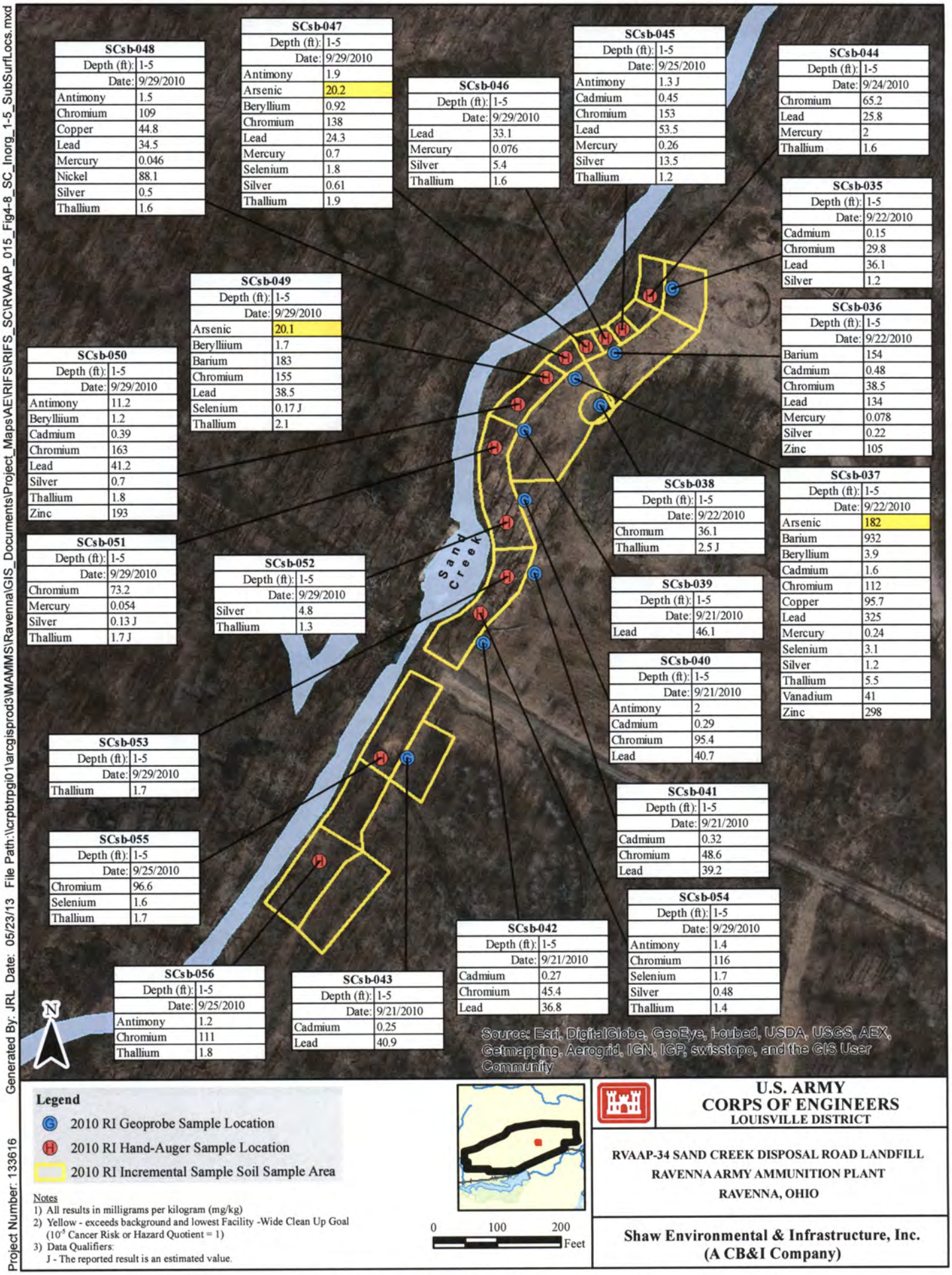


Figure 4-8 Inorganic SRCs in Subsurface Soil, 1-5 Feet Below Ground Surface

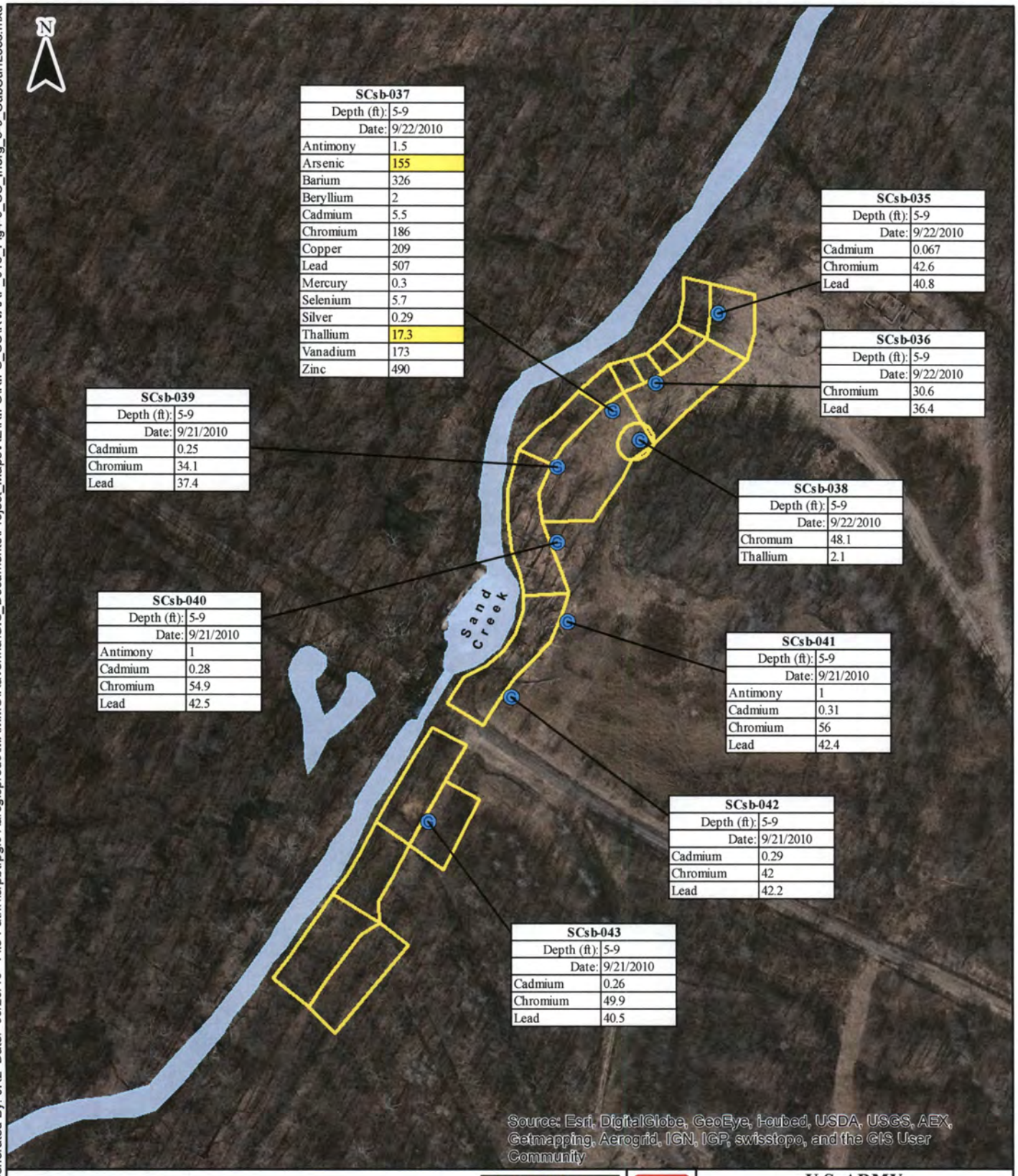


Figure 4-9 Inorganic SRCs in Subsurface Soil, 5-9 Feet Below Ground Surface

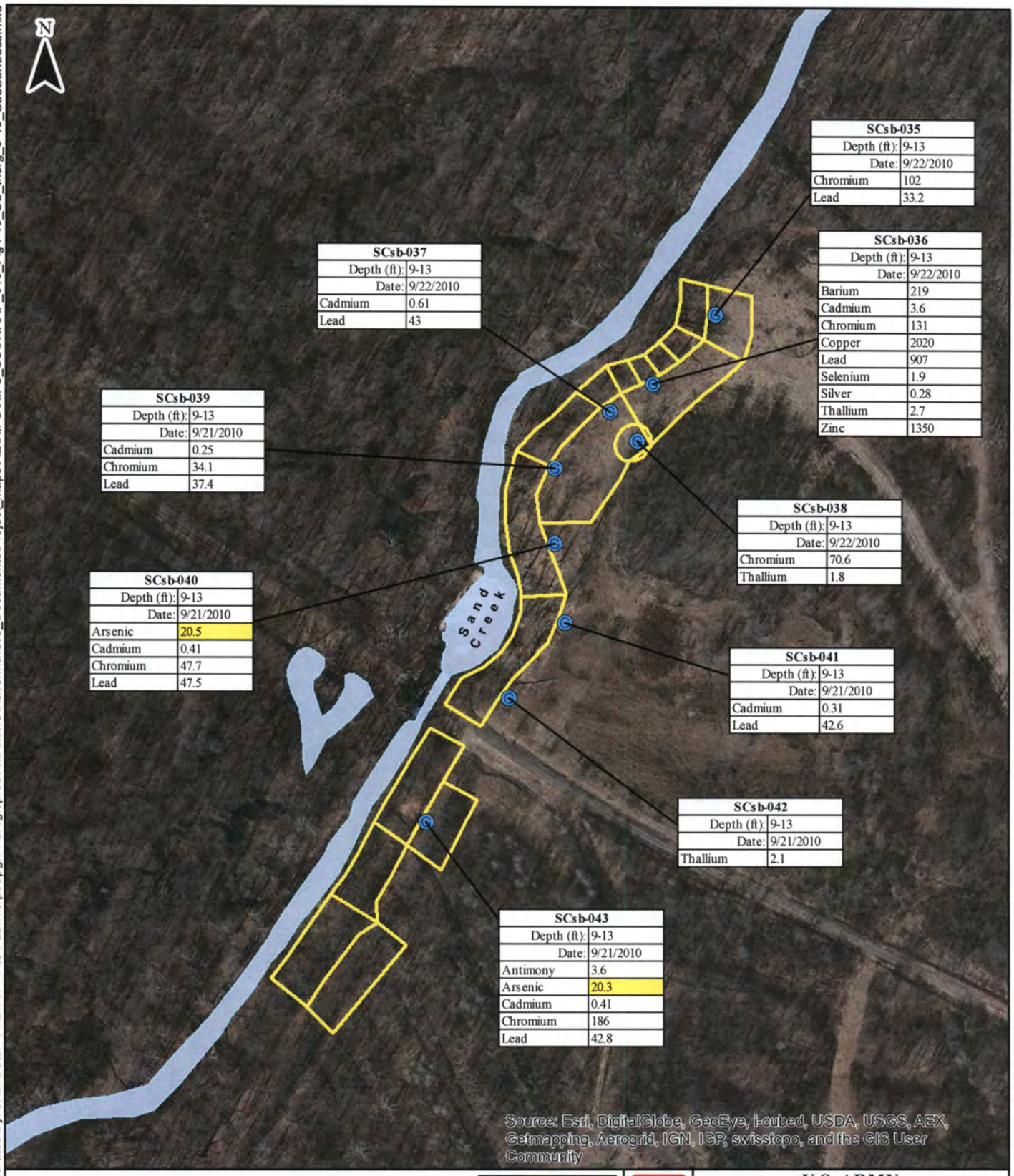


Figure 4-10 Inorganic SRCs in Subsurface Soil, 9-13 Feet Below Ground Surface

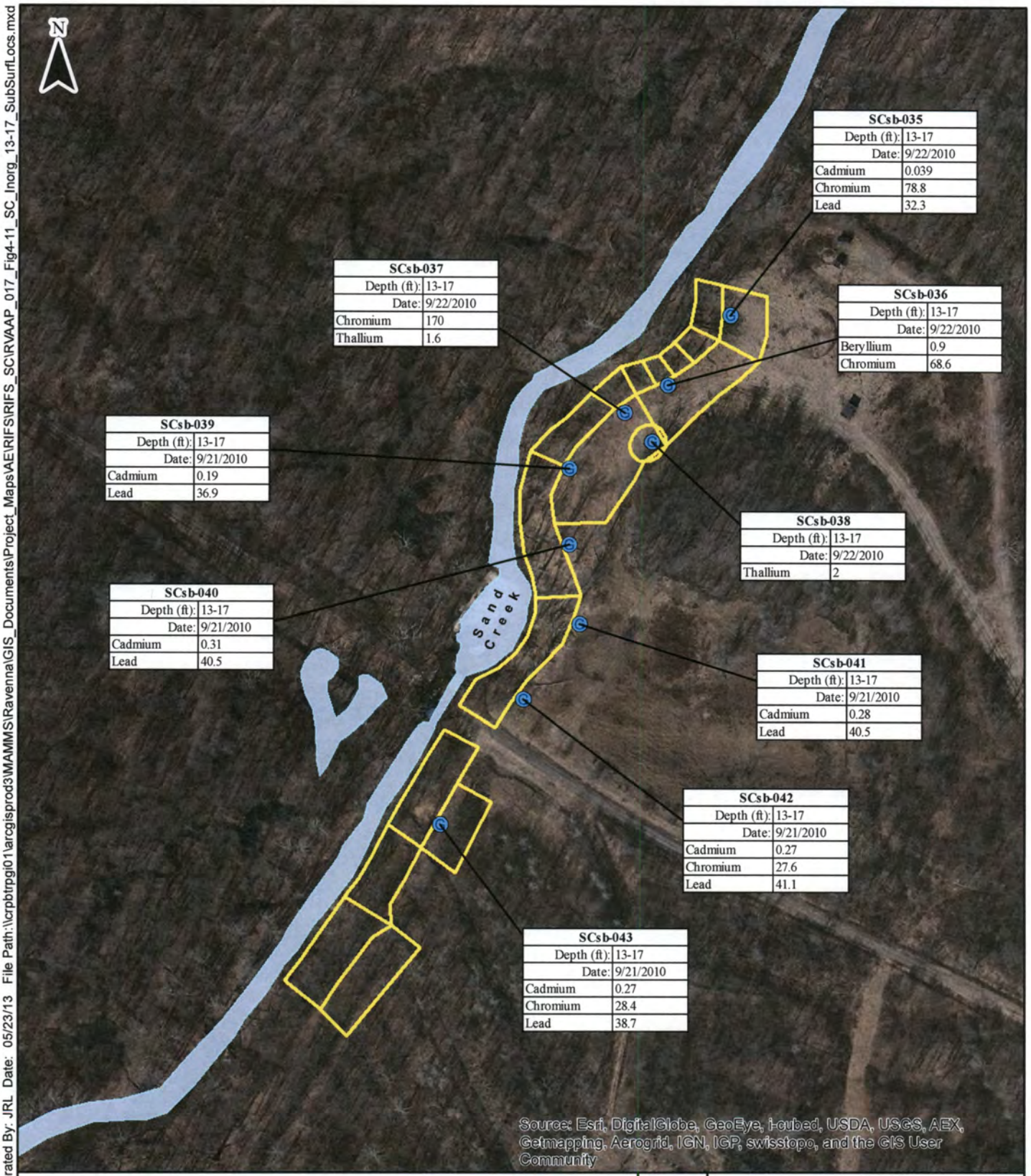


Figure 4-11 Inorganic SRCs in Subsurface Soil, 13-17 Feet Below Ground Surface

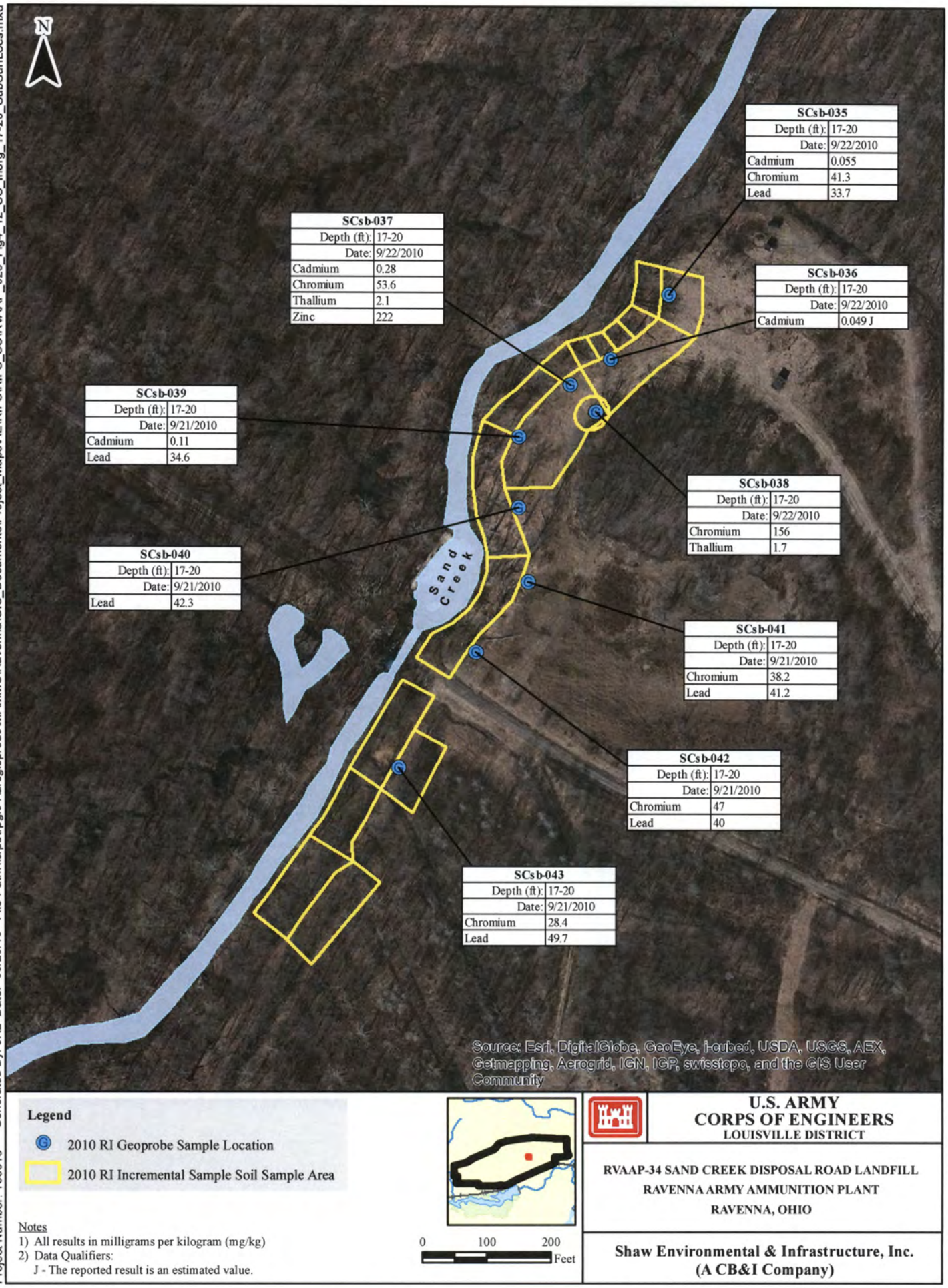


Figure 4-12 Inorganic SRCs in Subsurface Soil, 17-20 Feet Below Ground Surface

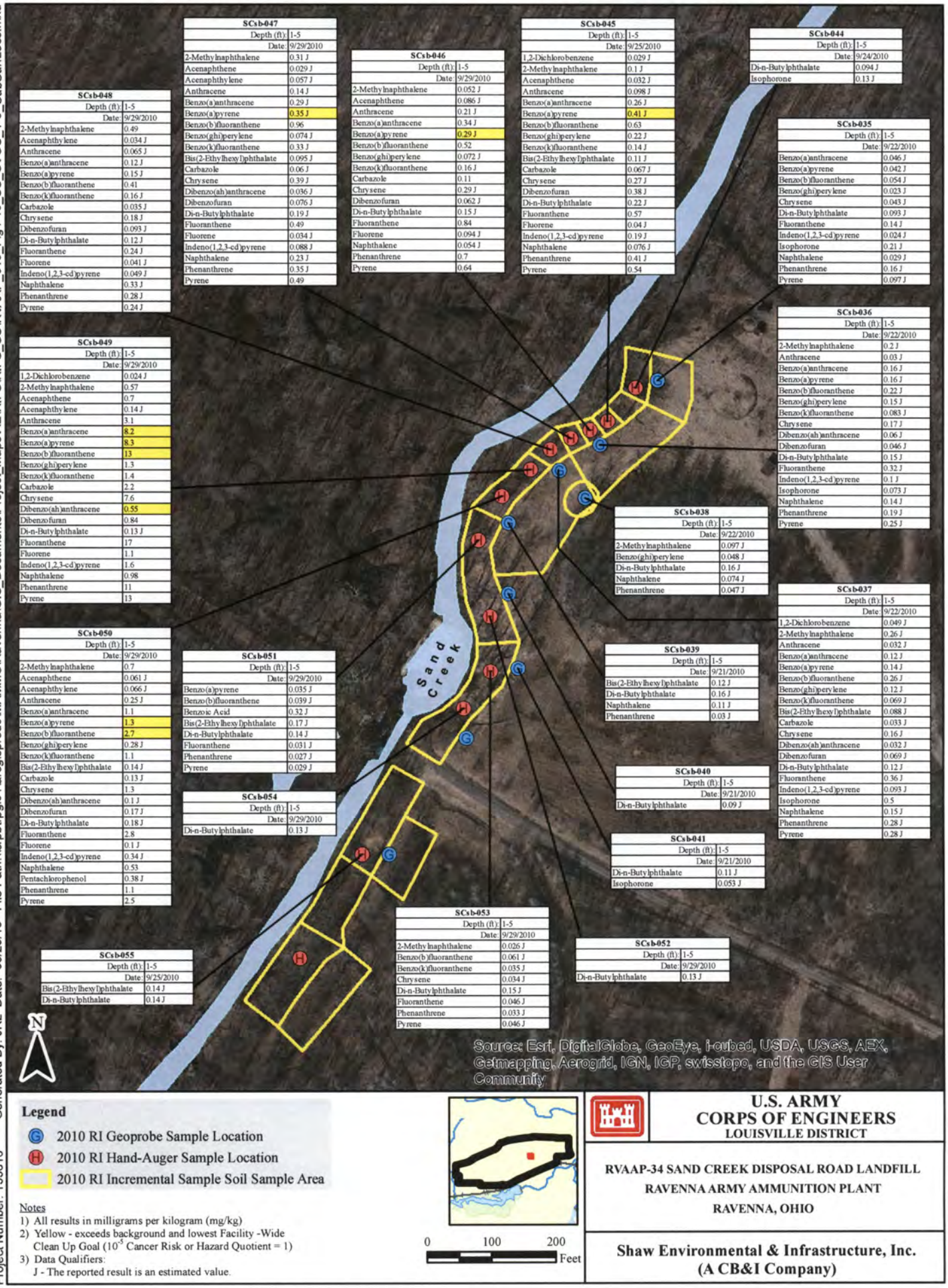


Figure 4-13 SVOC SRCs in Subsurface Soil, 1-5 Feet Below Ground Surface



Figure 4-14 SVOC SRCs in Subsurface Soil, 5-9 Feet Below Ground Surface

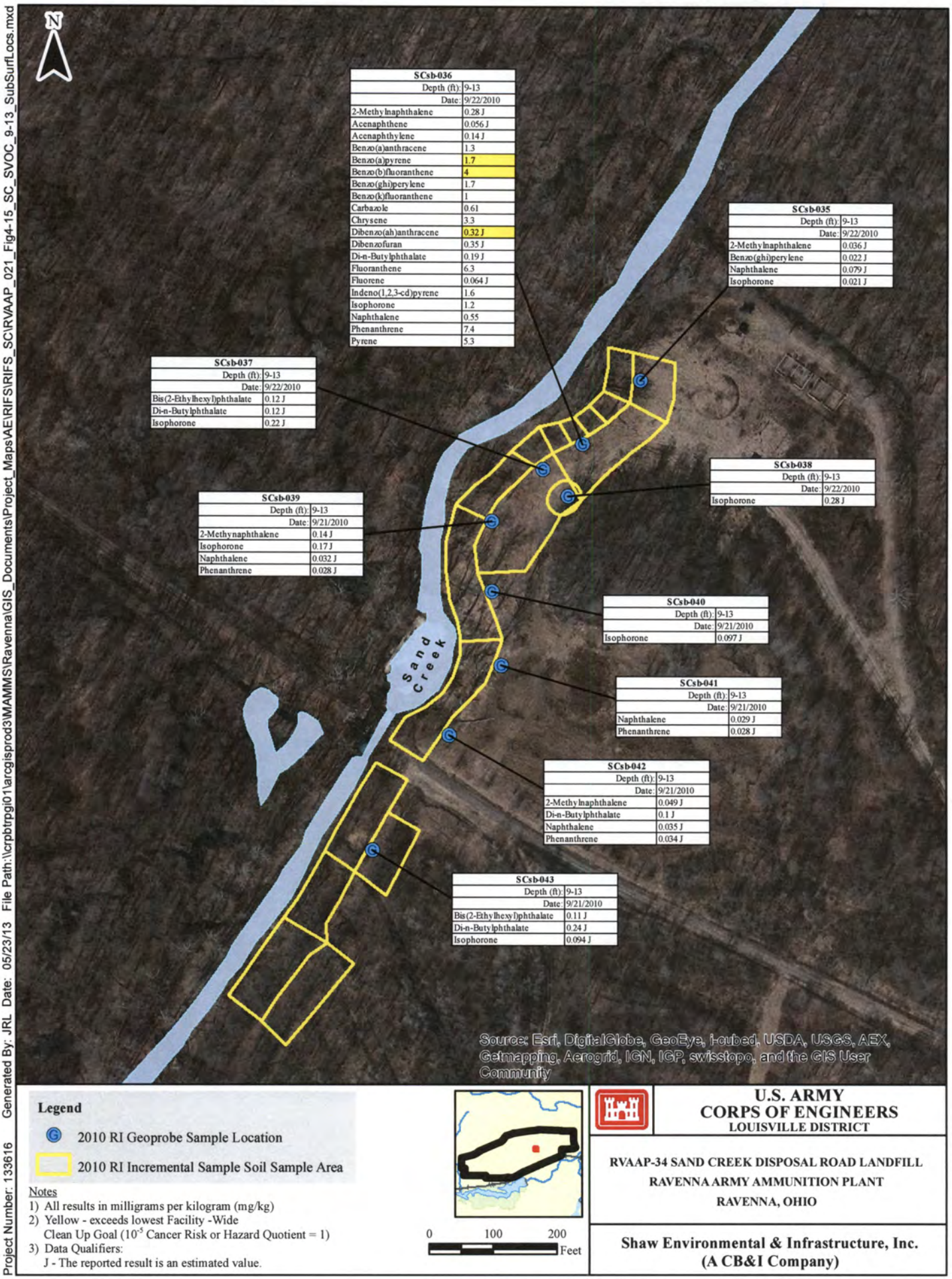


Figure 4-15 SVOC SRCs in Subsurface Soil, 9-13 Feet Below Ground Surface



Figure 4-16 SVOC SRCs in Subsurface Soil, 13-17 Feet Below Ground Surface

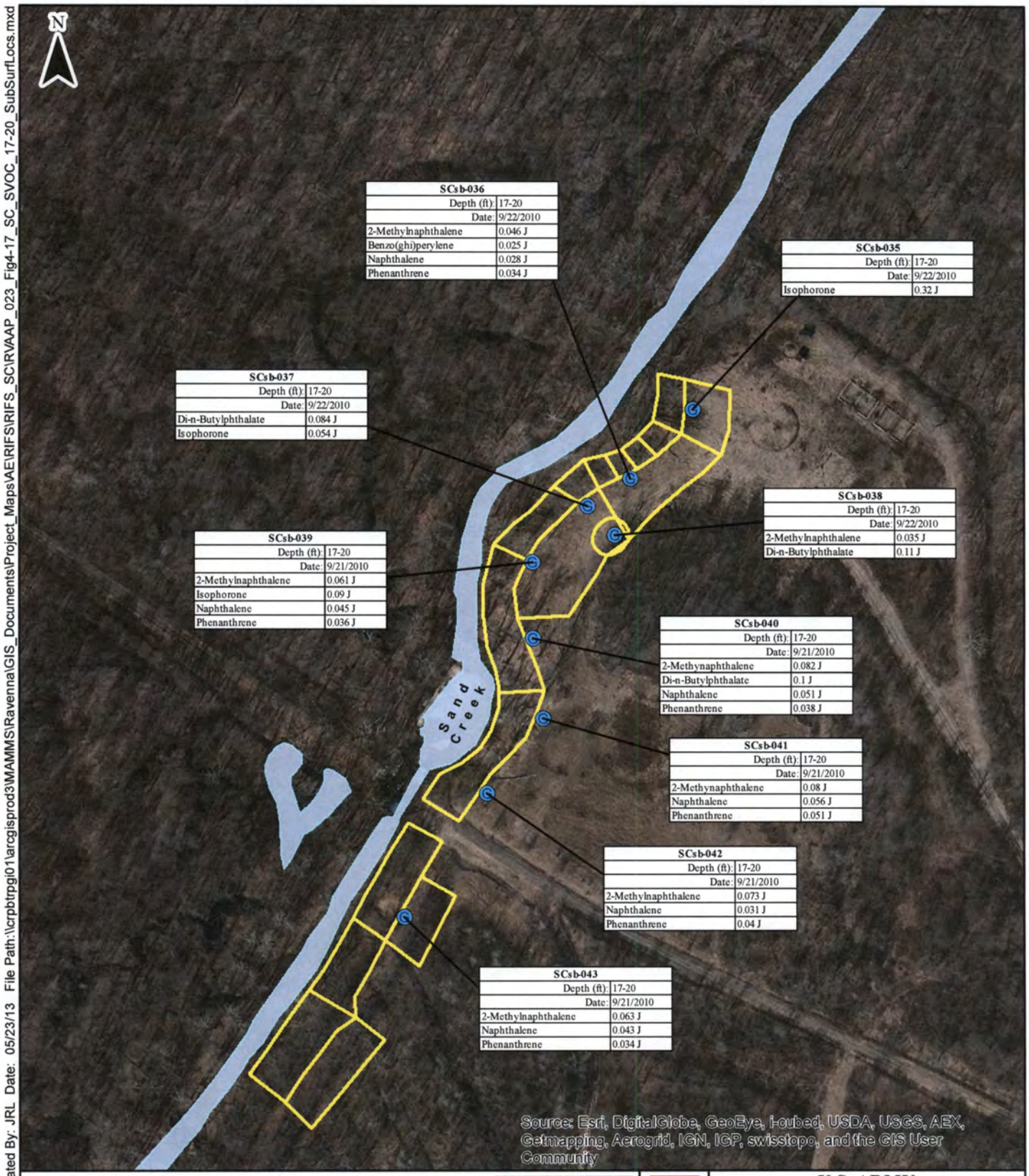


Figure 4-17 SVOC SRCs in Subsurface Soil, 17-20 Feet Below Ground Surface

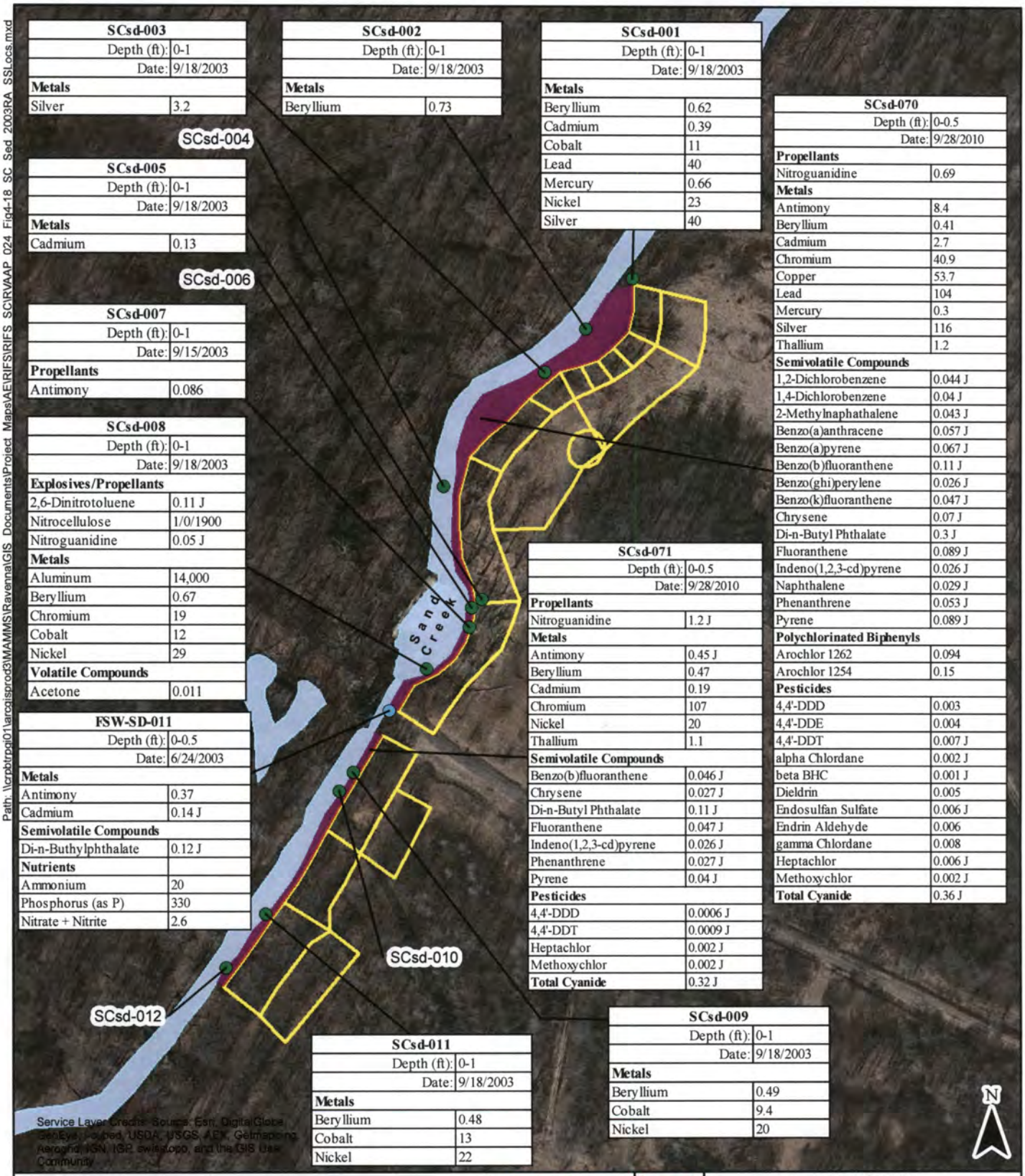
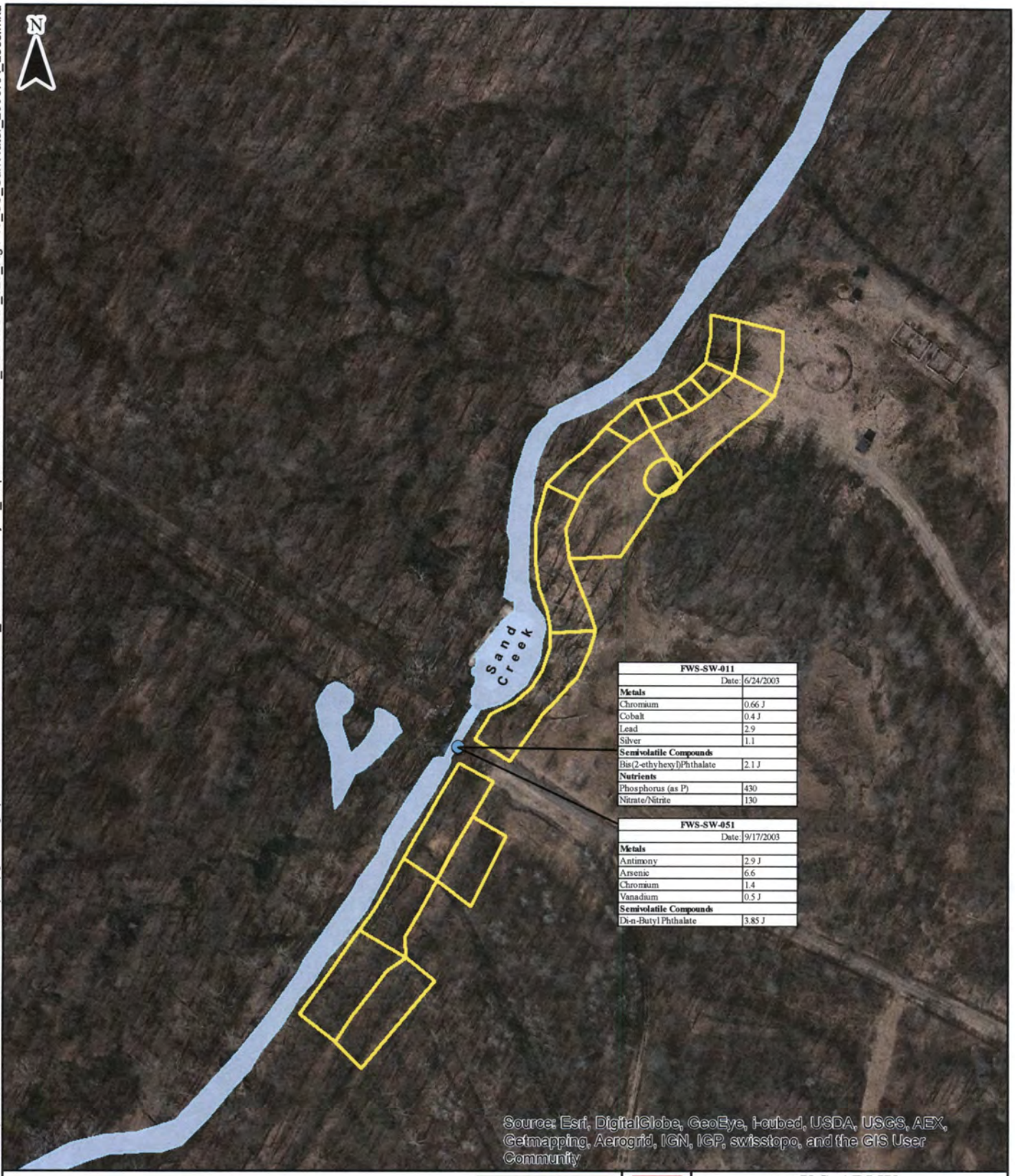


Figure 4-18 All SRCs in Sediment



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Legend

- 2003 Facility-Wide Biological and Water Quality Study Surface Water Sample Location
- 2010 RI Incremental Sample Soil Sample Area

Notes
1) µg/L = micrograms per Liter
2) Data Qualifiers:
J - The reported result is an estimated value.

0 100 200 Feet

U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

RVAAP-34 SAND CREEK DISPOSAL ROAD LANDFILL
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
(A CB&I Company)

Figure 4-19 All SRCs in Surface Water

Table 4-1. Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill.

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
Surface Soil						
SCss-001-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-002-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-003-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-004-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-005-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-006-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-007-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-008-0001-SO	9/9/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-009-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-010-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-011-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-012-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-013-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-014-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-015-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-016-0001-SO	9/10/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-017-0001-SO	9/15/03	0–1	GR	N&E	Exp/Prop, Metals, Pesticides, PCB, SVOCs, VOCs, Total Cyanide, asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-018-0001-SO	9/15/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-019-0001-SO	9/15/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-020-0001-SO	9/15/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample

Table 4-1 Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill (continued).

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
SCss-021-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-022-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-023-0001-SO	9/17/03	0–1	GR	N&E	Exp/Prop, Metals, Pesticides, PCB, SVOCs, VOCs, Total Cyanide, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-024-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-025-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-026-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-027-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-028-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-029-0001-SO	9/17/03	0–1	GR	N&E	Exp/Prop, Metals, Pesticides, PCB, SVOCs, VOCs, Total Cyanide, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-030-0001-SO	9/17/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-CONT1-0001-SO	9/22/03	0–1	GR	N&E	Metals, Asbestos	2003 RA confirmatory (after removal actions) surface soil sample
SCss-CONT2-0001-SO	9/22/03	0–1	GR	N&E	Explosives	2003 RA confirmatory (after removal actions) surface soil sample
SCss-CONT3-0001-SO	9/22/03	0–1	GR	N&E	Explosives	2003 RA confirmatory (after removal actions) surface soil sample
SCss-057M-0001-SO	9/24/10	0–1	ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide, Hex. Chrome	RI surface soil sample
SCss-057D-0001-SO	9/24/10	0–1	GR	N&E, R, F&T	VOCs	RI surface soil sample (discrete)
SCss-058M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-059M -0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-060M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI surface soil sample
SCss-061M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-062M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI surface soil sample

Table 4-1 Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill (continued).

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
SCss-063M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-064M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI surface soil sample
SCss-065M-0001-SO	9/23/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-066M-0001-SO	9/24/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI surface soil sample
SCss-067M-0001-SO	9/21/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-068M-0001-SO	9/21/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-068D-0001-SO	9/21/10	0–1	GR	N&E, R, F&T	VOCs	RI surface soil sample (discrete)
SCss-069M-0001-SO	9/24/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-072M-0001-SO	11/9/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-073M-0001-SO	11/9/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-074M-0001-SO	11/9/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-075M-0001-SO	11/9/10	0–1	ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI surface soil sample
SCss-076M-0001-SO	11/9/10	0–1	ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide, Hex. Chrome	RI surface soil sample
Subsurface Soil (>1 foot bgs)						
SCsb-035M-0001-SO	9/22/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-035M-0002-SO	9/22/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-035M-0003-SO	9/22/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-035M-0004-SO	9/22/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-035M-0005-SO	9/22/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-036M-0001-SO	9/22/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI subsurface soil sample
SCsb-036M-0002-SO	9/22/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample

Table 4-1 Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill (continued).

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
SCsb-036M-0003-SO	9/22/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-036M-0004-SO	9/22/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-036M-0005-SO	9/22/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-037D-0001-SO	9/22/10	1–5	GR	N&E, R, F&T	VOCs	RI subsurface soil sample (discrete)
SCsb-037M-0001-SO	9/22/10	1–5	Mod. ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide	RI subsurface soil sample
SCsb-037M-0002-SO	9/22/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-037M-0003-SO	9/22/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-037M-0004-SO	9/22/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-037M-0005-SO	9/22/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-038M-0001-SO	9/22/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-038M-0002-SO	9/22/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-038M-0003-SO	9/22/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-038M-0004-SO	9/22/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-038M-0005-SO	9/22/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-038D-0005-SO	9/22/10	17–20	GR	N&E, R, F&T	VOCs	RI subsurface soil sample (discrete)
SCsb-039M-0001-SO	9/21/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-039M-0002-SO	9/21/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-039M-0003-SO	9/21/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-039M-0004-SO	9/21/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-039M-0005-SO	9/21/10	17–20	Mod. ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide	RI subsurface soil sample

Table 4-1 Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill (continued).

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
SCsb-040M-0001-SO	9/21/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-040M-0002-SO	9/21/10	5–9	Mod. ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide	RI subsurface soil sample
SCsb-040D-0002-SO	9/21/10	5–9	GR	N&E, R, F&T	VOCs	RI subsurface soil sample (discrete)
SCsb-040M-0003-SO	9/21/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-040M-0004-SO	9/21/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-040M-0005-SO	9/21/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-041M-0001-SO	9/21/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-041M-0002-SO	9/21/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-041M-0003-SO	9/21/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-041M-0004-SO	9/21/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-041M-0005-SO	9/21/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-042M-0001-SO	9/21/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-042M-0002-SO	9/21/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-042M-0003-SO	9/21/10	9–13	Mod. ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide	RI subsurface soil sample
SCsb-042D-0003-SO	9/21/10	9–13	GR	N&E, R, F&T	VOCs	RI subsurface soil sample (discrete)
SCsb-042M-0004-SO	9/21/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-042M-0005-SO	9/21/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-043M-0001-SO	9/21/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-043M-0002-SO	9/21/10	5–9	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-043M-0003-SO	9/21/10	9–13	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample

Table 4-1 Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill (continued).

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
SCsb-043M-0004-SO	9/21/10	13–17	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-043M-0005-SO	9/21/10	17–20	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-044M-0001-SO	9/24/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-045M-0001-SO	9/25/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-046M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI subsurface soil sample
SCsb-047M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-048M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide, Hex. Chrome	RI subsurface soil sample
SCsb-048D-0001-SO	9/29/10	1–5	GR	N&E, R, F&T	VOCs	RI subsurface soil sample (discrete)
SCsb-049M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-050M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-051M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI subsurface soil sample
SCsb-052M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-053M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-054M-0001-SO	9/29/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-055M-0001-SO	9/25/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs	RI subsurface soil sample
SCsb-056M-0001-SO	9/25/10	1–5	Mod. ISM	N&E, R, F&T	Explosives, Metals, SVOCs, Hex. Chrome	RI subsurface soil sample
Sediment						
FSW-SD-011-0000	6/24/03	0–0.5	ISM	N&E	Metals, Explosives, Pesticides, PCBs, SVOCs, Total Cyanide, Nutrients	2003 FWBWQS sediment sample from Sand Creek
SCsd-001-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from flood plan
SCsd-002-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from Sand Creek
SCsd-003-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from floodplain

Table 4-1 Data and use information for environmental samples collected as Sand Creek Disposal Road Landfill (continued).

Sample Location ID	Date	Depth (feet bgs)	Sample Type	Data Use Type	Analyses	Comments
SCsd-004-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from Sand Creek
SCsd-005-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from floodplain
SCsd-006-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from Sand Creek
SCsd-007-0001-SD	9/18/03	0–1	GR	N&E	Exp/Prop, Metals, Pesticides, PCB, SVOCs, VOCs, Asbestos	2003 RA sediment sample from floodplain
SCsd-008-0001-SD	9/18/03	0–1	GR	N&E	Exp/Prop, Metals, Pesticides, PCB, SVOCs, VOCs, Asbestos	2003 RA sediment sample
SCsd-009-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from floodplain
SCsd-010-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from Sand Creek
SCsd-011-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from Sand Creek
SCsd-012-0001-SD	9/18/03	0–1	GR	N&E	Metals, Asbestos	2003 RA sediment sample from floodplain
SCsd-070M-0001-SD	9/28/10	0–0.5	ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide, Hex. Chrome	RI sediment sample from floodplain
SCsd-071M-0001-SD	9/28/10	0–0.5	ISM	N&E, R, F&T	Exp/Prop, Metals, Pesticides, PCB, SVOCs, Total Cyanide, Hex. Chrome	RI sediment sample from floodplain
SCsd-071D-0001-SD	9/28/10	0–0.5	GR	N&E, R, F&T	VOCs	RI sediment sample (discrete)
Surface Water						
FSW-SW-011-0000	6/24/03	---	GR	N&E, R	Metals, Explosives, Pesticides, PCBs, SVOCs, Total Cyanide, Nutrients	2003 FWBWQS surface water sample
FSW-SW-051-0000	9/17/03	---	GR	N&E, R	Metals, Explosives, SVOCs	2003 FWBWQS surface water sample
SCsw-001-0001-SW	9/18/03	---	GR	N&E, R	Exp/Prop, Metals, Pesticides, PCB, SVOC, VOCs, Total Cyanide, Asbestos	2003 RA surface water sample
SCsw-002-0001-SW	9/15/03	---	GR	N&E, R	Metals, asbestos	2003 RA surface water sample
SCsw-003-0001-SW	9/15/03	---	GR	N&E, R	Metals, asbestos	2003 RA surface water sample

--- denotes not applicable. bgs denotes below ground surface. Exp/Prop denotes explosives and propellants. F&T denotes fate and transport evaluation. FWBWQS denotes Facility-Wide Biological and Water Quality Study. GR denotes grab sample collection method (discrete). Hex. Chrome denotes hexavalent chromium. ID denotes identification. ISM denotes incremental sampling method. Mod. ISM denotes modified incremental sampling method. N&E denotes nature and extent of contamination evaluation. PCB denotes polychlorinated biphenyl. R denotes risk assessment evaluation. RA denotes removal action. RI denotes remedial investigation. SVOC denotes semivolatile organic compound. VOC denotes volatile organic compound. Body Break

Table 4-2. Screening for SRCs in surface soil samples (discrete) data collected during the 2003 Removal Action.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Explosives and Propellants								
2,4,6-Trinitrotoluene	118-96-7	2/5	0.039 J	0.5	0.3	NA	Yes	Detected organic
2,4-Dinitrotolune	121-14-2	1/5	0.037 J	0.037 J	0.05	NA	Yes	Detected organic
2,6-Dinitrotoluene	606-20-2	1/5	0.17	0.17	0.11	NA	Yes	Detected organic
Nitrocellulose	9004-70-0	2/3	3.5	5	3.23	NA	Yes	Detected organic
Inorganics								
Aluminum	7429-90-5	31/31	5,700	17,000	10,525	17,700	No	Below BSV
Antimony	7440-36-0	11/31	0.0037	25	1.56	0.96	Yes	Above BSV
Arsenic	7440-38-2	31/31	2.5	100	17.25	15.4	Yes	Above BSV
Barium	7440-39-3	31/31	30	1,600	157	88.4	Yes	Above BSV
Beryllium	7440-41-7	31/31	0.22 J	1.2	1.87	0.88	Yes	Above BSV
Cadmium	7440-43-9	12/31	0.14	40	2.86	0	Yes	Above BSV
Calcium	7440-70-2	31/31	340	38,000	4,944	15,800	No	Essential nutrient
Chromium	7440-47-3	31/31	7.6	230	32.5	17.4	Yes	Above BSV
Cobalt	7440-48-4	31/31	3.3	26	10.3	10.6	Yes	Above BSV
Copper	7440-50-8	31/31	7.3	470	58.5	17.7	Yes	Above BSV
Iron	7439-89-6	31/31	13,000	44,000	24,742	23,100	No	Essential nutrient
Lead	7439-92-1	31/31	8	1,600	106.7	26.1	Yes	Above BSV
Magnesium	7439-95-4	31/31	1,300	5,100	2,929	3,030	No	Essential nutrient
Manganese	7439-96-5	31/31	90	4,800	574	1,450	Yes	Above BSV
Mercury	7439-97-6	30/31	0.015	130	4.4	0.036	Yes	Above BSV
Nickel	7440-02-0	31/31	9.2	110	26.2	21.1	Yes	Above BSV
Potassium	7440-09-7	31/31	770	2,400	1,348	927	No	Essential nutrient
Selenium	7782-49-2	8/31	0.53	3.2	1.84	1.4	Yes	Above BSV
Silver	7440-22-4	9/31	0.47	630	58.3	0	Yes	Above BSV
Sodium	7440-23-5	7/31	120	550	111.3	123	No	Essential nutrient
Thallium	7440-28-0	1/31	0.58	0.58	0.16	0	No	Less than 5% FOD
Vanadium	7440-62-2	31/31	10	25	18.2	31.1	No	Below BSV
Zinc	7440-66-6	31/31	35	620	121	61.8	Yes	Above BSV

Table 4-2. Screening for SRCs in surface soil samples (discrete) data collected during the 2003 Removal Action (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Semivolatile Organic Compounds								
Benzo(a)anthracene	56-55-3	2/3	0.0044 J	0.3100	0.0363	NA	Yes	Detected organic
Benzo(a)pyrene	50-32-8	2/3	0.0047 J	0.2900	0.1046	NA	Yes	Detected organic
Benzo(b)fluoranthene	205-99-2	2/3	0.0051 J	0.3000	0.1080	NA	Yes	Detected organic
Benzo(k)fluoranthene	207-08-9	2/3	0.0054 J	0.3300	0.1181	NA	Yes	Detected organic
Benzo(g,h,i)perylene	191-24-2	1/3	0.1300	0.1300	0.0567	NA	Yes	Detected organic
Bis(2-Ethylhexyl)phthalate	117-81-7	2/3	0.0220 J	0.0900	0.069	NA	Yes	Detected organic
Chrysene	218-01-9	2/3	0.0046 J	0.2900	0.1045	NA	Yes	Detected organic
Dibenzo(a,h)anthracene	53-70-3	1/3	0.0690	0.0690	0.0363	NA	Yes	Detected organic
Fluoranthene	206-44-0	2/3	0.0098 J	0.5200	0.1829	NA	Yes	Detected organic
Indeno(1,2,3-cd)pyrene	193-39-5	1/3	0.1300	0.1300	0.0567	NA	Yes	Detected organic
Phenanthrene	85-01-8	1/3	0.0890	0.0890	0.0430	NA	Yes	Detected organic
Pyrene	129-00-0	1/3	0.5300	0.5300	0.1900	NA	Yes	Detected organic
Volatile Organic Compounds								
Chloroethane	75-00-03	1/3	0.09 J	0.09 J	0.03	NA	Yes	Detected organic

BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
FOD denotes frequency of detection.
J denotes the reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
SRC denotes site-related chemical

Table 4-3. Screening for SRCs in surface soil samples (ISM) data collected during the 2003 Removal Action.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Explosives and Propellants								
2,4,6-Trinitrotoluene	118-96-7	2/18	0.26 J	3.9	0.41	NA	Yes	Detected organic
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/18	0.26 J	0.26 J	0.22	NA	Yes	Detected organic
Nitroguanidine	556-88-7	1/2	0.64	1.2	0.40	NA	Yes	Detected organic
Inorganics								
Aluminum	7429-90-5	18/18	26.1	16,700	10,123	17,700	No	Below BSV
Antimony	7440-36-0	11/18	0.75	17.1	2.4	0.96	Yes	Above BSV
Arsenic	7440-38-2	17/18	4.5	36.6	14	15.4	Yes	Above BSV
Barium	7440-39-3	18/18	1.5	764	128	88.4	Yes	Above BSV
Beryllium	7440-41-7	17/18	0.41	1.1	0.59	0.88	Yes	Above BSV
Cadmium	7440-43-9	16/18	0.057	12.9	1.61	0	Yes	Above BSV
Calcium	7440-70-2	18/18	26.5	32,500	9,844	15,800	No	Essential nutrient
Chromium	7440-47-3	18/18	0.26	188	79	17.4	Yes	Above BSV
Cobalt	7440-48-4	17/18	6.7	19.7	9.3	10.4	Yes	Above BSV
Copper	7440-50-8	18/18	0.49	726	77	17.7	Yes	Above BSV
Iron	7439-89-6	18/18	86.8	34,800	24,483	23,100	No	Essential nutrient
Lead	7439-92-1	18/18	0.88	405	81	26.1	Yes	Above BSV
Magnesium	7439-95-4	18/18	6.6	8,130	3,312	3,030	No	Essential nutrient
Manganese	7439-96-5	18/18	2.2	920	511	1,450	No	Below BSV
Mercury	7439-97-6	18/18	0.026	24.6	3.6	0.036	Yes	Above BSV
Nickel	7440-02-0	18/18	0.08 J	48.2	25.8	21.1	Yes	Above BSV
Potassium	7440-09-7	18/18	693	1,650	1,094	927	No	Essential nutrient
Selenium	7782-49-2	14/18	0.13	3.1	1.2	1.4	Yes	Above BSV
Silver	7440-22-4	14/18	0.52	256	42.3	0	Yes	Above BSV
Sodium	7440-23-5	18/18	20.5	150	68	123	No	Essential nutrient
Thallium	7440-28-0	16/18	0.14 J	3.2 J	1.2	0	Yes	Above BSV
Vanadium	7440-62-2	17/18	14.2	23.8	17.9	31.1	No	Below BSV
Zinc	7440-66-6	18/18	0.96	373	127	61.8	Yes	Above BSV

Table 4-3. Screening for SRCs in surface soil samples (ISM) data collected during the 2003 Removal Action (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
General Chemistry								
Cyanide, total	57-12-5	2/2	0.35	0.39 J	0.03	0	Yes	Above BSV
Semivolatile Organic Compounds								
1,2,4-Trichlorobenzene	120-82-1	1/18	0.027 J	0.027 J	0.197	NA	Yes	Detected organic
1,2-Dichlorobenzene	95-50-1	17/18	0.028 J	0.11 J	0.14415	NA	Yes	Detected organic
1,3-Dichlorobenzene	541-73-1	1/18	0.031 J	0.031 J	0.197	NA	Yes	Detected organic
1,4-Dichlorobenzene	106-46-7	6/18	0.022 J	0.27 J	0.168	NA	Yes	Detected organic
2-Methylnaphthalene	91-57-6	11/18	0.045 J	0.53	0.249	NA	Yes	Detected organic
Acenaphthene	83-32-9	7/18	0.029 J	0.44	0.184	NA	Yes	Detected organic
Acenaphthylene	208-96-8	8/18	0.029 J	0.16 J	0.155	NA	Yes	Detected organic
Anthracene	120-12-7	10/18	0.026 J	1.1	0.275	NA	Yes	Detected organic
Benzo(a)anthracene	56-55-3	15/18	0.027 J	2.6	0.472	NA	Yes	Detected organic
Benzo(a)pyrene	50-32-8	15/18	0.026 J	2.4	0.419	NA	Yes	Detected organic
Benzo(b)fluoranthene	205-99-2	15/18	0.039 J	4.8	0.715	NA	Yes	Detected organic
Benzo(g,h,i)perylene	191-24-2	11/18	0.031 J	0.69	0.223	NA	Yes	Detected organic
Benzo(k)fluoranthene	207-08-9	14/18	0.027 J	1.4	0.275	NA	Yes	Detected organic
Benzoic Acid	65-85-0	4/18	0.39 J	0.57 J	0.721	NA	Yes	Detected organic
Bis(2-Ethylhexyl)phthalate	117-81-7	7/18	0.1 J	1.7	0.519	NA	Yes	Detected organic
Carbazole	86-74-8	9/18	0.034 J	0.61	0.197	NA	Yes	Detected organic
Chrysene	218-01-9	14/18	0.049 J	2.7	0.479	NA	Yes	Detected organic
Dibenzo(a,h)anthracene	53-70-3	7/18	0.055 J	0.28 J	0.176	NA	Yes	Detected organic
Dibenzofuran	132-64-9	10/18	0.027 J	0.33 J	0.1715	NA	Yes	Detected organic
Diethyl Phthalate	84-66-2	2/18	0.069 J	0.14 J	0.196	NA	Yes	Detected organic
Di-n-Butyl Phthalate	84-74-2	17/18	0.082 J	0.47	0.170	NA	Yes	Detected organic
Fluoranthene	206-44-0	16/18	0.04 J	4.3	0.877	NA	Yes	Detected organic
Fluorene	86-73-7	8/18	0.031 J	0.47	0.191	NA	Yes	Detected organic
Indeno(1,2,3-cd)pyrene	193-39-5	11/18	0.025 J	0.81	0.233	NA	Yes	Detected organic
Isophorone	78-59-1	6/18	0.051 J	0.2 J	0.179	NA	Yes	Detected organic
Naphthalene	91-20-3	11/18	0.028 J	0.33 J	0.184	NA	Yes	Detected organic

Table 4-3. Screening for SRCs in surface soil samples (ISM) data collected during the 2003 Removal Action (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Pentachlorophenol	87-86-5	2/18	0.40 J	0.52 J	0.499	NA	Yes	Detected organic
Phenanthrene	85-01-8	15/18	0.026 J	3.4	0.611	NA	Yes	Detected organic
Pyrene	129-00-0	15/18	0.035 J	4	0.683	NA	Yes	Detected organic
Pesticides								
4,4'-DDD	72-54-8	2/2	0.0014	0.0023	0.002	NA	Yes	Detected organic
4,4'-DDT	50-29-3	2/2	0.0015	0.0017	0.002	NA	Yes	Detected organic
alpha-Chlordane	5103-71-9	1/2	0.0015	0.0015	0.002	NA	Yes	Detected organic
Heptachlor	76-44-8	2/2	0.001	0.0081	0.005	NA	Yes	Detected organic
Lindane	58-89-9	1/2	0.0013	0.0013	0.001	NA	Yes	Detected organic
Methoxychlor	72-43-5	1/2	0.0016	0.0016	0.001	NA	Yes	Detected organic

BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
ISM denotes incremental sampling method.
J denotes the reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
SRC denotes site-related contaminant.

Table 4-4. Analytes detected in 2003 Removal Action surface soil samples (discrete).

Detected Analyte	Station ID:	SCss-001	SCss-002	SCss-003	SCss-004	SCss-005	SCss-006	SCss-007	SCss-008	SCss-009
	Sample ID:	SCss-001-0001-SO	SCss-002-0001-SO	SCss-003-0001-SO	SCss-004-0001-SO	SCss-005-0001-SO	SCss-006-0001-SO	SCss-007-0001-SO	SCss-008-0001-SO	SCss-009-0001-SO
	Sample Date:	9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/10/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos
	BSV									
Inorganics (mg/kg)										
Aluminum	*17,700*	10,000	11,000	10,000	9,200	15,000	17,000	9,300	9,500	7,800
Antimony	*0.96*	0.61	<0.4 U	<0.36 U	1.6	25	2.5	11	1.6	0.12
Arsenic	*15.4*	10	13	9.2	8.4	30	49	38	100	10
Barium	*88.4*	74	54	61	230	1,600	470	800	170	56
Beryllium	*0.88*	0.56	0.38	0.44	0.55	1.1	1.2	0.78	1	0.33
Cadmium	*0*	0.6	0.36	0.26	15	40	7.2	18	3.3	0.14
Calcium	*15,800*	3,500	4,000	4,500	12,000	24,000	38,000	8,700	4,700	1,800
Chromium	*17.4*	21	16	18	45	230	60	140	41	11
Cobalt	*10.4*	12	8.9	11	8.6	13	9.9	9.6	9.3	6.8
Copper	*17.7*	32	19	20	99	330	110	270	110	12
Iron	*23,100*	23,000	23,000	25,000	26,000	44,000	29,000	40,000	31,000	17,000
Lead	*26.1*	50	19	25	390	1,600	250	450	80	13
Magnesium	*3,030*	3,000	3,000	3,400	2,900	5,100	4,600	2,400	2,100	1,800
Manganese	*1,450*	600	390	460	720	1,200	1,500	950	580	400
Mercury	*0.036*	0.72	0.46	0.072	130	2.3	0.51	1.4	0.79	0.061
Nickel	*21.1*	25	20	22	24	30	110	38	36	14
Potassium	*927*	1,500	1,500	1,400	1,100	2,200	1,800	1,200	1,400	920
Selenium	*1.4*	<1.4 U	<1.4 U	<1.2 U	<1.3 U	<1.5 U	0.89	1.3	3.2	0.66
Silver	*0*	85	1.2	<0.61 U	55	580	140	630	310	<0.61 U
Sodium	*123*	120	140 U	<120 U	400	550	270	280	230	<120 U
Thallium	*0*	<0.28 U	<0.26 U	<0.24 U	<0.26 U	0.3	<0.25 U	0.58	<0.26 U	<0.23 U
Vanadium	*31.1*	17	19	18	16	19	20	17	22	13
Zinc	*61.8*	150	110	100	520	620	170	360	250	66
Asbestos (f/cc)										
Asbestos	*NA*	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD

Table 4-4. Analytes detected in 2003 Removal Action surface soil samples (discrete) (continued).

Detected Analyte	Station ID: / Sample ID: / Sample Date: / Depth (feet bgs): / Parameters: / BSV	SCss-010 / SCss-010-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-011 / SCss-011-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-012 / SCss-012-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-013 / SCss-013-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-014 / SCss-014-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-015 / SCss-015-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-016 / SCss-016-0001-SO / 9/10/2003 / 0–1 / metals, asbestos	SCss-017 / SCss-017-0001-SO / 9/15/2003 / 0–1 / explosives, propellants, metals, SVOCs, VOCs, total cyanide, asbestos
Explosives/Propellants (mg/kg)									
2,4,6-Trinitrotoluene	*NA*	NT	NT	NT	NT	NT	NT	NT	<0.1 U
2,4-Dinitrotoluene	*NA*	NT	NT	NT	NT	NT	NT	NT	<0.1 U
2,6-Dinitrotoluene	*NA*	NT	NT	NT	NT	NT	NT	NT	<0.2 U
Nitrocellulose	*NA*	NT	NT	NT	NT	NT	NT	NT	3.5
Inorganics (mg/kg)									
Aluminum	*17,700*	8,500	12,000	11,000	14,000	12,000	5,700	12,000	13,000
Antimony	*0.96*	<0.41 U	0.42	<0.34 U	0.46	<0.35 U	<0.36 U	<0.37 U	0.0037
Arsenic	*15.4*	13	10	21	12	2.5	9.8	10	8.6
Barium	*88.4*	58	70	64	72	72	34	57	200
Beryllium	*0.88*	0.6	0.41	0.5	0.6	0.32	0.22	0.31	0.53
Cadmium	*0*	0.21	0.33	<0.22 U	<0.22 U	<0.22 U	<0.22 U	<0.25 U	0.23
Calcium	*15,800*	4,900	14,000	2,100	2,300	2,400	1,700	3,100	2,200
Chromium	*17.4*	16	110	17	19	13	8.4	16	16
Cobalt	*10.4*	7.9	8.5	12	14	3.3	4.9	11	26
Copper	*17.7*	39	470	18	20	7.3	12	8.4	9.6
Iron	*23,100*	30,000	23,000	25,000	28,000	13,000	13,000	22,000	21,000
Lead	*26.1*	20	50	13	21	8	11	15	14
Magnesium	*3,030*	2,100	2,900	3,500	4,000	1,300	1,500	2,300	1,900
Manganese	*1,450*	510	580	240	380	90	270	340	4,800
Mercury	*0.036*	0.062	0.049	0.015	0.024	0.016	0.032	0.034	0.04
Nickel	*21.1*	18	53	26	28	9.4	11	14	19
Potassium	*927*	1,100	1,400	1,700	1,900	1,400	800	1,200	1,300
Selenium	*1.4*	<1.3 U	0.57	<1.1 U	<1.1 U	<1.1 U	<1.1 U	0.53	0.89
Silver	*0*	<0.67 U	0.47	<0.54 U	<0.56 U	<0.57 U	<0.55 U	<0.63 U	1
Sodium	*123*	<130 U	140	<110 U	<110 U	<110 U	<110 U	<130 U	<120 U

Table 4-4. Analytes detected in 2003 Removal Action surface soil samples (discrete) (continued).

Detected Analyte	Station ID:	SCss-010	SCss-011	SCss-012	SCss-013	SCss-014	SCss-015	SCss-016	SCss-017
	Sample ID:	SCss-010-0001-SO	SCss-011-0001-SO	SCss-012-0001-SO	SCss-013-0001-SO	SCss-014-0001-SO	SCss-015-0001-SO	SCss-016-0001-SO	SCss-017-0001-SO
	Sample Date:	9/10/2003	9/10/2003	9/10/2003	9/10/2003	9/10/2003	9/10/2003	9/10/2003	9/15/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	explosives, propellants, metals, SVOCs, VOCs, total cyanide, asbestos
	BSV								
Thallium	*0*	<0.27 U	<0.23 U	<0.23 U	<0.24 U	<0.23 U	<0.23 U	<0.24 U	<0.22 U
Vanadium	*31.1*	16	19	17	22	17	10	25	23
Zinc	*61.8*	100	160	58	68	35	49	55	58
Semivolatile Organic Compounds (mg/kg)									
Phenanthrene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.089
Fluoranthene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.52
Pyrene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.53
Benzo(a)anthracene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.31
Chrysene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.29
Bis(2-Ethylhexyl)phthalate	*NA*	NT	NT	NT	NT	NT	NT	NT	0.09 J
Benzo(b)fluoranthene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.3
Benzo(k)fluoranthene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.33
Benzo(a)pyrene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.29
Indeno(1,2,3-cd)pyrene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.13
Dibenzo(a,h)anthracene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.069
Benzo(g,h,i)perylene	*NA*	NT	NT	NT	NT	NT	NT	NT	0.13
Asbestos (f/cc)									
Asbestos	*NA*	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD

Table 4-4. Analytes detected in 2003 Removal Action surface soil samples (discrete) (continued).

Detected Analyte	Station ID:	SCss-018	SCss-019	SCss-020	SCss-021	SCss-022	SCss-023	SCss-024	SCss-025
	Sample ID:	SCss-018-0001-SO	SCss-019-0001-SO	SCss-020-0001-SO	SCss-021-0001-SO	SCss-022-0001-SO	SCss-023-0001-SO	SCss-024-0001-SO	SCss-025-0001-SO
	Sample Date:	9/15/2003	9/15/2003	9/15/2003	9/17/2003	9/17/2003	9/15/2003	9/17/2003	9/17/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, total cyanide, asbestos	metals, asbestos	metals, asbestos
	BSV								
Inorganics (mg/kg)									
Aluminum	*17,700*	13,000	13,000	11,000	10,000	8,300	14,000	9,100	8600
Antimony	*0.96*	<0.34 U	0.0059	<0.34 U	<0.72 U	<0.66 U	0.064	<0.71 U	<0.69 U
Arsenic	*15.4*	13	16	13	12	8.5	17	13	15
Barium	*88.4*	69	62	45	33	40	55	46	41
Beryllium	*0.88*	0.58	0.59	0.37	0.42	0.5	0.65	0.52	0.45
Cadmium	*0*	<0.22 U	<0.22 U	<0.21 U	<0.24 U	0.22	<0.22 U	<0.23 U	<0.23 U
Calcium	*15,800*	2,500	2,200	340	390	1,200	1,900	1,000	1,000
Chromium	*17.4*	18	19	16	14	13	20	15	13
Cobalt	*10.4*	13	12	9.5	9.7	11	13	12	11
Copper	*17.7*	20	19	14	14	16	20	17	15
Iron	*23,100*	27,000	29,000	23,000	22,000	23,000	32,000	25,000	21,000
Lead	*26.1*	15	12	14	14	20	11	20	14
Magnesium	*3,030*	4,200	4,100	2,800	2,600	3,200	4,700	3,500	2,900
Manganese	*1,450*	310	300	270	240	240	300	310	250
Mercury	*0.036*	<0.02 U	0.021	0.026	0.045	0.051	0.027	0.021	0.017
Nickel	*21.1*	29	28	20	18	22	32	26	20
Potassium	*927*	1,900	1,800	1,300	770	1,200	2,100	1,000	980
Selenium	*1.4*	<1.1 U	<1.1 U	<1.1 U	<1.2 U	<1.1 U	<1.1 U	<1.2 U	<1.2 U
Silver	*0*	<0.56 U	<0.55 U	<0.53 U	<0.6 U	<0.56 U	<0.54 U	<0.58 U	<0.58 U
Thallium	*0*	<0.23 U	<0.22 U	<1.1 U	<0.24 U	<0.22 U	<0.22 U	<0.24 U	<0.23 U
Vanadium	*31.1*	20	20	18	20	17	21	18	18
Zinc	*61.8*	65	62	57	57	69	68	71	61
Asbestos (f/cc)									
Asbestos	*NA*	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD

Table 4-4. Analytes detected in 2003 Removal Action surface soil samples (discrete) (continued).

Detected Analyte	Station ID:	SCss-026	SCss-027	SCss-028	SCss-029	SCss-030	SCss-CONT1	SCss-CONT2	SCss-CONT3
	Sample ID:	SCss-026-0001-SO	SCss-027-0001-SO	SCss-028-0001-SO	SCss-029-0001-SO	SCss-030-0001-SO	SCss-CONT1-0001-SO	SCss-CONT2-0001-SO	SCss-CONT3-0001-SO
	Sample Date:	9/17/2003	9/17/2003	9/17/2003	9/17/2003	9/17/2003	9/15/2003	9/22/2003	9/22/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	metals, asbestos	metals, asbestos	metals, asbestos	explosives, propellants, metals, SVOCs, VOCs, total cyanide, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos
	BSV								
Explosives/Propellants (mg/kg)									
2,4,6-Trinitrotoluene	*NA*	NT	NT	NT	<0.1 U	NT	NT	<0.5 U	0.039 J
2,4-Dinitrotoluene	*NA*	NT	NT	NT	0.037 J	NT	NT	<0.1 U	<0.1 U
2,6-Dinitrotoluene	*NA*	NT	NT	NT	0.170 J	NT	NT	<0.2 U	<0.2 U
Nitrocellulose	*NA*	NT	NT	NT	5	NT	NT	NT	NT
Inorganics (mg/kg)									
Aluminum	*17,700*	10,000	7,100	9,200	9,100	8,300	8,600	NT	NT
Antimony	*0.96*	<0.72 U	<0.72 U	<0.73 U	<0.74 U	<0.72 U	0.31	NT	NT
Arsenic	*15.4*	11	8.2	12	15	11	16	NT	NT
Barium	*88.4*	69	30	52	47	44	91	NT	NT
Beryllium	*0.88*	0.6	0.30	0.45	0.5	0.47	0.30	NT	NT
Calcium	*15,800*	2,200	740	1,200	1,300	1,700	1,700	NT	NT
Chromium	*17.4*	15	9.8	13	14	12	21	NT	NT
Cobalt	*10.4*	13	5.3	11	13	13	6.4	NT	NT
Copper	*17.7*	16	7.6	12	14	13	28	NT	NT
Iron	*23,100*	25,000	15,000	23,000	22,000	19,000	28,000	NT	NT
Lead	*26.1*	18	17	16	20	17	19	NT	NT
Magnesium	*3,030*	3,400	1,400	2,800	2,900	2,300	2,200	NT	NT
Manganese	*1,450*	330	220	340	310	270	98	NT	NT
Mercury	*0.036*	0.016	0.039	0.031	0.026	0.032	0.033	NT	NT
Nickel	*21.1*	28	9.2	19	22	19	22	NT	NT
Potassium	*927*	1,100	630	900	920	980	2,400	NT	NT
Vanadium	*31.1*	19	17	20	18	17	14	NT	NT
Zinc	*61.8*	65	41	57	62	59	45	NT	NT

Table 4-4. Analytes detected in 2003 Removal Action surface soil samples (discrete) (continued).

Detected Analyte	Station ID:	SCss-026	SCss-027	SCss-028	SCss-029	SCss-030	SCss-CONT1	SCss-CONT2	SCss-CONT3
	Sample ID:	SCss-026-0001-SO	SCss-027-0001-SO	SCss-028-0001-SO	SCss-029-0001-SO	SCss-030-0001-SO	SCss-CONT1-0001-SO	SCss-CONT2-0001-SO	SCss-CONT3-0001-SO
	Sample Date:	9/17/2003	9/17/2003	9/17/2003	9/17/2003	9/17/2003	9/15/2003	9/22/2003	9/22/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	metals	metals	metals	explosives, propellants, metals, SVOCs, VOCs, total cyanide	metals	metals	explosives	explosives
	BSV								
Volatile Organic Compounds (mg/kg)									
Chloroethane	NA	NT	NT	NT	0.091 J	NT	NT	NT	NT
Semivolatile Organic Compounds (mg/kg)									
Fluoranthene	*NA*	NT	NT	NT	0.0098 J	NT	NT	NT	NT
Benzo(a)anthracene	*NA*	NT	NT	NT	0.0044 J	NT	NT	NT	NT
Chrysene	*NA*	NT	NT	NT	0.0046 J	NT	NT	NT	NT
Bis(2-Ethylhexyl)phthalate	*NA*	NT	NT	NT	0.022 J	NT	NT	NT	NT
Benzo(b)fluoranthene	*NA*	NT	NT	NT	0.0051 J	NT	NT	NT	NT
Benzo(k)fluoranthene	*NA*	NT	NT	NT	0.0054 J	NT	NT	NT	NT
Benzo(a)pyrene	*NA*	NT	NT	NT	0.0047 J	NT	NT	NT	NT
Asbestos (f/cc)									
Asbestos		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD

< denotes less than
Background values taken from the Final Facility-Wide Human Health Remediation Goals at the former RVAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value.
bgs denotes below ground surface.
BSV denotes background screening value
f/cc denotes fibers per cubic centimeter.
ID denotes identification.
J denotes result is less than the reporting limit, but greater than or equal to the method detection limit.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
NAD denotes no asbestos detected.
NT denotes not tested.
RVAAP denotes former Ravenna Army Ammunition Plant.
SVOC denotes semivolatile organic compound.
U denotes analyte was not detected above the method detection limit.
VOC denotes volatile organic compound.

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted.

Detected Analyte	Station ID:	SCss-057	SCss-058	SCss-059	SCss-060	SCss-061	SCss-062	SCss-063	SCss-064
	Sample ID:	SCss-057M-0001-SO	SCss-058M-0001-SO	SCss-059M-0001-SO	SCss-060M-0001-SO	SCss-061M-0001-SO	SCss-062M-0001-SO	SCss-063M-0001-SO	SCss-064M-0001-SO
	Sample Date:	9/24/2010	9/23/2010	9/23/2010	9/23/2010	9/23/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, propellants, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV								
Explosives/Propellants (mg/kg)									
2,4,6-Trinitrotoluene	*NA*	<0.089 U	0.26 J	<0.089 U	0.09 U	<0.09 U	<0.09 U	<0.09 U	<0.09 U
Nitroguanidine	*NA*	0.64	NT	NT	NT	NT	NT	NT	NT
Metals (mg/kg)									
Aluminum	*17,700*	12,800	10,400	12,200	9,170	9,550	10,600	11,100	16,700
Antimony	*0.96*	<1.6 UJ	3.1	<0.43 U	1.5	17.1	3.7	2.8	0.75
Arsenic	*15.4*	8.3 J	4.5	10.4	13.4	21.2	36.6	16.2	11.9
Barium	*88.4*	67.6	127	66.8	163	764	226	180	128
Beryllium	*0.88*	0.71	0.66	0.41	0.58	0.66	1.1	1	0.64
Cadmium	*0*	0.41 J	1.9	<0.032 U	3.6	12.9	2.3	2.8	0.69
Calcium	*15,800*	4,880	21,500	32,500	17,900	11,900	15,300	10,400	13,900
Chromium	*17.4*	174	143	30.9	33.5	77.6	106	39.9	187
Cobalt	*10.4*	13.2	6.7	12.2	7.4	10	6.7	8.2	8.3
Copper	*17.7*	25.3	33.7	17.8	42.8	188	63.7	95.5	726
Iron	*23,100*	30,000	27,100	28,200	23,000	34,800	25,200	30,200	26,900
Lead	*26.1*	12.1 J	139	10.8	134	405	141	109	131
Magnesium	*3,030*	4,410	3,930	8,130	4,340	3,500	2,650	2,900	4,380
Manganese	*1,450*	421	729	453	705	876	765	707	674
Mercury	*0.036*	15.1	11.1	24.6	8.8	2.7	0.5	0.55	0.078
Nickel	*21.1*	34.6	21.7	26.4	21	30.7	37.6	27.6	48.2
Potassium	*927*	1,540	1,180	1,030	942	1,020	1,120	810	1,480
Selenium	*1.4*	<1.4 UJ	0.83 J	<0.37 U	0.63 J	0.4 J	3.1	1.9	0.48
Silver	*0*	12.9	3.8	<0.091 U	47.9 J	256	145	120	0.95
Sodium	*123*	51.8	99.6	61	55.4	108	107	70.6	150

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-057	SCss-058	SCss-059	SCss-060	SCss-061	SCss-062	SCss-063	SCss-064
	Sample ID:	SCss-057M-0001-SO	SCss-058M-0001-SO	SCss-059M-0001-SO	SCss-060M-0001-SO	SCss-061M-0001-SO	SCss-062M-0001-SO	SCss-063M-0001-SO	SCss-064M-0001-SO
	Sample Date:	9/24/2010	9/23/2010	9/23/2010	9/23/2010	9/23/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, propellants, SVOCs, pesticides, PCBs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV								
Thallium	*0*	3.2 J	1.7	1.8	1.7	2.4	1.4	2.7	1.1
Vanadium	*31.1*	20.9	14.8	17.6 J	16.3 J	21.6 J	15.7	18.3	23.8
Zinc	*61.8*	94	269	59.9	234	373	111	303	235
Semivolatile Organic Compounds (mg/kg)									
1,2,4-Trichlorobenzene	*NA*	<0.021 U	<0.021 U	<0.022 U	<0.023 U	0.027 J	<0.022 U	<0.022 U	<0.022 U
1,2-Dichlorobenzene	*NA*	0.028 J	<0.024 U	0.028 J	0.078 J	0.11 J	0.041 J	0.05 J	<0.025 U
1,3-Dichlorobenzene	*NA*	<0.02 U	<0.02 U	<0.021 U	<0.021 U	0.031 J	<0.021 U	<0.021 U	<0.021 U
1,4-Dichlorobenzene	*NA*	<0.019 U	0.022 J	0.058 J	0.21 J	0.27 J	0.041 J	0.047 J	<0.02 U
2-Methylnaphthalene	*NA*	<0.025 U	0.37 J	0.23 J	0.35 J	0.48	0.41	0.48	0.096 J
Acenaphthene	*NA*	<0.024 U	0.043 J	0.44	0.34 J	0.074 J	<0.025 U	0.047 J	<0.025 U
Acenaphthylene	*NA*	<0.024 U	0.16 J	0.056 J	0.13 J	0.087 J	<0.025 U	0.033 J	<0.025 U
Anthracene	*NA*	<0.024 U	0.3 J	1.1	1.1	0.32 J	0.056 J	0.16 J	0.026 J
Benzo(a)anthracene	*NA*	0.046 J	0.74	1.8	2.6	0.89	0.18 J	0.59	0.078 J
Benzo(a)pyrene	*NA*	0.045 J	0.59	1.5	2.4	0.76	0.17 J	0.53	0.078 J
Benzo(b)fluoranthene	*NA*	0.072 J	1	2.3	4.8	1.7	0.33 J	0.77	0.12 J
Benzo(g,h,i)perylene	*NA*	<0.022 U	0.17 J	0.51	0.69	0.24 J	0.13 J	0.36 J	0.066 J
Benzo(k)fluoranthene	*NA*	0.042 J	0.33 J	0.68	1.4	0.76	0.13 J	0.3 J	0.045 J
Benzoic Acid	*NA*	<0.3 U	<0.3 U	0.45 J	0.41 J	0.39 J	0.3 U	<0.3 U	<0.3 U
Bis(2-Ethylhexyl)phthalate	*NA*	<0.089 U	<0.089 U	0.11 J	<0.093 U	<0.093 U	<0.09 U	<0.089 U	<0.09 U
Carbazole	*NA*	<0.029 U	0.078 J	0.61	0.59	0.12 J	0.045 J	0.1 J	<0.029 U
Chrysene	*NA*	0.049 J	0.7	1.6	2.7	0.97	0.22 J	0.57	0.1 J
Dibenzo(a,h)anthracene	*NA*	<0.022 U	0.075 J	0.17 J	0.28 J	0.11 J	<0.023 U	0.097 J	<0.023 U
Dibenzofuran	*NA*	<0.024 U	0.14 J	0.3 J	0.33 J	0.16 J	0.089 J	0.12 J	0.027 J
Di-n-Butyl Phthalate	*NA*	0.17 J	0.12 J	0.18 J	0.47	0.3 J	0.14 J	0.22 J	0.12 J
Fluoranthene	*NA*	0.078 J	1.8	3.8	4.3	1.4	0.33 J	1.4	0.17 J

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-057	SCss-058	SCss-059	SCss-060	SCss-061	SCss-062	SCss-063	SCss-064
	Sample ID:	SCss-057M-0001-SO	SCss-058M-0001-SO	SCss-059M-0001-SO	SCss-060M-0001-SO	SCss-061M-0001-SO	SCss-062M-0001-SO	SCss-063M-0001-SO	SCss-064M-0001-SO
	Sample Date:	9/24/2010	9/23/2010	9/23/2010	9/23/2010	9/23/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, propellants, SVOCs, pesticides, PCBs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV								
Fluorene	*NA*	<0.025 U	0.19 J	0.46	0.47	0.079 J	<0.026 U	0.051 J	<0.026 U
Indeno(1,2,3-cd)pyrene	*NA*	<0.023 U	0.18 J	0.54	0.81	0.27 J	0.11 J	0.33 J	0.055 J
Isophorone	*NA*	<0.051 U	0.11 J	<0.053 U	<0.054 U	<0.053 U	0.13 J	0.2 J	0.13 J
Naphthalene	*NA*	<0.021 U	0.24 J	0.22 J	0.32 J	0.31 J	0.25 J	0.33 J	0.063 J
Pentachlorophenol	*NA*	<0.24 UJ	<0.24 U	<0.25 U	0.52 J	0.4 J	<0.25 U	<0.25 U	<0.25 U
Phenanthrene	*NA*	0.033 J	1.2	3.4	3.1	0.69	0.29 J	0.74	0.16 J
Pyrene	*NA*	0.063 J	1.3	3	4	1.5	0.28 J	1	0.16 J
Pesticides (mg/kg)									
4,4'-DDD	*NA*	0.0014 J	NT	NT	NT	NT	NT	NT	NT
4,4'-DDT	*NA*	0.0015 J	NT	NT	NT	NT	NT	NT	NT
Heptachlor	*NA*	0.0081 J	NT	NT	NT	NT	NT	NT	NT

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-065	SCss-066	SCss-067	SCss-068	SCss-069	SCss-072	SCss-073	SCss-074
	Sample ID:	SCss-065M-0001-SO	SCss-066M-0001-SO	SCss-067M-0001-SO	SCss-068M-0001-SO	SCss-069M-0001-SO	SCss-072M-0001-SO	SCss-073M-0001-SO	SCss-074M-0001-SO
	Sample Date:	9/22/2010	9/22/2010	9/21/2010	9/21/2010	9/24/2010	11/9/2010	11/9/2010	11/9/2010
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV								
Explosives/Propellants (mg/kg)									
2,4,6-Trinitrotoluene	*NA*	<0.09 U	<0.089 U	<0.09 U	<0.09 U	3.9	<0.09 U	<0.091 U	<0.09 U
2-Amino-4,6-Dinitrotoluene	*NA*	<0.05 U	<0.05 U	<0.05 U	<0.05 U	0.26 J	<0.05 U	<0.05 U	<0.05 U
Inorganics (mg/kg)									
Aluminum	*17,700*	12,500	13,000	10,700	9,150	26.1	7,980	9,480	9,100
Antimony	*0.96*	<0.083 U	<0.082 U	<0.082 U	<0.082 U	<0.16 U	0.89	2.9	1.4
Arsenic	*15.4*	10	12.8	10	11.2	<0.27 U	14.5	21.8	18.3
Barium	*88.4*	67.3	58.8	48.5	49.7	1.5	52.8	94.3	96.1
Beryllium	*0.88*	0.57	0.69	0.48	0.41	<0.0082 U	0.51	0.77	0.78
Cadmium	*0*	0.12	0.41	0.071	0.057	<0.012 U	0.3	0.63	1.6
Calcium	*15,800*	3,080	2,810	1,410	1,650	26.5	3,790	10,300	6,240
Chromium	*17.4*	30.8	38.6	24.7	24.2	0.26	32 J	130	88.4
Cobalt	*10.4*	9.3	10.2	8.7	7.6	<0.031 U	9.9	10.8	19.7
Copper	*17.7*	21.4	16.5	11.8	11	0.49	16.4	24.3	67
Iron	*23,100*	27,400	26,300	23,100	22,500	86.8	22,600	24,800	25,400
Lead	*26.1*	37	37.1	35.5	29.8	0.88	8.9	50.3	140
Magnesium	*3,030*	3,570	3,830	2,880	2,320	6.6	2,970	3,040	2,540
Manganese	*1,450*	451	383	316	395	2.2	356	576	471
Mercury	*0.036*	0.029	0.07	0.026	0.031	0.061	0.063	0.27	0.13

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-065	SCss-066	SCss-067	SCss-068	SCss-069	SCss-072	SCss-073	SCss-074
	Sample ID:	SCss-065M-0001-SO	SCss-066M-0001-SO	SCss-067M-0001-SO	SCss-068M-0001-SO	SCss-069M-0001-SO	SCss-072M-0001-SO	SCss-073M-0001-SO	SCss-074M-0001-SO
	Sample Date:	9/22/2010	9/22/2010	9/21/2010	9/21/2010	9/24/2010	11/9/2010	11/9/2010	11/9/2010
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV								
Nickel	*21.1*	22	25.6	21.3	20.9	0.083 J	21.7	32.7	25.9
Potassium	*927*	1,120	1,140	821	693	1,650	940	1,350	1,130
Selenium	*1.4*	0.13	<0.072 U	0.18 J	0.24	0.19 J	1.6	2.4	0.98
Silver	*0*	1.3	<0.017 U	<0.017 U	<0.017 U	0.52	2.7	2	0.69
Sodium	*123*	36.5	39.1	22.1	20.5	74	45	101	83.8
Thallium	*0*	0.76	0.72	0.97	0.62	1.1	<0.081 U	<0.082 U	0.23 J
Vanadium	*31.1*	18.6	18.4	16.8	14.8	<0.023 U	14.2	19.8	19.2
Zinc	*61.8*	68.8	61.6	49.7	48.2	0.96	54.4	86.1	147
Semivolatile Organic Compounds (mg/kg)									
1,2-Dichlorobenzene	*NA*	<0.025 U	<0.025 U	<0.025 U	<0.024 U	<0.025 U	<0.024 U	0.039 J	<0.025 U
2-Methylnaphthalene	*NA*	<0.026 U	<0.026 U	<0.026 U	<0.025 U	0.064 J	<0.025 U	0.24 J	0.53
Acenaphthene	*NA*	<0.025 U	<0.025 U	<0.025 U	<0.024 U	<0.064 U	<0.029 U	0.035 J	0.029 J
Acenaphthylene	*NA*	0.11 J	<0.025 U	<0.025 U	<0.024 U	<0.025 U	<0.024 U	0.029 J	0.042 J
Anthracene	*NA*	0.23 J	<0.025 U	<0.025 U	<0.024 U	<0.025 U	<0.024 U	0.093 J	0.07 J
Benzo(a)anthracene	*NA*	0.79	<0.026 U	<0.026 U	<0.025 U	0.062 J	0.027 J	0.37 J	0.3 J
Benzo(a)pyrene	*NA*	0.61	<0.024 U	<0.024 U	<0.023 U	0.054 J	0.026 J	0.35 J	0.31 J
Benzo(b)fluoranthene	*NA*	1	<0.026 U	<0.026 U	<0.025 U	0.12 J	0.039 J	0.58	0.51
Benzo(g,h,i)perylene	*NA*	0.3 J	<0.023 U	<0.022 U	<0.022 U	<0.023 UJ	<0.022 U	0.19 J	0.15 J
Benzo(k)fluoranthene	*NA*	0.29 J	<0.026 U	<0.026 U	<0.025 U	0.047 J	<0.025 U	0.2 J	0.14 J

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-065	SCss-066	SCss-067	SCss-068	SCss-069	SCss-072	SCss-073	SCss-074
	Sample ID:	SCss-065M-0001-SO	SCss-066M-0001-SO	SCss-067M-0001-SO	SCss-068M-0001-SO	SCss-069M-0001-SO	SCss-072M-0001-SO	SCss-073M-0001-SO	SCss-074M-0001-SO
	Sample Date:	9/22/2010	9/22/2010	9/21/2010	9/21/2010	9/24/2010	11/9/2010	11/9/2010	11/9/2010
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV								
Benzoic Acid	*NA*	0.57 J	<0.3 U	<0.3 U	<0.29 U	<0.3 U	<0.3 U	<0.3 U	<0.3 U
Bis(2-Ethylhexyl)phthalate	*NA*	<0.091 U	<0.089 U	<0.089 U	0.1 J	<0.089 U	1.7	0.19 J	0.49 J
Carbazole	*NA*	0.034 J	<0.029 U	<0.029 U	<0.028 U	<0.029 U	<0.028 U	0.058 J	0.057 J
Chrysene	*NA*	0.76	<0.026 U	<0.026 U	<0.025 U	0.061 J	<0.025 U	0.4 J	0.34 J
Dibenzofuran	*NA*	0.037 J	<0.025 U	<0.025 U	<0.024 U	<0.025 U	<0.024 U	0.072 J	0.11 J
Diethyl Phthalate	*NA*	0.66 U	<0.67 U	<0.66 U	<0.065 U	<0.066 U	0.069 J	<0.065 U	<0.065 U
Di-n-Butyl Phthalate	*NA*	0.082 J	<0.081 U	0.093 J	0.088 J	0.15 J	0.13 J	0.14 J	0.15 J
Fluoranthene	*NA*	1.7	0.04 J	<0.027 U	<0.026 U	0.14 J	0.046 J	0.76	0.64
Fluorene	*NA*	0.059 J	<0.026 U	<0.026 U	<0.025 U	<0.026 U	<0.025 U	0.033 J	0.031 J
Indeno(1,2,3-cd)pyrene	*NA*	0.34 J	<0.024 U	<0.024 U	<0.023 U	<0.024 UJ	<0.023 U	0.17 J	0.16 J
Isophorone	*NA*	<0.052 U	0.07 J	<0.051 U	0.051 J	<0.051 U	<0.051 U	<0.051 U	<0.051 U
Naphthalene	*NA*	0.029 J	<0.022 U	<0.021 U	<0.021 U	0.05 J	<0.021 U	0.17 J	<0.021 U
Phenanthrene	*NA*	0.78	<0.027 U	<0.027 U	<0.026 U	0.093 J	0.026 J	0.45	0.43
Pyrene	*NA*	<0.027 U	0.035 J	<0.027 U	<0.026 U	0.12 J	0.035 J	0.62	0.52

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-075	SCss-076
	Sample ID:	SCss-075M-0001-SO	SCss-076M-0001-SO
	Sample Date:	11/9/2010	11/9/2010
	Depth (feet bgs):	0–1	0–1
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs, pesticides, PCBs, total cyanide
	BSV		
Inorganics (mg/kg)			
Aluminum	*17,700*	9,780	7,990
Antimony	*0.96*	1.3	3.1
Arsenic	*15.4*	12.4	10.3
Barium	*88.4*	54.5	74.8
Beryllium	*0.88*	0.54	0.48
Cadmium	*0*	0.85	0.65
Calcium	*15,800*	1,100	18,500
Chromium	*17.4*	81	188
Cobalt	*10.4*	9.9	8.7
Copper	*17.7*	13.1	10.1
Iron	*23,100*	24,100	19,000
Lead	*26.1*	13.2	18.2
Magnesium	*3,030*	2,470	1,750
Manganese	*1,450*	256	661
Mercury	*0.036*	0.054	0.049
Nickel	*21.1*	21.8	25.3
Potassium	*927*	878	845
Selenium	*1.4*	1.4	2.2

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-075	SCss-076
	Sample ID:	SCss-075M-0001-SO	SCss-076M-0001-SO
	Sample Date:	11/9/2010	11/9/2010
	Depth (feet bgs):	0–1	0–1
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs, pesticides, PCBs, total cyanide
	BSV		
Silver	*0*	0.095 J	0.11
Sodium	*123*	35.4	68.1
Thallium	*0*	0.14 J	0.73
Vanadium	*31.1*	18.1	15.9
Zinc	*61.8*	50.1	46.9
Semivolatile Organic Compounds (mg/kg)			
2-Methylnaphthalene	*NA*	<0.025 U	0.045 J
Benzo(a)anthracene	*NA*	0.046 J	0.052 J
Benzo(a)pyrene	*NA*	0.034 J	0.045 J
Benzo(b)fluoranthene	*NA*	0.11 J	0.077 J
Benzo(g,h,i)perylene	*NA*	0.031 J	<0.023 U
Benzo(k)fluoranthene	*NA*	0.035 J	0.027 J
Bis(2-Ethylhexyl)phthalate	*NA*	0.91 J	0.27 J
Chrysene	*NA*	0.14 J	0.051 J
Diethyl Phthalate	*NA*	0.14 J	<0.066 U
Di-n-Butyl Phthalate	*NA*	0.087 J	0.14 J
Fluoranthene	*NA*	0.3 J	0.081 J
Indeno(1,2,3-cd)pyrene	*NA*	0.025 J	<0.024 U
Naphthalene	*NA*	<0.021 U	0.028 J

Table 4-5. Analytes detected in surface soil samples (ISM) collected during the RI with the analytes that were also detected in the surface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCss-075	SCss-076
	Sample ID:	SCss-075M-0001-SO	SCss-076M-0001-SO
	Sample Date:	11/9/2010	11/9/2010
	Depth (feet bgs):	0–1	0–1
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs, pesticides, PCBs, total cyanide
	BSV		
Phenanthrene	*NA*	0.09 J	0.05 J
Pyrene	*NA*	0.2 J	0.072 J
Pesticides (mg/kg)			
4,4'-DDD	*NA*	NT	0.0023 J
4,4'-DDT	*NA*	NT	0.0017 J
alpha-Chlordane	*NA*	NT	0.0015 J
Heptachlor	*NA*	NT	0.001 J
Lindane	*NA*	NT	0.0013 J
Methoxychlor	*NA*	NT	0.0016 J
General Chemistry			
Total Cyanide	*0*	NT	0.39 J

< denotes less than
Background values taken from the Final Facility-Wide Human Health Remediation Goals at the RAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value.
bgs denotes below ground surface.
BSV denotes background screening value
Cr^{+6} denotes hexavalent chromium.
J denotes the reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
NT denotes not tested.
PCB denotes polychlorinated biphenyl.
SVOC denotes semivolatile organic compound.
U denotes analyte was not detected and is reported as less than the limit of detection.
VOC denotes volatile organic compound.

Table 4-6. Summary of the SRCs identified in the subsurface soil samples.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Explosives and Propellants								
2,4,6-Trinitrotoluene	118-96-7	1/58	0.1 J	0.1 J	0.218	NA	Yes	Detected organic
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/58	0.26 J	0.26 J	0.221	NA	Yes	Detected organic
m-Nitrotoluene	99-08-1	1/58	0.32 J	0.32 J	0.222	NA	Yes	Detected organic
Inorganics								
Aluminum	7429-90-5	58/58	7,050	16,600	11,991	19,500	No	Below BSV
Antimony	7440-36-0	39/58	0.11 J	11.2	0.74	0.96	Yes	Above BSV
Arsenic	7440-38-2	57/58	2	182	18.24	19.8	Yes	Above BSV
Barium	7440-39-3	58/58	33.4	932	85.7	124	Yes	Above BSV
Beryllium	7440-41-7	58/58	0.31	3.9	0.71	0.88	Yes	Above BSV
Cadmium	7440-43-9	38/58	0.039	5.5	0.52	0	Yes	Above BSV
Calcium	7440-70-2	58/58	507	82,400	10,221	35,500	No	Essential nutrient
Chromium	7440-47-3	58/58	14	186	64.5	27.2	Yes	Above BSV
Cobalt	7440-48-4	58/58	4.4	22.3	10.4	23.2	No	Below BSV
Copper	7440-50-8	58/58	11.5	2,020	59.6	32.3	Yes	Above BSV
Iron	7439-89-6	58/58	19,500	79,400	32,672	35,200	No	Essential nutrient
Lead	7439-92-1	58/58	4.9	907	60.8	19.1	Yes	Above BSV
Magnesium	7439-95-4	58/58	1,880	8,830	5,247	8,790	No	Essential nutrient
Manganese	7439-96-5	58/58	244	2,010	512	3,030	No	Below BSV
Mercury	7439-97-6	58/58	0.0042 J	2	0.076	0.044	Yes	Above BSV
Nickel	7440-02-0	58/58	10.4	88.1	28.1	60.7	Yes	Above BSV
Potassium	7440-09-7	58/58	584	4,600	1,625	3,350	No	Essential nutrient
Selenium	7782-49-2	26/58	0.14 J	5.7	0.47	1.5	Yes	Above BSV
Silver	7440-22-4	14/58	0.13	13.5	0.50	0	Yes	Above BSV
Sodium	7440-23-5	58/58	20.2	264	95.2	145	No	Essential nutrient
Thallium	7440-28-0	41/58	0.19	17.3	1.36	0.91	Yes	Above BSV
Vanadium	7440-62-2	58/58	12.3	173	19.2	37.6	Yes	Above BSV
Zinc	7440-66-6	58/58	38.9	1,350	96.5	93.3	Yes	Above BSV
General Chemistry								
Cyanide, total	57-12-5	1/5	0.76	0.76	0.2	0	Yes	Above BSV

Table 4-6. Summary of the SRCs identified in the subsurface soil samples (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Semivolatile Organic Compounds								
1,2-Dichlorobenzene	95-50-1	4/58	0.024 J	0.049 J	0.191	NA	Yes	Detected organic
1,4-Dichlorobenzene	106-46-7	1/58	0.022 J	0.022 J	0.199	NA	Yes	Detected organic
2-Methylnaphthalene	91-57-6	18/58	0.026 J	0.7	0.174	NA	Yes	Detected organic
Acenaphthene	83-32-9	6/58	0.029 J	0.7	0.198	NA	Yes	Detected organic
Acenaphthylene	208-96-8	5/58	0.034 J	0.14 J	0.19219	NA	Yes	Detected organic
Anthracene	120-12-7	8/58	0.03 J	3.1	0.242	NA	Yes	Detected organic
Benzo(a)anthracene	56-55-3	11/58	0.046 J	8.2	0.370	NA	Yes	Detected organic
Benzo(a)pyrene	50-32-8	13/58	0.036 J	8.3	0.37993	NA	Yes	Detected organic
Benzo(b)fluoranthene	205-99-2	14/58	0.027 J	13	0.5501	NA	Yes	Detected organic
Benzo(g,h,i)perylene	191-24-2	13/58	0.022 J	1.7	0.22302	NA	Yes	Detected organic
Benzo(k)fluoranthene	207-08-9	11/58	0.027 J	4.4 J	0.29283	NA	Yes	Detected organic
Benzoic Acid	65-85-0	1/58	0.32 J	0.32 J	0.581	NA	Yes	Detected organic
Bis(2-Ethylhexyl)phthalate	117-81-7	10/58	0.088 J	0.85 J	0.447	NA	Yes	Detected organic
Carbazole	86-74-8	8/58	0.033 J	2.2	0.23	NA	Yes	Detected organic
Chrysene	218-01-9	12/58	0.034 J	7.6	0.39829	NA	Yes	Detected organic
Dibenzo(a,h)anthracene	53-70-3	6/58	0.032 J	0.55 J	0.200	NA	Yes	Detected organic
Dibenzofuran	132-64-9	11/58	0.024 J	0.84	0.1859	NA	Yes	Detected organic
Di-n-Butyl Phthalate	84-74-2	31/58	0.081 J	0.27 J	0.158	NA	Yes	Detected organic
Fluoranthene	206-44-0	14/58	0.027 J	17	0.65869	NA	Yes	Detected organic
Fluorene	86-73-7	9/58	0.034 J	1.1	0.197	NA	Yes	Detected organic
Indeno(1,2,3-cd)pyrene	193-39-5	10/58	0.024 J	1.6 J	0.23783	NA	Yes	Detected organic
Isophorone	78-59-1	21/58	0.053 J	1.2	0.211	NA	Yes	Detected organic
Naphthalene	91-20-3	18/58	0.021 J	0.98	0.167	NA	Yes	Detected organic
Pentachlorophenol	87-86-5	1/58	0.38 J	0.38 J	0.499	NA	Yes	Detected organic
Phenanthrene	85-01-8	20/58	0.027 J	11	0.484	NA	Yes	Detected organic
Pyrene	129-00-0	14/58	0.029 J	13	0.560	NA	Yes	Detected organic
Volatile Organic Compounds								
1,2-Dimethylbenzene	95-47-6	2/5	0.013 J	0.35	0.089	NA	Yes	Detected organic
Benzene	71-43-2	1/5	0.06	0.06	0.035	NA	Yes	Detected organic

Table 4-6. Summary of the SRCs identified in the subsurface soil samples (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Ethylbenzene	100-41-4	1/5	0.15	0.15	0.053	NA	Yes	Detected organic
Toluene	108-88-3	2/5	0.012 J	0.31	0.081	NA	Yes	Detected organic
Xylene (Total)	1330-20-7	1/5	0.36	0.36	0.119	NA	Yes	Detected organic
Pesticides								
4,4’-DDE	72-55-9	1/5	0.0051 J	0.0051 J	0.00114	NA	Yes	Detected organic
4,4’-DDT	50-29-3	2/5	0.00091 J	0.013 J	0.00455	NA	Yes	Detected organic
Aldrin	309-00-2	1/5	0.0012 J	0.0012 J	0.00159	NA	Yes	Detected organic
alpha-BHC	319-84-6	2/5	0.0013 J	0.011 J	0.00358	NA	Yes	Detected organic
beta-BHC	319-85-7	1/5	0.0032 J	0.0032 J	0.00182	NA	Yes	Detected organic
delta-BHC	319-86-8	1/5	0.0016 J	0.0016 J	0.00161	NA	Yes	Detected organic
Dieldrin	60-57-1	1/5	0.0034 J	0.0034 J	0.00985	NA	Yes	Detected organic
Endosulfan II	33213-65-9	1/5	0.0036 J	0.0036 J	0.0008	NA	Yes	Detected organic
Endrin aldehyde	7421-93-4	1/5	0.005 J	0.005 J	0.00233	NA	Yes	Detected organic
gamma-Chlordane	5566-34-7	1/5	0.0054 J	0.0054 J	0.00217	NA	Yes	Detected organic
Heptachlor	76-44-8	4/5	0.0009 J	0.0058 J	0.00232	NA	Yes	Detected organic
Heptachlor epoxide	1024-57-3	1/5	0.00071 J	0.00071 J	0.00129	NA	Yes	Detected organic
Methoxychlor	72-43-5	2/5	0.001 J	0.0058 J	0.0021	NA	Yes	Detected organic
Polychlorinated Biphenyls (mg/kg)								
Arochlor-1254	11097-69-1	1/5	0.14 J	0.14 J	0.03	NA	Yes	Detected organic

BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
J denotes the reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
SRC denotes site-related chemical

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted.

Detected Analyte	Station ID:	SCsb-035M	SCsb-035M	SCsb-035M	SCsb-035M	SCsb-035M	SCsb-036M	SCsb-036M
	Sample ID:	SCsb-035M-0001-SO	SCsb-035M-0002-SO	SCsb-035M-0003-SO	SCSsb-035M-0004-SO	SCsb-035M-0005-SO	SCsb-036M-0001-SO	SCsb-036M-0002-SO
	Sample Date:	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	1–5	5–9	9–13	13–17	17–20	1–5	5–9
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	12,900	11,100	9,680	12,300	13,100	10,300	7,050
Antimony	*0.96*	<0.081 U	<0.081 U	0.51	0.35	<0.081 U	<0.082 U	<0.081 U
Arsenic	*19.8*	15.7	6	15	16.8	15.4	9.2	13
Barium	*124*	50.1	105	41.8	49.2	41.1	154	40.7
Beryllium	*0.88*	0.67	0.81	0.45	0.53	0.54	0.72	0.33
Cadmium	*0*	0.15	0.067	<0.006 U	0.039	0.055	0.48	<0.0061 U
Calcium	*35,500*	4,980	4,460	17,900	6,920	4,770	14,900	3,180
Chromium	*27.2*	29.8	42.6	102	78.8	41.3	38.5	30.6
Cobalt	*23.2*	11.4	11.5	8.5	10.4	10.8	8.1	6.9
Copper	*32.3*	16.1	23	18.8	15.2	15.2	15.8	18.7
Iron	*35,200*	34,400	30,300	30,400	32,400	31,600	21,800	25,200
Lead	*19.1*	36.1	40.8	33.2	32.3	33.7	134	36.4
Magnesium	*2,790*	5,470	4,790	7,090	6,620	6,520	5,660	2,440
Manganese	*3,030*	399	849	440	356	271	702	480
Mercury	*0.044*	0.02	0.033	0.0099	0.0077 J	0.0059 J	0.078	0.011
Nickel	*60.7*	30	43.6	21.3	27.8	28.9	33.4	17.9
Potassium	*3,350*	1,160	2,300	1,580	2,000	1,690	923	694
Selenium	*1.5*	<0.071 U	0.49	<0.07 U	<0.071 U	<0.071 U	0.47	0.14 J
Silver	*0*	1.2	<0.034 U	<0.034 U	<0.017 U	<0.017 U	0.22	<0.034 U
Sodium	*145*	46.3	134	101	89.6	68	62.2	22.8
Thallium	*0.91*	0.7	0.86	0.77	0.71	0.76	0.83	0.7
Vanadium	*37.6*	16.7	15.1	14.1	16.5	16.4	17.8	12.6
Zinc	*93.3*	57.5	81.6	48.5	52	53.2	105	68.7
Semivolatile Organic Compounds (mg/kg)								
2-Methylnaphthalene	*NA*	<0.025 U	0.28 J	0.036 J	0.03 J	<0.025 U	0.2 J	<0.025 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-035M	SCsb-035M	SCsb-035M	SCsb-035M	SCsb-035M	SCsb-036M	SCsb-036M
	Sample ID:	SCsb-035M-0001-SO	SCsb-035M-0002-SO	SCsb-035M-0003-SO	SCSsb-035M-0004-SO	SCsb-035M-0005-SO	SCsb-036M-0001-SO	SCsb-036M-0002-SO
	Sample Date:	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	1–5	5–9	9–13	13–17	17–20	1–5	5–9
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs
	BSV							
Anthracene	*NA*	<0.024 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.03 J	<0.024 U
Benzo(a)anthracene	*NA*	0.046 J	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.16 J	<0.025 U
Benzo(a)pyrene	*NA*	0.042 J	0.036 J	<0.023 U	<0.023 U	<0.023 U	0.16 J	<0.023 U
Benzo(b)fluoranthene	*NA*	0.054 J	0.062 J	<0.025 U	<0.025 U	<0.025 U	0.22 J	<0.025 U
Benzo(g,h,i)perylene	*NA*	0.023 J	0.14 J	0.022 J	<0.022 U	<0.022 U	0.15 J	<0.022 U
Benzo(k)fluoranthene	*NA*	0.025 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.083 J	<0.025 U
Chrysene	*NA*	0.043 J	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.17 J	<0.025 U
Dibenzo(a,h)anthracene	*NA*	<0.022 U	<0.022 U	<0.022 U	<0.022 U	<0.022 U	0.06 J	<0.022 U
Dibenzofuran	*NA*	<0.024 U	0.035 J	<0.024 U	<0.024 U	<0.024 U	0.046 J	<0.024 U
Di-n-Butyl Phthalate	*NA*	0.093 J	0.11 J	<0.079 U	0.084 J	<0.08 U	0.15 J	0.089 J
Fluoranthene	*NA*	0.14 J	0.027 J	<0.026 U	<0.026 U	<0.026 U	0.32 J	<0.026 U
Fluorene	*NA*	<0.025 U	0.044 J	<0.025 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U
Indeno(1,2,3-cd)pyrene	*NA*	0.024 J	<0.023 U	<0.023 U	<0.023 U	<0.023 U	0.1 J	<0.023 U
Isophorone	*NA*	0.21 J	<0.05 U	0.079 J	0.42 J	0.32 J	0.073 J	0.18 J
Naphthalene	*NA*	0.029 J	0.11 J	0.021 J	<0.021 U	<0.021 U	0.14 J	<0.021 U
Phenanthrene	*NA*	0.16 J	0.13 J	<0.026 U	<0.026 U	<0.026 U	0.19 J	<0.026 U
Pyrene	*NA*	0.097 J	0.072 J	<0.026 U	<0.026 U	<0.026 U	0.25 J	<0.026 U

Table 4-7 Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-036M	SCsb-036M	SCSB-036M	SCsb-037D	SCsb-037M	SCsb-037M	SCsb-037M
	Sample ID:	SCsb-036M-0003-SO	SCsb-036M-0004-SO	SCsb-036M-0005-SO	SCsb-037D-0001-SO	SCsb-037M-0001-SO	SCsb-037M-0002-SO	SCsb-037M-0003-SO
	Sample Date:	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	9–13	13–17	17–20	1–5	1–5	5–9	9–13
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	VOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	11,800	18,200	12,700	NT	14,800	15,900	11,100
Antimony	*0.96*	<0.33 U	<0.32 U	<0.32 U	NT	0.93 J	1.5	0.52 J
Arsenic	*19.8*	<0.53 U	8.5	9.2	NT	182	155	8.1
Barium	*124*	219	66.5	41.1	NT	932	326	52
Beryllium	*0.88*	0.4	0.9	0.43	NT	3.9	2	0.31
Cadmium	*0*	3.6	<0.024 U	0.049 J	NT	1.6	5.5	0.61
Calcium	*35,500*	13,100	5,520	12,900	NT	13,900	33,200	2,020
Chromium	*27.2*	131	68.6	21.5	NT	112	186	25
Cobalt	*23.2*	8.1	19.1	12.3	NT	9	8.9	7.1
Copper	*32.3*	2,020	21.5	20.5	NT	95.7	209	23.1
Iron	*35,200*	79,400	41,400	37,500	NT	41,500	47,600	28,000
Lead	*19.1*	907	10.9	6.8	NT	325	507	43
Magnesium	*2,790*	3,900	6,670	8,540	NT	3,050	5,230	2,700
Manganese	*3,030*	626	525	477	NT	743	1,050	463
Mercury	*0.044*	0.044	0.014	0.0067 J	NT	0.24	0.3	0.019
Nickel	*60.7*	42.8	39.6	28.4	NT	35.7	51.6	17.1
Potassium	*3,350*	2,220	2,080	1,370	NT	1,020	1,740	650
Selenium	*1.5*	1.9	0.53 J	<0.28 U	NT	3.1	5.7	<0.28 U
Silver	*0*	0.28	<0.069 U	<0.068 U	NT	1.2	0.29	<0.069 U
Sodium	*145*	254	93.1	89.5	NT	178	264	24.4
Thallium	*0.91*	2.7	2.7	2.3	NT	5.5	17.3	2.4
Vanadium	*37.6*	17.3	22.5	16.9	NT	41	173	19.6
Zinc	*93.3*	1,350	90	64.3	NT	298	490	86.3

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID: / Sample ID: / Sample Date: / Depth (feet bgs): / Parameters: / BSV	SCsb-036M SCsb-036M-0003-SO 9/22/2010 9–13 explosives, metals, SVOCs *NA*	SCsb-036M SCsb-036M-0004-SO 9/22/2010 13–17 explosives, metals, SVOCs *NA*	SCSB-036M SCsb-036M-0005-SO 9/22/2010 17–20 explosives, metals, SVOCs *NA*	SCsb-037D SCsb-037D-0001-SO 9/22/2010 1–5 VOCs *NA*	SCsb-037M SCsb-037M-0001-SO 9/22/2010 1–5 explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide *NA*	SCsb-037M SCsb-037M-0002-SO 9/22/2010 5–9 explosives, metals, SVOCs *NA*	SCsb-037M SCsb-037M-0003-SO 9/22/2010 9–13 explosives, metals, SVOCs *NA*
Semivolatile Organic Compounds (mg/kg)								
1,2-Dichlorobenzene	*NA*	<0.024 U	<0.024 U	<0.024 U	NT	0.049 J	0.043 J	<0.024 U
1,4-Dichlorobenzene	*NA*	<0.019 U	<0.019 U	<0.019 U	NT	<0.019 U	0.022 J	<0.019 U
2-Methylnaphthalene	*NA*	0.28 J	0.068 J	0.046 J	NT	0.26 J	0.24 J	<0.025 U
Acenaphthene	*NA*	0.056 J	<0.024 U	<0.024 U	NT	<0.024 U	<0.024 U	<0.024 U
Acenaphthylene	*NA*	0.14 J	<0.024 U	<0.024 U	NT	<0.024 U	<0.024 U	<0.024 U
Anthracene	*NA*	<0.024 U	<0.024 U	<0.024 U	NT	0.032 J	<0.024 U	<0.024 U
Benzo(a)anthracene	*NA*	1.3	<0.025 U	<0.025 U	NT	0.12 J	0.053 J	<0.025 U
Benzo(a)pyrene	*NA*	1.7	<0.023 U	<0.023 U	NT	0.14 J	0.048 J	<0.023 U
Benzo(b)fluoranthene	*NA*	4	<0.025 U	<0.025 U	NT	0.26 J	0.12 J	<0.025 U
Benzo(g,h,i)perylene	*NA*	1.7	0.048 J	0.025 J	NT	0.12 J	0.038 J	<0.022 U
Benzo(k)fluoranthene	*NA*	1	<0.025 U	<0.025 U	NT	0.069 J	0.027 J	<0.025 U
Bis(2-Ethylhexyl)phthalate	*NA*	<0.089 U	<0.087 U	<0.087 U	NT	0.088 J	<0.089 U	0.12 J
Carbazole	*NA*	0.61	<0.028 U	<0.028 U	NT	0.033 J	<0.028 U	<0.028 U
Chrysene	*NA*	3.3	<0.025 U	<0.025 U	NT	0.16 J	0.089 J	<0.025 U
Dibenzo(a,h)anthracene	*NA*	0.32 J	<0.022 U	<0.022 U	NT	0.032 J	<0.022 U	<0.022 U
Dibenzofuran	*NA*	0.35 J	<0.024 U	<0.024 U	NT	0.069 J	0.055 J	<0.024 U
Di-n-Butyl Phthalate	*NA*	0.19 J	<0.079 U	<0.079 U	NT	0.12	0.27 J	0.12 J
Fluoranthene	*NA*	6.3	<0.026 U	<0.026 U	NT	0.36 J	0.17 J	<0.026 U
Fluorene	*NA*	0.064 J	<0.025 U	<0.025 U	NT	<0.025 U	<0.025 U	<0.025 U
Indeno(1,2,3-cd)pyrene	*NA*	1.6	<0.023 U	<0.023 U	NT	0.093 J	0.025 J	<0.023 U
Isophorone	*NA*	1.2	0.12 J	<0.05 U	NT	0.5	0.43	0.22 J
Naphthalene	*NA*	0.55	0.06 J	0.028 J	NT	0.15 J	0.15 J	<0.021 U
Phenanthrene	*NA*	7.4	0.038 J	0.034 J	NT	0.28 J	0.19 J	<0.026 U
Pyrene	*NA*	<0.024 U	<0.026 U	<0.026 U	NT	0.28 J	0.15 J	<0.026 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-036M	SCsb-036M	SCSB-036M	SCsb-037D	SCsb-037M	SCsb-037M	SCsb-037M
	Sample ID:	SCsb-036M-0003-SO	SCsb-036M-0004-SO	SCsb-036M-0005-SO	SCsb-037D-0001-SO	SCsb-037M-0001-SO	SCsb-037M-0002-SO	SCsb-037M-0003-SO
	Sample Date:	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	9–13	13–17	17–20	1–5	1–5	5–9	9–13
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	VOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Volatile Organic Compounds (mg/kg)								
1,2-Dimethylbenzene	*NA*	NT	NT	NT	0.013 J	NT	NT	NT
Toluene	*NA*	NT	NT	NT	0.012 J	NT	NT	NT
Pesticides (mg/kg)								
4,4’-DDE	*NA*	NT	NT	NT	NT	0.0069	NT	NT
4,4’-DDT	*NA*	NT	NT	NT	NT	0.009 J	NT	NT
Aldrin	*NA*	NT	NT	NT	NT	0.0012 J	NT	NT
alpha BHC	*NA*	NT	NT	NT	NT	0.011	NT	NT
beta-BHC	*NA*	NT	NT	NT	NT	0.0032 J	NT	NT
delta-BHC	*NA*	NT	NT	NT	NT	0.0016 J	NT	NT
Dieldrin	*NA*	NT	NT	NT	NT	0.0034 J	NT	NT
Endrin aldehyde	*NA*	NT	NT	NT	NT	0.005	NT	NT
gamma-Chlordane	*NA*	NT	NT	NT	NT	0.0054	NT	NT
Heptachlor	*NA*	NT	NT	NT	NT	0.0058 J	NT	NT
Heptachlor epoxide	*NA*	NT	NT	NT	NT	0.00071 J	NT	NT
Methoxychlor	*NA*	NT	NT	NT	NT	0.0058 J	NT	NT
Polychlorinated Biphenyls (mg/kg)								
Arochlor-1254	*NA*	NT	NT	NT	NT	0.14	NT	NT

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-037M	SCsb-037M	SCsb-038M	SCsb-038M	SCsb-038M	SCsb-038M	SCsb-038M
	Sample ID:	SCsb-037M-0004-SO	SCsb-037M-0005-SO	SCsb-038M-0001-SO	SCsb-038M-0002-SO	SCsb-038M-0003-SO	SCsb-038M-0004-SO	SCsb-038M-0005-SO
	Sample Date:	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	13–17	17–20	1–5	5–9	9–13	13–17	17–20
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	10,000	13,300	<14,900 UJ	14,200	11,000	14,400	10,900
Antimony	*0.96*	0.59	<0.16 U	0.16 J	<0.16 U	0.26 J	<0.16 U	0.63
Arsenic	*19.8*	2	5.3	7	8.2	9.1	6.5	6.1
Barium	*124*	45.9	71.9	93.6	51.6	33.4	50.4	43.8
Beryllium	*0.88*	0.31	0.62	<0.71 UJ	0.63	0.46	0.55	0.38
Cadmium	*0*	<0.012 U	0.28	0.012	<0.012 U	<0.012 U	<0.012 U	<0.012 U
Calcium	*35,500*	913	1,270	507	3,070	5,450	8,920	10,900
Chromium	*27.2*	170	53.6	36.1 J	48.1	70.6	16.3	156
Cobalt	*23.2*	4.4	11.8	22.3 J	10.8	8.8	11.1	9
Copper	*32.3*	13.3	15.5	20.8	17.7	17	16.5	18.6
Iron	*35,200*	23,600	32,500	36,500 J	35,600	30,100	35,800	29,600
Lead	*19.1*	10.9	11.5	11.1	6.6	6.6	5.3	5.3
Magnesium	*2,790*	2,120	3,420	3,230	4,430	4,290	7,260	6,840
Manganese	*3,030*	308	511	732	425	366	333	369
Mercury	*0.044*	0.019	0.018	0.019 J	0.0081	0.0053 J	0.0057 J	0.0079
Nickel	*60.7*	10.4	30.2	24.8	26.8	19.5	25.4	20.4
Potassium	*3,350*	1,030	1,570	2,100 J	2,100	1,970	2,390	2,020
Selenium	*1.5*	1	0.67 J	<1 U	0.53 J	0.26 J	0.45 J	0.6 J
Silver	*0*	<0.034 U	<0.034 U	0.035	<0.034 U	<0.034 U	0.034 U	<0.034 U
Sodium	*145*	67.6	61	67.7 J	77.4	80.2	115	134
Thallium	*0.91*	1.6	2.1	2.5 J	2.1	1.8	2	1.7
Vanadium	*37.6*	14.5	17.7	19.6 J	17.7	15.3	17.3	14.3
Zinc	*93.3*	51	222	68.7 J	57.7	47.8	54.4	48.1
Semivolatile Organic Compounds (mg/kg)								
2,6-Dinitrotoluene	*NA*	0.047 J	<0.024 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-037M	SCsb-037M	SCsb-038M	SCsb-038M	SCsb-038M	SCsb-038M	SCsb-038M
	Sample ID:	SCsb-037M-0004-SO	SCsb-037M-0005-SO	SCsb-038M-0001-SO	SCsb-038M-0002-SO	SCsb-038M-0003-SO	SCsb-038M-0004-SO	SCsb-038M-0005-SO
	Sample Date:	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010	9/22/2010
	Depth (feet bgs):	13–17	17–20	1–5	5–9	9–13	13–17	17–20
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
2-Methylnaphthalene	*NA*	<0.025 U	<0.025 U	0.097 J	<0.025 U	0.14 J	0.072 J	0.035 J
Dibenzofuran	*NA*	<0.024 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.025 J	<0.024 U
Di-n-Butyl Phthalate	*NA*	0.11 J	<0.084 J	0.16 J	0.093 J	<0.08 U	0.08 U	0.11 J
Fluorene	*NA*	<0.025 U	<0.025 U	<.025 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U
Isophorone	*NA*	<0.31 U	<0.054 J	<0.051 U	0.19 J	0.28 J	<0.051 U	0.05 J
Naphthalene	*NA*	<0.021 U	<0.021 U	0.074 J	<0.021 U	<0.021 U	0.049 J	<0.021 U
Phenanthrene	*NA*	<0.026 U	<0.026 U	0.047 J	<0.026 U	<0.026 U	0.039 J	<0.026 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-039M	SCsb-039M	SCsb-039M	SCsb-039M	SCsb-039M	SCsb-040M	SCsb-040M
	Sample ID:	SCsb-039M-0001-SO	SCsb-039M-0002-SO	SCsb-039M-0003-SO	SCsb-039M-0004-SO	SCsb-039M-0005-SO	SCsb-040M-0001-SO	SCsb-040M-0002-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010
	Depth (feet bgs):	1–5	5–9	9–13	13–17	17–20	1–5	5–9
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide	explosives, metals, SVOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	10,700	12,600	12,400	12,200	10,700	12,500	11,500
Antimony	*0.96*	0.11 J	<0.081 U	<0.081 U	<0.081 U	<0.081 U	2	1
Arsenic	*19.8*	15.1	15.6	15.3	15.7	14.9	12.8	14.7
Barium	*124*	58.7	47.8	42.2	38.7	38.3	80.4	49.8
Beryllium	*0.88*	0.66	0.54	0.49	0.45	0.45	0.75	0.66
Cadmium	*0*	0.33	0.25	0.18	0.19	0.11	0.29	0.28
Calcium	*35,500*	4,230	8,670	6,770	8,780	10,200	1,710	4,700
Chromium	*27.2*	18	34.1	33.8	26.7	24	95.4	54.9
Cobalt	*23.2*	11.6	11.8 J	11.3	11.5	10.3	10.8	11.1
Copper	*32.3*	17.7	16.3 J	16.5	16.1	16.3	19.1	17.1
Iron	*35,200*	36,400	31,400 J	34,200	29,900	29,800	37,200	33,700
Lead	*19.1*	46.1	37.4	35.6	36.9	34.6	40.7	42.5
Magnesium	*2,790*	4,550	6,310	6,790	7,840	8,020	3,940	5,690
Manganese	*3,030*	420	333	354	336	366	431	312
Mercury	*0.044*	0.0072 J	0.0069 J	0.0057 J	0.0073 J	0.0059 J	0.014	0.0064 J
Nickel	*60.7*	27.8	30.5	30	30.5	27.5	27	25.8
Potassium	*3,350*	1,170	1,570	1,490	1,530	1,320	1,680	2,070
Sodium	*145*	43.8	65.1	66.6	92.4	87.3	75	124
Thallium	*0.91*	<0.081 U	0.71 J	0.87	0.71	0.6	<0.081 U	<0.081 U
Vanadium	*37.6*	14.7	16.8	16.5	15.6	14.1	18.3	15.3
Zinc	*93.3*	56.4	56.5 J	56.7	55.2	56.3	55.7	54.1
Semivolatile Organic Compounds (mg/kg)								
2-Methylnaphthalene	*NA*	<0.025 U	0.19 J	0.14 J	0.088 J	0.061 J	<0.025 U	<0.025 U
Bis(2-Ethylhexyl)phthalate	*NA*	0.12 J	<0.088 U	<0.088 U	<0.089 U	<0.088 U	<0.088 U	0.085 J
Dibenzofuran	*NA*	<0.024 U	<0.024 U	<0.024 U	0.024 J	<0.024 U	<0.024 U	<0.24 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-039M	SCsb-039M	SCsb-039M	SCsb-039M	SCsb-039M	SCsb-040M	SCsb-040M
	Sample ID:	SCsb-039M-0001-SO	SCsb-039M-0002-SO	SCsb-039M-0003-SO	SCsb-039M-0004-SO	SCsb-039M-0005-SO	SCsb-040M-0001-SO	SCsb-040M-0002-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010
	Depth (feet bgs):	1–5	5–9	9–13	13–17	17–20	1–5	5–9
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide	explosives, metals, SVOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide
	BSV							
Di-n-Butyl Phthalate	NA	0.16 J	0.081 J	<0.08 U	0.092 J	<0.08 U	0.09 J	0.12 J
Fluorene	NA	<0.025 U	0.034 J	<0.025 U	<0.025 U	<0.025 U	<0.025 U	<0.25 U
Isophorone	*NA*	0.11 J	0.5 J	0.17 J	<0.051 U	0.09 J	<0.051 U	0.06 J
Naphthalene	*NA*	<0.021 U	0.053 J	0.032 J	0.057 J	0.045 J	<0.021 U	<0.021 U
Phenanthrene	*NA*	0.03 J	0.11 J	0.028 J	0.049 J	0.036 J	<0.026 U	<0.026 U
Pesticides (mg/kg)								
alpha-BHC	*NA*	NT	NT	NT	NT	<0.0006 U	NT	0.0013 J
Heptachlor	*NA*	NT	NT	NT	NT	0.001 J	NT	0.0091 J
Methoxychlor	*NA*	NT	NT	NT	NT	<0.0007 U	NT	0.001 J

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-040M	SCsb-040M	SCsb-040M	SCsb-041M	SCsb-041M	SCsb-041M	SCsb-041M
	Sample ID:	SCsb-040M-0003-SO	SCsb-040M-0004-SO	SCsb-040M-0005-SO	SCsb-041M-0001-SO	SCsb-041M-0002-SO	SCsb-041M-0003-SO	SCsb-041M-0004-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010
	Depth (feet bgs):	9–13	13–17	17–20	1–5	5–9	9–13	13–17
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	10,300	10,100	9,510	11,600	13,000	10,400	10,100
Antimony	*0.96*	0.74	0.32	<0.08 U	0.85	1	0.24 J	0.15 J
Arsenic	*19.8*	20.5	16.3	14.4	13.6	15.4	15.7	14
Barium	*124*	34.6	39.9	35.7	73.8	51.2	46.1	38
Beryllium	*0.88*	0.62	0.58	0.54	0.72	0.67	0.6	0.56
Cadmium	*0*	0.41	0.26	0.31	0.32	0.31	0.31	0.3
Calcium	*35,500*	5,560	7,710	7,870	7,780	6,080	6,460	7,980
Chromium	*27.2*	47.7	26.9	16	48.6	56	24	17.7
Cobalt	*23.2*	14.4	11.1	10.9	11.4	11.6	12.1	10.9
Copper	*32.3*	17	15.9	15.8	17.1	17	16.6	15.8
Iron	*35,200*	40,000	34,700	34,000	32,500	32,200	33,700	32,000
Lead	*19.1*	47.5	40.5	42.3	39.2	42.4	42.6	40.5
Magnesium	*2,790*	5,380	6,160	6,410	4,550	5,800	6,100	6,470
Manganese	*3,030*	1,110	528	382	372	403	466	362
Mercury	*0.044*	0.0055 J	0.004 J	0.0041 J	0.0068 J	0.0049 J	0.0079 J	0.0055 J
Nickel	*60.7*	33.3	25.4	25.2	26.4	28	28.1	25.4
Potassium	*3,350*	1,840	2010	1,540	1,690	2,040	1,730	1,630
Sodium	*145*	97.5	112	99.6	74.5	91.3	95.2	110
Thallium	*0.91*	0.34	<0.08 U	<0.08 U	<0.081 U	<0.081 U	<0.081 U	<0.081 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-040M	SCsb-040M	SCsb-040M	SCsb-041M	SCsb-041M	SCsb-041M	SCsb-041M
	Sample ID:	SCsb-040M-0003-SO	SCsb-040M-0004-SO	SCsb-040M-0005-SO	SCsb-041M-0001-SO	SCsb-041M-0002-SO	SCsb-041M-0003-SO	SCsb-041M-0004-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010
	Depth (feet bgs):	9–13	13–17	17–20	1–5	5–9	9–13	13–17
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Vanadium	*37.6*	14.1	13.1	12.3	15.8	15.6	14.1	12.8
Zinc	*93.3*	58.3	52.3	52.3	52.4	54.7	55.2	52.4
Semivolatile Organic Compounds (mg/kg)								
2-Methylnaphthalene	*NA*	<0.025 U	0.082 J	<0.082 U	<0.026 U	<0.025 U	0.043 J	0.084 J
Di-n-Butyl Phthalate	*NA*	<0.08 U	<0.079 U	0.1 J	0.11 J	0.081 J	<0.08 U	<0.08 U
Isophorone	*NA*	0.097 J	0.088 J	<0.05 U	0.053 J	0.11 J	<0.051 U	<0.05 U
Naphthalene	*NA*	<0.021 U	0.057 J	0.051 J	<0.021 U	<0.021 U	0.029 J	0.057 J
Phenanthrene	*NA*	<0.026 U	0.039 J	0.038 J	<0.027 U	<0.026 U	0.028 J	0.042 J

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-041M	SCsb-042M	SCsb-042M	SCsb-042M	SCsb-042M	SCsb-042M	SCsb-043M
	Sample ID:	SCsb-041M-0005-SO	SCsb-042M-0001-SO	SCsb-042M-0002-SO	SCsb-042M-0003-SO	SCsb-042M-0004-SO	SCsb-042M-0005-SO	SCsb-043M-0001-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010
	Depth (feet bgs):	17–20	1–5	5–9	9–13	13–17	17–20	1–5
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	10,900	11,900	11,600	14,000	11,200	10,700	11,400
Antimony	*0.96*	0.52	0.69	0.58	<0.4 U	0.25 J	0.79	<0.082 U
Arsenic	*19.8*	14.8	12.4	16.4	15.4	13.9	14.8	15.5
Barium	*124*	45.8	78.1	48.8	69.3	46.9	43.8	56.8
Beryllium	*0.88*	0.6	0.76	0.63	0.49	0.62	0.57	0.67
Cadmium	*0*	0.28	0.27	0.29	<0.03 U	0.31	0.27	0.25
Calcium	*35,500*	8,220	2210	6,220	5,360	8,900	8,400	1,490
Chromium	*27.2*	38.2	45.4	42	19.8	27.6	47	19.4
Cobalt	*23.2*	11	11.9	10.9	13	11	10.5	11.2
Copper	*32.3*	16.5	18.7	17.1	21	17.1	16.4	18
Iron	*35,200*	31,700	32,700	33,500	35,600	34,400	32,600	35,500
Lead	*19.1*	41.2	36.8	42.2	11.2	41.1	40	40.9
Magnesium	*2,790*	6,610	3,830	5,030	5,490	6,870	6,540	4,070
Manganese	*3,030*	360	412	445	451	391	385	385
Mercury	*0.044*	0.0066 J	0.012	0.0052 J	0.008	0.0059 J	0.0044 J	0.011
Nickel	*60.7*	25.7	26.4	26	30.7	26.1	24.7	26.6
Potassium	*3,350*	2,150	1,650	1,950	1,880	2,110	2,070	1,080
Sodium	*145*	135	64.4	83.2	92	113	118	48.1
Thallium	*0.91*	<0.08 U	<0.081 U	<0.081 U	2.1	<0.081 U	0.19 J	<0.082 U
Vanadium	*37.6*	14.1	17	15.1	20.5	14.7	13.6	15.6

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-041M	SCsb-042M	SCsb-042M	SCsb-042M	SCsb-042M	SCsb-042M	SCsb-043M
	Sample ID:	SCsb-041M-0005-SO	SCsb-042M-0001-SO	SCsb-042M-0002-SO	SCsb-042M-0003-SO	SCsb-042M-0004-SO	SCsb-042M-0005-SO	SCsb-043M-0001-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/21/2010
	Depth (feet bgs):	17–20	1–5	5–9	9–13	13–17	17–20	1–5
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, VOCs, pesticides, PCBs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs
	BSV							
Zinc	*93.3*	52.6	56.3	54.1	67	54.5	51.3	56
Semivolatile Organic Compounds (mg/kg)								
2-Methylnaphthalene	*NA*	0.08 J	<0.025 U	<0.025 U	0.049 J	0.068 J	0.073 J	<0.025 U
Dibenzofuran	*NA*	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.024 J	<0.024 U	<0.024 U
Di-n-Butyl Phthalate	NA	<0.079 U	<0.08 U	<0.079 U	0.1 J	<0.081 U	<0.079 U	<0.08 U
Isophorone	NA	<0.05 U	<0.05 U	0.07 J	<0.051 U	<0.051 U	<0.05 U	<0.051 U
Naphthalene	*NA*	0.056 J	<0.021 U	<0.021 U	0.035 J	0.06 J	0.031 J	<0.021 U
Phenanthrene	*NA*	0.051 J	<0.026 U	<0.026 U	0.034 J	0.043 J	0.04 J	<0.026 U
Pesticides (mg/kg)								
Heptachlor	*NA*	NT	NT	NT	0.009	NT	NT	NT

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-043M	SCsb-043M	SCsb-043M	SCsb-043M	SCsb-044M	SCsb-045M	SCsb-046M
	Sample ID:	SCsb-043M-0002-SO	SCsb-043M-0003-SO	SCsb-043M-0004-SO	SCsb-043M-0005-SO	SCsb-044M-0001-SO	SCsb-045M-0001-SO	SCsb-046M-0001-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/24/2010	9/25/2010	9/29/2010
	Depth (feet bgs):	5–9	9–13	13–17	17–20	1–5	1–5	1–5
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV							
Inorganics (mg/kg)								
Aluminum	*19,500*	12,300	16,600	10,800	11,700	11,100	8,490	11,600
Antimony	*0.96*	0.8	3.6	0.33	0.11 J	0.7	1.3 J	0.41 J
Arsenic	*19.8*	15.8	20.3	13.7	13.8	7.8	11.9	11.1
Barium	*124*	54.8	83.3	48.5	48.9	45	113	94.6
Beryllium	*0.88*	0.7	0.88	0.59	0.64	0.41	0.52	0.53
Cadmium	*0*	0.26	0.41	0.24	0.27	<0.012 U	0.45	<0.012 U
Calcium	*35,500*	5,020	4,600	7,330	8,280	2,690	56,600	12,600
Chromium	*27.2*	49.9	186	25.3	28.4	65.2	153	20.4
Cobalt	*23.2*	12.3	13.2	10.4	10.9	9.2	6.6	7.6
Copper	*32.3*	17.6	18.9	16.6	16.3	14.3	24	16.6
Iron	*35,200*	32,400	38,200	32,600	33,400	26,700	19,500	27,000
Lead	*19.1*	40.5	42.8	38.7	49.7	25.8	53.5	33.1
Magnesium	*2,790*	5,280	5,330	6,040	6,780	4,110	5,610	4,260
Manganese	*3,030*	461	630	312	366	312	658	483
Mercury	*0.044*	0.0042 J	0.0064 J	0.006 J	0.007 J	2	0.26	0.076
Nickel	*60.7*	28.5	30.8	25.1	26.1	20	18.9	17.4
Potassium	*3,350*	2,270	4,600	1,780	2,250	1,570	1,030	838
Selenium	*1.5*	0.071	<0.07 U	<0.071 U	<0.07 U	0.22 J	0.86 J	1.1
Silver	*0*	<0.017 U	<0.017 U	<0.017 U	<0.017 U	<0.034 U	13.5	5.4
Sodium	*145*	88.9	215	89.5	124	58.1	72.9	39.9
Thallium	*0.91*	<0.082 U	0.39	<0.081 U	<0.08 U	1.6	1.2	1.6
Vanadium	*37.6*	16.3	22.2	14.1	14.7	15.4	14.7	17
Zinc	*93.3*	56.1	58.5	51.8	53	48	76	56.7

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-043M	SCsb-043M	SCsb-043M	SCsb-043M	SCsb-044M	SCsb-045M	SCsb-046M
	Sample ID:	SCsb-043M-0002-SO	SCsb-043M-0003-SO	SCsb-043M-0004-SO	SCsb-043M-0005-SO	SCsb-044M-0001-SO	SCsb-045M-0001-SO	SCsb-046M-0001-SO
	Sample Date:	9/21/2010	9/21/2010	9/21/2010	9/21/2010	9/24/2010	9/25/2010	9/29/2010
	Depth (feet bgs):	5–9	9–13	13–17	17–20	1–5	1–5	1–5
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV							
Semivolatile Organic Compounds (mg/kg)								
1,2-Dichlorobenzene	*NA*	<0.025 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.029 J	<0.025 U
2-Methylnaphthalene	*NA*	<0.026 U	<0.025 U	0.049 J	0.063 J	0.025 U	0.1 J	0.052 J
Acenaphthene	*NA*	<0.025 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.032 J	0.086 J
Anthracene	*NA*	<0.025 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.098 J	0.21 J
Benzo(a)anthracene	*NA*	<0.026 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.26 J	0.34 J
Benzo(a)pyrene	*NA*	<0.024 U	<0.023 U	<0.023 U	<0.023 U	<0.023 U	0.41 J	0.29J
Benzo(b)fluoranthene	*NA*	<0.026 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.63 J	0.52 J
Benzo(g,h,i)perylene	*NA*	<0.023 U	<0.022 U	<0.022 U	<0.022 U	<0.022 U	0.22 J	0.072 J
Benzo(k)fluoranthene	*NA*	<0.026 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.14 J	0.16 J
Bis(2-Ethylhexyl)phthalate	*NA*	<0.089 U	0.11 J	<0.088 U	<0.087 U	<0.088 U	0.11 J	<0.089 U
Carbazole	*NA*	<0.029 U	<0.028 U	<0.028 U	<0.028 U	<0.028 U	0.067 J	0.11 J
Chrysene	*NA*	<0.026 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.27 J	0.29 J
Dibenzofuran	*NA*	<0.025 U	<0.024 U	<0.024 U	<0.024 U	<0.024 U	0.038 J	0.062 J
Di-n-Butyl Phthalate	*NA*	<0.081 U	0.24 J	<0.08 U	<0.079 U	0.094 J	0.22 J	0.15 J
Fluoranthene	*NA*	<0.027 U	<0.026 U	<0.026 U	<0.026 U	<0.026 U	0.57	0.84
Fluorene	*NA*	<0.026 U	<0.025 U	<0.025 U	<0.025 U	<0.025 U	0.04 J	0.094 J
Indeno(1,2,3-cd)pyrene	*NA*	<0.024 U	<0.023 U	<0.023 U	<0.023 U	<0.023 U	0.19 J	<0.024 UJ
Isophorone	*NA*	0.064 J	0.094 J	0.1 J	<0.05 U	0.13 J	<0.053 U	<0.051 U
Naphthalene	*NA*	<0.022 U	<0.021 U	0.054 J	0.043 J	0.021 U	0.076 J	0.054 J
Phenanthrene	*NA*	<0.027 U	<0.026 U	0.037 J	0.034 J	0.026 U	0.41 J	0.7
Pyrene	*NA*	<0.027 U	<0.026 U	<0.026 U	<0.026 U	<0.026 U	0.54	0.64

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-047M	SCsb-048D	SCsb-048M	SCsb-049M	SCsb-050M	SCsb-051M	SCsb-052M
	Sample ID:	SCsb-047M-0001-SO	SCsb-048D-0001-SO	SCsb-048M-0001-SO	SCsb-049M-0001-SO	SCsb-050M-0001-SO	SCsb-051M-0001-SO	SCsb-052M-0001-SO
	Sample Date:	9/29/2010	9/29/2010	9/29/2010	9/29/2010	9/29/2010	9/21/2010	9/24/2010
	Depth (feet bgs):	1–5	1–5	1–5	1–5	1–5	1–5	1–5
	Parameters:	explosives, metals, SVOCs	VOCs	explosives, propellants, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs
	BSV							
Explosives/Propellants (mg/kg)								
2,4,6-Trinitrotoluene	*NA*	<0.089 U	NT	<0.9 U	0.1 J	<0.9 U	<0.9 U	<0.9 U
2-Amino-4,6-Dinitrotoluene	*NA*	<0.05 U	NT	<0.05 U	0.26 J	<0.05 U	<0.05 U	<0.05 U
m-Nitrotoluene	*NA*	<0.07U	NT	<0.07U	0.32 J	<0.07U	<0.07U	<0.07U
Inorganics (mg/kg)								
Aluminum	*19,500*	13,700	NT	13,000	17,600	11,500	12,000	9,050
Antimony	*0.96*	1.9	NT	1.5	0.71 J	11.2	<0.41 UJ	0.55
Arsenic	*19.8*	20.2	NT	15	20.1	13.2	14.6	10.2
Barium	*124*	112	NT	137	183	77.6	76.9	45.6
Beryllium	*0.88*	0.92	NT	1.5	1.7	1.2	0.6	0.4
Cadmium	*0*	<0.012 U	NT	<0.012 U	<0.03 U	0.39	<0.031 UJ	0.062
Calcium	*35,500*	28,200	NT	37,100	82,400	5,410	10,600	3,410
Chromium	*27.2*	138	NT	109	155	163	73.2	14
Cobalt	*23.2*	6.5	NT	6	9.4	7.6	11.2	7.3
Copper	*32.3*	19.3	NT	44.8	30.7	153	20.7	12.5
Iron	*35,200*	22,800	NT	22,800	24,000	25,800	29,800	24,700
Lead	*19.1*	24.3	NT	34.5	38.5	41.2	10.9	10.9
Magnesium	*2,790*	3,660	NT	3,580	8,830	1,880	4,520	4,340
Manganese	*3,030*	950	NT	1,150	1,640	477	552	244
Mercury	*0.044*	0.7	NT	0.046	0.032	0.16	0.054	0.016
Nickel	*60.7*	47.7	NT	88.1	27.3	22.5	27.9	17.1
Potassium	*3,350*	1,170	NT	1,020	1,430	937	1,140	1,140
Selenium	*1.5*	1.8	NT	1.1	0.51 J	1.5	<0.36 U	0.53 J
Silver	*0*	0.61	NT	0.5	0.17 J	0.7	0.13 J	4.8
Sodium	*145*	121	NT	227	180	76.1	53.7	66.4

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID: / Sample ID: / Sample Date: / Depth (feet bgs): / Parameters:	BSV	SCsb-047M SCsb-047M-0001-SO 9/29/2010 1–5 explosives, metals, SVOCs	SCsb-048D SCsb-048D-0001-SO 9/29/2010 1–5 VOCs	SCsb-048M SCsb-048M-0001-SO 9/29/2010 1–5 explosives, propellants, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	SCsb-049M SCsb-049M-0001-SO 9/29/2010 1–5 explosives, metals, SVOCs	SCsb-050M SCsb-050M-0001-SO 9/29/2010 1–5 explosives, metals, SVOCs	SCsb-051M SCsb-051M-0001-SO 9/21/2010 1–5 explosives, metals, SVOCs, Cr^{+6}	SCsb-052M SCsb-052M-0001-SO 9/24/2010 1–5 explosives, metals, SVOCs
Thallium		*0.91*	1.9	NT	1.6	2.1	1.8	1.7 J	1.3
Vanadium		*37.6*	17.3	NT	13.3	19.7	17.7	17.6	12.8
Zinc		*93.3*	49	NT	41.3	53.8	193	66.6 J	42.2
Semivolatile Organic Compounds (mg/kg)									
1,2-Dichlorobenzene		*NA*	<0.025 U	NT	<0.024 U	0.024 J	<0.025 U	<0.024 U	<0.024 U
2-Methylnaphthalene		*NA*	0.31 J	NT	0.49	0.57	0.7	<0.025 U	<0.025 U
Acenaphthene		*NA*	0.029 J	NT	<0.024 U	0.7	0.061 J	<0.024 U	<0.024 U
Acenaphthylene		*NA*	0.057 J	NT	0.034 J	0.14 J	0.066 J	<0.024 U	<0.024 U
Anthracene		*NA*	0.14 J	NT	0.065 J	3.1	0.25	<0.024 U	<0.024 U
Benzo(a)anthracene		*NA*	0.29 J	NT	0.12 J	8.2	1.1	<0.025 U	<0.026 U
Benzo(a)pyrene		*NA*	0.35 J	NT	0.15 J	8.3	1.3 J	0.035 J	<0.023 UJ
Benzo(b)fluoranthene		*NA*	0.96 J	NT	0.41 J	13	2.7 J	0.039 J	<0.026 UJ
Benzo(g,h,i)perylene		*NA*	0.074 J	NT	<0.022 UJ	1.3 J	0.28 J	<0.022 UJ	<0.022 UJ
Benzo(k)fluoranthene		*NA*	0.33 J	NT	0.16 J	4.4 J	1.1 J	<0.025 UJ	<0.026 UJ
Benzoic Acid		*NA*	<0.3 U	NT	<0.29 U	<0.3 U	<0.3 U	0.32 J	<0.3 U
Bis(2-Ethylhexyl)phthalate		*NA*	0.095 J	NT	<0.088 U	<0.089 U	0.14 J	0.17 J	<0.089 U
Carbazole		*NA*	0.06 J	NT	0.035 J	<2.2	0.13 J	<0.029 U	<0.029 U
Chrysene		*NA*	0.39 J	NT	0.18 J	7.6	1.3	<0.025 U	<0.026 U
Dibenzo(a,h)anthracene		*NA*	0.036 J	NT	<0.022 UJ	0.55 J	0.1 J	<0.022 UJ	<0.022 UJ
Dibenzofuran		*NA*	0.076 J	NT	0.093 J	0.84	0.17 J	<0.024 U	<0.024 U
Di-n-Butyl Phthalate		*NA*	0.19 J	NT	0.12 J	0.13 J	0.18 J	0.14 J	0.13 J
Fluoranthene		*NA*	0.49	NT	0.24 J	17	2.8	0.031 J	<0.027 U
Fluorene		*NA*	0.034 J	NT	0.041 J	1.1	0.1 J	<0.025 U	<0.026 U
Indeno(1,2,3-cd)pyrene		*NA*	0.088 J	NT	0.049 J	1.6 J	0.34 J	<0.023 UJ	<0.023 UJ
Isophorone		*NA*	<0.051 U	NT	0.05	<0.051 U	<0.051 U	<0.051 U	<0.051 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-047M	SCsb-048D	SCsb-048M	SCsb-049M	SCsb-050M	SCsb-051M	SCsb-052M
	Sample ID:	SCsb-047M-0001-SO	SCsb-048D-0001-SO	SCsb-048M-0001-SO	SCsb-049M-0001-SO	SCsb-050M-0001-SO	SCsb-051M-0001-SO	SCsb-052M-0001-SO
	Sample Date:	9/29/2010	9/29/2010	9/29/2010	9/29/2010	9/29/2010	9/21/2010	9/24/2010
	Depth (feet bgs):	1–5	1–5	1–5	1–5	1–5	1–5	1–5
	Parameters:	explosives, metals, SVOCs	VOCs	explosives, propellants, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}	explosives, metals, SVOCs
	BSV							
Naphthalene	*NA*	0.23 J	NT	0.33 J	0.98	0.53	<0.021 U	<0.021 U
Pentachlorophenol	*NA*	<0.25 U	NT	<0.24 U	<0.24 U	0.38 J	<0.24 U	<0.24 U
Phenanthrene	*NA*	0.35 J	NT	0.28 J	11	1.1	0.027 J	<0.027 U
Pyrene	*NA*	0.49	NT	0.24 J	13	2.5	0.029 J	<0.027 U
Volatile Organic Compounds (mg/kg)								
1.2-Dimethylbenzene	*NA*	NT	0.35	NT	NT	NT	NT	NT
Benzene	*NA*	NT	0.06	NT	NT	NT	NT	NT
Ethylbenzene	*NA*	NT	0.15	NT	NT	NT	NT	NT
Toluene	*NA*	NT	0.31	NT	NT	NT	NT	NT
Xylene (Total)	*NA*	NT	0.36	NT	NT	NT	NT	NT
Pesticides (mg/kg)								
4,4'-DDE	*NA*	NT	NT	0.0051 J	NT	NT	NT	NT
4,4'-DDT	*NA*	NT	NT	0.013 J	NT	NT	NT	NT
Endosulfan II	*NA*	NT	NT	0.0036 J	NT	NT	NT	NT
General Chemistry								
Total Cyanide	*0*	NT	NT	0.76	NT	NT	NT	NT

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-053M	SCsb-054M	SCsb-055M	SCsb-056M
	Sample ID:	SCsb-053M-0001-SO	SCsb-054M-0001-SO	SCsb-055M-0001-SO	SCsb-056M-0001-SO
	Sample Date:	9/25/2010	9/29/2010	9/25/2010	9/25/2010
	Depth (feet bgs):	1–5	1–5	1–5	1–5
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV				
Inorganics (mg/kg)					
Aluminum	*19,500*	10,700	8,410	15,200	12,800
Antimony	*0.96*	0.16 U	1.4	0.93	1.2
Arsenic	*19.8*	17.7	11.4	11.1	15.2
Barium	*124*	46.4	80	91 B	58.9
Beryllium	*0.88*	0.43	0.4	0.77	0.54
Calcium	*35,500*	5,440	3,40	12,000	3,340
Chromium	*27.2*	18.3	116	96.6	111
Cobalt	*23.2*	11.6	4.8	8.4	11.4
Copper	*32.3*	16.5	16	11.5	16.9
Iron	*35,200*	33,100	25,800	30,000	33,500
Lead	*19.1*	8.7	20.3	15.7	11.7
Magnesium	*2,790*	5,440	2,130	4,670	5,180
Manganese	*3,030*	584	420	711	342
Mercury	*0.044*	0.026	0.0087	0.021	0.014
Nickel	*60.7*	26.3	14.9	16	25.9
Potassium	*3,350*	1,050	980	1,090	1,160
Selenium	*1.5*	0.72 J	1.7	1.6	0.46 J
Silver	*0*	<0.035 U	0.48	<0.035 U	<0.035 U
Sodium	*145*	44	31.7	70.3	47.5
Thallium	*0.91*	1.7	1.4	1.7	1.8
Vanadium	*37.6*	14.9	14.1	17.7	18.6
Zinc	*93.3*	54.4	47.5	38.9	55.3
Semivolatile Organic Compounds (mg/kg)					
2-Methylnaphthalene	*NA*	0.026 J	<0.025 U	<0.025 U	<0.025 U
Benzo(b)fluoranthene	*NA*	0.061 J	<0.025 UJ	<0.025 U	<0.025 U

Table 4-7. Analytes detected in each of the subsurface soil samples collected for the RI with the analytes detected in the subsurface soil samples from the 2003 Removal Action highlighted (continued).

Detected Analyte	Station ID:	SCsb-053M	SCsb-054M	SCsb-055M	SCsb-056M
	Sample ID:	SCsb-053M-0001-SO	SCsb-054M-0001-SO	SCsb-055M-0001-SO	SCsb-056M-0001-SO
	Sample Date:	9/25/2010	9/29/2010	9/25/2010	9/25/2010
	Depth (feet bgs):	1–5	1–5	1–5	1–5
	Parameters:	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs	explosives, metals, SVOCs, Cr^{+6}
	BSV				
Benzo(k)fluoranthene	*NA*	0.035 J	<0.025 UJ	<0.025 U	<0.025 U
Bis(2-Ethylhexyl)phthalate	*NA*	<0.089 U	<0.088 U	0.14 J	<0.088 U
Chrysene	*NA*	0.034 J	<0.025 U	<0.025 U	<0.025 U
Di-n-Butyl Phthalate	*NA*	0.15 J	0.13 J	0.14 J	0.2 J
Fluoranthene	*NA*	0.046 J	<0.026 U	<0.026 U	<0.026 U
Phenanthrene	*NA*	0.033 J	<0.026 U	<0.026 U	<0.026 U
Pyrene	*NA*	0.046 J	<0.026 U	<0.026 U	<0.026 U

< denotes less than
Background values taken from the Final Facility-Wide Human Health Remediation Goals at the former RVAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value.
bgs denotes below ground surface.
BSV denotes background screening value
Cr^{+6} denotes hexavalent chromium.
ID denotes identification.
J denotes reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
NT denotes not tested.
PCB denotes polychlorinated biphenyl.
RVAAP denotes former Ravenna Army Ammunition Plant.
SVOC denotes semivolatile organic compound.
U denotes analyte was not detected and is reported as less than the level of detection.
UJ denotes analtye not detected. The detection limits and quantitation limits are approximate.
VOC denotes volatile organic compound.

Table 4-8. Summary of SRCs identified in 2003 Removal Action from discrete sediment samples.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Explosives and Propellants								
2,6-Dinitrotoluene	606-20-2	1/2	0.11 J	0.11 J	0.11	NA	Yes	Detected organic
Nitrocellulose	9004-70-0	1/2	0.82	0.98	0.9	NA	Yes	Detected organic
Nitroguanidine	556-88-7	1/2	0.05 J	0.05 J	0.05	NA	Yes	Detected organic
Inorganics								
Aluminum	7429-90-5	12/12	1,500	14,000	6,241	13,900	Yes	Above BSV
Antimony	7440-36-0	1/12	0.086	0.086	0.32	0	Yes	Above BSV
Arsenic	7440-38-2	12/12	3.4	15	9.9	19.5	No	Below BSV
Barium	7440-39-3	12/12	9.4	59	18.36	123	No	Below BSV
Beryllium	7440-41-7	12/12	0.073	0.67	0.31	0.38	Yes	Above BSV
Cadmium	7440-43-9	2/12	0.13	0.39	0.23	0	Yes	Above BSV
Calcium	7440-70-2	12/12	570	3,300	1,780	15,800	No	Essential nutrient
Chromium	7440-47-3	12/12	2.3	19	9.24	18.1	Yes	Above BSV
Cobalt	7440-48-4	12/12	2	13	6.6	9.1	Yes	Above BSV
Copper	7440-50-8	12/12	2.6	26	11.6	27.6	No	Below BSV
Iron	7439-89-6	12/12	4,300	30,000	14,967	28,200	No	Essential nutrient
Lead	7439-92-1	12/12	2.9	40	11.2	27.4	Yes	Above BSV
Magnesium	7439-95-4	12/12	620	4,800	1,880	2,760	No	Essential nutrient
Manganese	7439-96-5	12/12	52	960	329	1,950	No	Below BSV
Mercury	7439-97-6	10/12	0.012	0.66	0.076	0.059	Yes	Above BSV
Nickel	7440-02-0	12/12	3.6	29	14	17.7	Yes	Above BSV
Potassium	7440-09-7	12/12	230	2,300	878	0	No	Essential nutrient
Selenium	7782-49-2	1/12	0.57	0.57	1.2	1.7	No	Below BSV
Silver	7440-22-4	2/12	3.2	40	3.9	0	Yes	Above BSV
Thallium	7440-28-0	1/12	0.36	0.36	0.14	0.89	No	Below BSV
Vanadium	7440-62-2	12/12	2.9	21	10.6	26.1	No	Below BSV
Zinc	7440-66-6	12/12	15	170	57.1	532	No	Below BSV
Volatile Organic Compounds								
Acetone	57-64-01	1/2	0.011	0.011	0.011	NA	Yes	Detected organic

BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
mg/kg denotes milligrams per kilogram.
J denotes reported result is an estimated value.
NA denotes not available.
SRC denotes site-related chemical

Table 4-9. Summary of the SRCs identified in the ISM sediment samples collected for 2003 Facility-Wide Biological and Water Quality Study.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Inorganics								
Aluminum	7429-90-5	1/1	5,500	5,500	5,500	13,900	No	Below BSV
Antimony	7440-36-0	1/1	0.37	0.37	0.37	0	Yes	Above BSV
Arsenic	7440-38-2	1/1	12.3	12.3	12.3	19.5	No	Below BSV
Barium	7440-39-3	1/1	42.3	42.3	42.3	123	No	Below BSV
Beryllium	7440-41-7	1/1	0.34	0.34	0.34	0.38	No	Below BSV
Cadmium	7440-43-9	1/1	0.14 J	0.14 J	0.14	0	Yes	Above BSV
Calcium	7440-70-2	1/1	1,930 J	1,930 J	1,930	15,800	No	Essential nutrient
Chromium	7440-47-3	1/1	8	8	8	18.1	No	Below BSV
Cobalt	7440-48-4	1/1	6.1	6.1	6.1	9.1	No	Below BSV
Copper	7440-50-8	1/1	12.2	12.2	12.2	27.6	No	Below BSV
Iron	7439-89-6	1/1	16,300	16,300	16,300	28,200	No	Essential nutrient
Lead	7439-92-1	1/1	9.5	9.5	9.5	27.4	No	Below BSV
Magnesium	7439-95-4	1/1	1,890 J	1,890 J	1,890	2,760	No	Essential nutrient
Manganese	7439-96-5	1/1	497	497	497	1,950	No	Below BSV
Nickel	7440-02-0	1/1	12.7	12.7	12.7	17.7	No	Below BSV
Selenium	7782-49-2	1/1	0.63	0.63	0.63	1.7	No	Below BSV
Sodium	7440-23-5	1/1	98.4	98.4	98.4	112	No	Essential nutrient
Thallium	7440-28-0	1/1	0.54	0.54	0.54	0.89	No	Below BSV
Vanadium	7440-62-2	1/1	10	10	10	26.1	No	Below BSV
Zinc	7440-66-6	1/1	63.4	63.4	63.4	532	No	Below BSV
Semivolatile Organic Compounds								
Di-n-Butyl Phthalate	84-74-2	1/1	0.12 J	0.12 J	0.12	NA	Yes	Detected organic
Nutrients								
Ammonia	7664-41-7	1/1	20	20	20	NA	Yes	Detected organic
Phosphorous	7803-51-2	1/1	330	330	330	NA	Yes	Detected inorganic
Nitrate/Nitrite	14797-55-8	1/1	2.6	2.6	2.6	NA	Yes	Detected inorganic

BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
J denotes reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
SRC denotes site-related chemical

Table 4-10. Summary of the SRCs identified from the ISM sediment samples collected for the RI.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
Explosives and Propellants								
Nitroguanidine	556-88-7	2/2	0.69	1.2 J	0.95	NA	Yes	Detected organic
Inorganics								
Aluminum	7429-90-5	2/2	7,240	7,580	7,410	13,900	No	Below BSV
Antimony	7440-36-0	2/2	0.45 J	8.4	0.87	0	Yes	Above BSV
Arsenic	7440-38-2	2/2	8.2	9.4	8.8	19.5	No	Below BSV
Barium	7440-39-3	2/2	75.7	231	153	123	Yes	Above BSV
Beryllium	7440-41-7	2/2	0.41	0.47	0.88	0.38	Yes	Above BSV
Cadmium	7440-43-9	2/2	0.19	2.7	1.44	0	Yes	Above BSV
Calcium	7440-70-2	2/2	2,330	3,240	2,785	5,510	No	Essential nutrient
Chromium	7440-47-3	2/2	40.9	107	74	18.1	Yes	Above BSV
Cobalt	7440-48-4	2/2	7.8	8.3	8	9.1	No	Below BSV
Copper	7440-50-8	2/2	16.6	53.7	35.2	27.6	Yes	Above BSV
Iron	7439-89-6	2/2	22,300	23,800	23,050	28,200	No	Essential nutrient
Lead	7439-92-1	2/2	7.2	104	55.6	27.4	Yes	Above BSV
Magnesium	7439-95-4	2/2	2,600	2,840	2,720	2,760	No	Essential nutrient
Manganese	7439-96-5	2/2	512	920	716	1,950	No	Below BSV
Mercury	7439-97-6	2/2	0.049	0.3	0.17	0.059	Yes	Above BSV
Nickel	7440-02-0	2/2	20	21.1	20.6	17.7	Yes	Above BSV
Potassium	7440-09-7	2/2	930	1,070	1,465	0	No	Essential nutrient
Selenium	7782-49-2	2/2	0.68 J	1.4 J	1.04	1.7	No	Below BSV
Silver	7440-22-4	1/2	116	116	58	0	Yes	Above BSV
Sodium	7440-23-5	2/2	52	221	136.5	0	No	Essential nutrient
Thallium	7440-28-0	2/2	1.1	2.1	1.6	0.89	Yes	Above BSV
Vanadium	7440-62-2	2/2	11.5	12.9	12.2	26.1	No	Below BSV
Zinc	7440-66-6	2/2	68.8	108	88.4	532	No	Below BSV
Semivolatile Organic Compounds								
1,2-Dichlorobenzene	95-50-1	1/2	0.044 J	0.0044 J	0.028	NA	Yes	Detected organic
1,4-Dichlorobenzene	106-46-7	1/2	0.040 J	0.040 J	0.025	NA	Yes	Detected organic

Table 4-10. Summary of the SRCs identified from the ISM sediment samples collected for the RI (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
2-Methylnaphthalene	91-57-6	1/2	0.043 J	0.043 J	0.022	NA	Yes	Detected organic
Benzo(a)anthracene	56-55-3	1/2	0.057 J	0.057 J	0.035	NA	Yes	Detected organic
Benzo(a)pyrene	50-32-8	1/2	0.067 J	0.067 J	0.040	NA	Yes	Detected organic
Benzo(b)fluoranthene	205-99-2	2/2	0.046 J	0.110 J	0.101	NA	Yes	Detected organic
Benzo(g,h,i)perylene	191-24-2	1/2	0.026 J	0.026 J	0.019	NA	Yes	Detected organic
Benzo(k)fluoranthene	207-08-9	1/2	0.047 J	0.047 J	0.030	NA	Yes	Detected organic
Chrysene	218-01-9	2/2	0.027 J	0.070 J	0.048	NA	Yes	Detected organic
Di-n-Butyl Phthalate	84-74-2	2/2	0.110 J	0.300 J	0.205	NA	Yes	Detected organic
Fluoranthene	206-44-0	2/2	0.047 J	0.089 J	0.068	NA	Yes	Detected organic
Indeno(1,2,3-cd)pyrene	193-39-5	1/2	0.026 J	0.026 J	0.019	NA	Yes	Detected organic
Naphthalene	91-20-3	1/2	0.029 J	0.029 J	0.020	NA	Yes	Detected organic
Phenanthrene	85-01-8	2/2	0.027 J	0.053 J	0.040	NA	Yes	Detected organic
Pyrene	129-00-0	2/2	0.040 J	0.089 J	0.065	NA	Yes	Detected organic
Polychlorinated Biphenyls								
Aroclor-1254	11097-69-1	1/2	0.15	0.15	0.080	NA	Yes	Detected organic
Aroclor-1262	37324-23-5	1/2	0.094	0.094	0.052	NA	Yes	Detected organic
Pesticides								
4,4'-DDD	72-54-8	2/2	0.00061	0.00340	0.0002	NA	Yes	Detected organic
4,4'-DDE	72-55-9	1/2	0.0043	0.0043	0.0022	NA	Yes	Detected organic
4,4'-DDT	50-29-3	2/2	0.00091 J	0.0068 J	0.0038	NA	Yes	Detected organic
alpha-Chlordane	5103-71-9	1/2	0.0023 J	0.0023 J	0.0012	NA	Yes	Detected organic
beta-BHC	319-85-7	1/2	0.0012 J	0.0012 J	0.0007	NA	Yes	Detected organic
delta-BHC	319-86-8	1/2	0.0017 J	0.0017 J	0.0009	NA	Yes	Detected organic
Dieldrin	60-57-1	1/2	0.0046	0.0046	0.0024	NA	Yes	Detected organic
Endosulfan Sulfate	1031-07-8	1/2	0.0055 J	0.0055 J	0.0030	NA	Yes	Detected organic
Endrin Aldehyde	7421-93-4	1/2	0.0063	0.0063	0.0034	NA	Yes	Detected organic
gamma-Chlordane	5103-74-2	1/2	0.0078	0.0078	0.0040	NA	Yes	Detected organic
Heptachlor	76-44-8	2/2	0.002 J	0.0057 J	0.0039	NA	Yes	Detected organic
Methoxychlor	72-43-5	2/2	0.0016 J	0.0021 J	0.00185	NA	Yes	Detected organic

Table 4-10. Summary of the SRCs identified from the ISM sediment samples collected for the RI (continued).

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Mean Result (mg/kg)	BSV (mg/kg)	SRC?	SRC Justification
General Chemistry								
Cyanide, total	57-12-5	2/2	0.32 J	0.36 J	0.22	0	Yes	Above background

BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
ISM denotes incremental sampling method.
J denotes reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
SRC denotes site-related chemical

Table 4-11. Analytes detected in discrete sediment samples collected during the 2003 Removal Action.

Detected Analyte	Station ID:	SCsd-001	SCsd-002	SCsd-003	SCsd-004	SCsd-005	SCsd-006
	Sample ID:	SCsd-001-0001-SD	SCsd-002-0001-SD	SCsd-003-0001-SD	SCsd-004-0001-SD	SCsd-005-0001-SD	SCsd-006-0001-SD
	Sample Date:	9/17/2003	9/18/2003	9/17/2003	9/18/2003	9/17/2003	9/18/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos
	BSV						
Inorganics (mg/kg)							
Aluminum	*13,900*	9,400	1,500	4,000	2,100	8,400	4,200
Arsenic	*19.5*	13	3.4	9	5.8	13	12
Barium	*123*	62	9.4	34	11	43	44
Beryllium	*0.38*	0.62	0.73	0.23	0.13	0.31	0.22
Cadmium	*0*	0.39	<0.23 U	<0.23 U	<0.21 U	0.13	<0.22 U
Calcium	*5,510*	3,200	790	1,600	900	2,400	1,000
Chromium	*18.1*	15	2.3	7.6	3.3	12	6.6
Cobalt	*9.1*	11	2	4.6	2.5	6.9	6
Copper	*27.6*	26	2.6	10	3.8	13	6.7
Iron	*28,200*	20,000	4,300	11,000	6,800	18,000	12,000
Lead	*27.4*	40	2.9	8.8	2.9	11	6.3
Magnesium	*2,760*	2,200	620	1,200	770	2,500	1,300
Manganese	*1,950*	960	73	290	99	270	280
Mercury	*0.059*	0.66	<0.02 U	0.029	<0.019 U	0.031	0.012
Nickel	*17.7*	23	3.6	9.6	5.7	17	11
Potassium	*0*	1,100	230	560	310	1,300	460
Selenium	*1.7*	<1.4 U	<1.1 U	0.57	<1 U	<1.2 U	<1.2 U
Silver	*0*	40	<0.57 U	3.2	<0.52 U	<0.61 U	<0.59 U
Sodium	*0*	170	<110 U	<110 U	<100 U	<120 U	<120 U
Thallium	*0.89*	0.36	<0.24 U	<0.23 U	<0.21 U	<0.25 U	<0.25 U
Vanadium	*26.1*	15	2.9	7.6	3.7	14	7.5
Zinc	*532*	170	15	43	19	78	29
Asbestos (f/cc)							
Asbestos	*NA*	NAD	NAD	NAD	NAD	NAD	NAD

Table 4-11. Analytes detected in discrete sediment samples collected during the 2003 Removal Action (continued).

Detected Analyte	Station ID:	SCsd-007	SCsd-008	SCsd-009	SCsd-010	SCsd-011	SCsd-012
	Sample ID:	SCsd-007-0001-SD	SCsd-008-0001-SD	SCsd-009-0001-SD	SCsd-010-0001-SD	SCsd-011-0001-SD	SCsd-012-0001-SD
	Sample Date:	9/17/2003	9/18/2003	9/17/2003	9/15/2003	9/18/2003	9/17/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, propellants, metals, VOCs, total cyanide, asbestos	explosives, propellants, metals, VOCs, total cyanide, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos
	BSV						
Explosives/Propellants (mg/kg)							
2,6-Dinitrotoluene	NA	<0.1 U	0.11 J	NT	NT	NT	NT
Nitrocellulose	NA	0.82	0.98	NT	NT	NT	NT
Nitroguanidine	NA	<0.25 U	0.05 J	NT	NT	NT	NT
Inorganics (mg/kg)							
Aluminum	*13,900*	3,100	14,000	10,000	3,500	9,200	5,500
Antimony	*0*	0.086	<0.8 U	<0.73 U	<0.73 U	<0.87 U	<0.87 U
Arsenic	*19.5*	5.3	15	14	5.6	13	9.4
Barium	*123*	21	53	57	29	59	38
Beryllium	*0.38*	0.095 J	0.67	0.49	0.15	0.48	0.29
Calcium	*5,510*	570	3,100	2,000	1,300	3,300	1,200
Chromium	*18.1*	4.5	19	14	5.5	13	8.1
Cobalt	*9.1*	2.3	12	9.4	4.1	13	5.9
Copper	*27.6*	3.9	19	17	8.7	15	14
Iron	*28,200*	6,500	30,000	23,000	11,000	22,000	15,000
Lead	*27.4*	4.8	11	15	5.4	17	9.4
Magnesium	*2,760*	870	4,800	2,800	1,200	2,600	1,700
Manganese	*1,950*	52	300	580	390	390	270
Mercury	*0.059*	0.0091	0.013	0.046	0.024	0.028	0.039
Nickel	*17.7*	5.9	29	20	8.7	22	13
Potassium	*0*	360	2,300	1,300	490	1,400	720
Vanadium	*26.1*	5	21	17	6.9	17	10

Table 4-11. Analytes detected in discrete sediment samples collected during the 2003 Removal Action (continued).

Detected Analyte	Station ID:	SCsd-007	SCsd-008	SCsd-009	SCsd-010	SCsd-011	SCsd-012
	Sample ID:	SCsd-007-0001-SD	SCsd-008-0001-SD	SCsd-009-0001-SD	SCsd-010-0001-SD	SCsd-011-0001-SD	SCsd-012-0001-SD
	Sample Date:	9/17/2003	9/18/2003	9/17/2003	9/15/2003	9/18/2003	9/17/2003
	Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1
	Parameters:	explosives, propellants, metals, VOCs, total cyanide, asbestos	explosives, propellants, metals, VOCs, total cyanide, asbestos	metals, asbestos	metals, asbestos	metals, asbestos	metals, asbestos
	BSV						
Zinc	*532*	18	64	72	41	79	57
Volatile Organic Compounds (mg/kg)							
Acetone	*NA*	<0.0055 U	0.011	NT	NT	NT	NT
Asbestos (f/cc)							
Asbestos	*NA*	NAD	NAD	NAD	NAD	NAD	NAD

Background values taken from the Final Facility-Wide Human Health Remediation Goals at the former RVAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value for inorganic site-related contaminant.
bgs denotes below ground surface.
BSV denotes background screening value
f/cc denotes fibers per cubic centimeter.
ID denotes identification.
J denotes result is less than the reporting limit, but greater than or equal to the method detection limit.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
NAD denotes no asbestos detected.
NT denotes not tested.
RVAAP denotes former Ravenna Army Ammunition Plant.
U denotes analyte was not detected above the method detection limit.
VOC denotes volatile organic compound.

Table 4-12. Analytes detected in the 2003 Facility-Wide Biological and Water Quality Study ISM sediment sample.

	Station ID:	S-7
	Sample ID:	FSW-SD-011-0000
	Sample Date:	6/24/2003
	Depth (feet bgs):	0–0.5
	Parameters:	explosives, metals, SVOCs, pesticides, PCBs, total cyanide, nutrients
Detected Analyte	BSV	
Inorganics (mg/kg)		
Aluminum	*13,900*	5,500
Antimony	*0*	0.37
Arsenic	*19.5*	12.3
Barium	*123*	42.3
Beryllium	*0.38*	0.34
Cadmium	*0*	0.14 J
Calcium	*5,510*	1,930 J
Chromium	*18.1*	8
Cobalt	*9.1*	6.1
Copper	*27.6*	12.2
Iron	*28,200*	16,300
Lead	*27.4*	9.5
Magnesium	*2,760*	1,890 J
Manganese	*1,950*	497
Nickel	*17.7*	12.7
Selenium	*1.7*	0.63
Sodium	*112*	98.4
Thallium	*0.89*	0.54
Vanadium	*26.1*	10
Zinc	*532*	63.4
Semivolatile Organic Compounds (mg/kg)		
Di-n-butyl phthalate	*NA*	0.12 J
Nutrients (mg/kg)		
Ammonia	*NA*	20
Phosphorus	*NA*	330

Table 4-12. Analytes detected in the 2003 Facility-Wide Biological and Water Quality Study ISM sediment sample (continued).

Detected Analyte	Station ID:	S-7
	Sample ID:	FSW-SD-011-0000
	Sample Date:	6/24/2003
	Depth (feet bgs):	0–0.5
	Parameters:	explosives, metals, SVOCs, pesticides, PCBs, total cyanide, nutrients
	BSV	
Nitrate	*NA*	2.6

Background values taken from the Final Facility-Wide Human Health Remediation Goals at the former RVAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value.
bgs denotes below ground surface.
BSV denotes background screening value
ID denotes identification.
J denotes estimated value due to QC parameter out of control.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
PCB denotes polychlorinated biphenyl.
QC denotes quality control.
RVAAP denotes former Ravenna Army Ammunition Plant.
SVOC denotes semivolatile organic compound.

Table 4-13. Analytes detected in the sediment samples (ISM) collected for this RI.

Detected Analyte	Station ID: / Sample ID: / Sample Date: / Depth (feet bgs): / Parameters: / BSV	SCsd-070 / SCss-070-0001-SD / 9/28/2010 / 0–0.5 / explosives, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	SCsd-071 / SCss-071-0001-SD / 9/28/2010 / 0–0.5 / explosives, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}
Explosives and Propellants (mg/kg)			
Nitroguanidine	NA	0.69	1.2 J
Inorganics (mg/kg)			
Aluminum	*13,900*	7,240 J	7,580 J
Antimony	*0*	8.4	0.45 J
Arsenic	*19.5*	9.4	8.2
Barium	*123*	231 J	75.7 J
Beryllium	*0.38*	0.41	0.47
Cadmium	*0*	2.7	0.19
Calcium	*5,510*	3,240	2,330
Chromium	*18.1*	40.9	107
Cobalt	*9.1*	7.8	8.3
Copper	*27.6*	53.7	16.6
Iron	*28,200*	23,800 J	22,300 J
Lead	*27.4*	104	7.2
Magnesium	*2,760*	2,840 J	2,600 J
Manganese	*1,950*	512	920
Mercury	*0.059*	0.3	0.049
Nickel	*17.7*	21.1	20
Potassium	*1,950*	1,070	930
Selenium	*1.7*	1.4 J	0.68 J
Silver	*0*	116	<0.087 U
Sodium	*112*	221	51
Thallium	*0.89*	1.2	1.1
Vanadium	*26.1*	11.5	12.9
Zinc	*532*	108	68.8

Table 4-13. Analytes detected in sediment samples (ISM) collected for this RI (continued).

Detected Analyte	Station ID:	SCsd-070	SCsd-071
	Sample ID:	SCss-070-0001-SD	SCss-071-0001-SD
	Sample Date:	9/28/2010	9/28/2010
	Depth (feet bgs):	0–0.5	0–0.5
	Parameters:	explosives, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	explosives, metals, SVOCs, pesticides, PCBs, total, cyanide, Cr^{+6}
	BSV		
Semivolatile Organic Compounds (mg/kg)			
1,2-Dichlorobenzene	NA	0.044 J	<0.025 U
1,4-Dichlorobenzene	NA	0.04 J	<0.019 U
2-Methylnaphthalene	NA	0.043 J	<0.026 U
Benzo(a)anthracene	NA	0.057 J	<0.026 U
Benzo(a)pyrene	NA	0.067 J	<0.024 U
Benzo(b)fluoranthene	NA	0.11 J	0.046 J
Benzo(g,h,i)perylene	NA	0.026 J	<0.023 U
Benzo(k)fluoranthene	NA	0.047 J	<0.026 U
Chrysene	NA	0.07 J	0.027 J
Di-n-Butyl Phthalate	NA	0.3 J	0.11 J
Fluoranthene	NA	0.089 J	0.047 J
Indeno(1,2,3-cd)pyrene	NA	0.026 J	<0.024 U
Naphthalene	NA	0.029 J	<0.021 U
Phenanthrene	NA	0.053 J	0.027 J
Pyrene	NA	0.089 J	0.04 J
Pesticides (mg/kg)			
4,4'-DDD	NA	0.0034	0.00061 J
4,4'-DDE	NA	0.0043	<0.0003 U
4,4'-DDT	NA	0.0068 J	0.00091 J
alpha-Chlordane	NA	0.0023 J	<0.0003 U
beta-BHC	NA	0.0012 J	<0.00061 U
delta-BHC	NA	0.0017	<0.0003 U
Dieldrin	NA	0.0046	<0.0003 U
Endosulfan Sulfate	NA	0.0055 J	<0.00091 U
Endrin Aldehyde	NA	0.0063	<0.0011 U

Table 4-13. Analytes detected in sediment samples (ISM) collected for this RI (continued).

Detected Analyte	Station ID:	SCsd-070	SCsd-071
	Sample ID:	SCss-070-0001-SD	SCss-071-0001-SD
	Sample Date:	9/28/2010	9/28/2010
	Depth (feet bgs):	0–0.5	0–0.5
	Parameters:	explosives, metals, SVOCs, pesticides, PCBs, total cyanide, Cr^{+6}	explosives, metals, SVOCs, pesticides PCBs, total cyanide, Cr^{+6}
	BSV		
gamma-Chlordane	NA	0.0078	<0.0003 U
Heptachlor	NA	0.0057 J	0.002 J
Methoxychlor	NA	0.0021 J	0.0016 J
Polychlorinated Biphenyls (mg/kg)			
Arochlor-1262	NA	0.094	<0.021 U
Arochlor-1254	NA	0.15	<0.023 U
General Chemistry (mg/kg)			
Total Cyanide	0	0.36 J	0.32 J

< denotes less than
Background values taken from the Final Facility-Wide Human Health Remediation Goals at the former RVAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value.
bgs denotes below ground surface.
BSV denotes background screening value
Cr^{+6} denotes hexavalent chromium.
ID denotes identification.
J denotes reported result is an estimated value.
mg/kg denotes milligrams per kilogram.
NA denotes not available.
PCB denotes polychlorinated biphenyl.
RVAAP denotes former Ravenna Army Ammunition Plant.
SVOC denotes semivolatile organic compound.
U denotes analyte was not detected and is reported as less than the limit of detection.

Table 4-14. Summary of SRCs that were identified from screening of the 2003 Removal Action surface water samples.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (µg/L)	Maximum Detect (µg/L)	Mean Result (µg/L)	BSV (µg/L)	SRC?	SRC Justification
Inorganics								
Aluminum	7429-90-5	3/3	28 J	94 J	65	3,370	No	Below BSV
Arsenic	7440-38-2	2/3	2.2	2.8	2.0	3.2	No	Below BSV
Barium	7440-39-3	3/3	36	40	38	47.5	No	Below BSV
Calcium	7440-70-2	3/3	60,000	62,000	61,000	0	No	Essential nutrient
Copper	7440-50-8	3/3	2.8 J	4.2 J	3.5	7.9	No	Below BSV
Iron	7439-89-6	3/3	580	780	713	2,560	No	Essential nutrient
Magnesium	7439-95-4	3/3	15,000	15,000	15,000	0	No	Essential nutrient
Manganese	7439-96-5	3/3	150	230	203	391	No	Below BSV
Potassium	7440-09-7	3/3	1,600	1,900	1,800	0	No	Essential nutrient
Sodium	7440-23-5	3/3	5,100	5,600	5,400	0	No	Essential nutrient
Zinc	7440-66-6	3/3	13 J	18 J	15.67	42	No	Below BSV

µg/L denotes micrograms per liter.
BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
J denotes reported result is an estimated value.
SRC denotes site-related chemical.

Table 4-15. Summary of SRCs that were identified from screening of the 2003 Facility-Wide Biological and Water Quality Study in the surface water samples.

Analyte	CAS Number	Frequency of Detection	Minimum Detect (µg/L)	Maximum Detect (µg/L)	Mean Result (µg/L)	BSV (µg/L)	SRC?	SRC Justification
Inorganics								
Aluminum	7429-90-5	2/2	94.6	120 J	107.3	3,370	No	Below BSV
Antimony	7440-36-0	1/2	2.9 J	2.9 J	1.9	0	Yes	Above BSV
Arsenic	7440-38-2	1/1	6.6	6.6	4.5	3.2	Yes	Above BSV
Barium	7440-39-3	2/2	41.8	42.3	42.1	47.5	No	Below BSV
Calcium	7440-70-2	2/2	53,300	61,500	57,400	0	No	Essential nutrient
Chromium	7440-47-3	2/2	0.66 J	1.4	1.03	0	Yes	Above BSV
Cobalt	7440-48-4	1/2	0.4 J	0.4 J	0.6	0	Yes	Above BSV
Copper	7440-50-8	1/2	1	1	1.3	7.9	No	Below BSV
Iron	7439-89-6	2/2	1,050	1,650	1,350	2,560	No	Essential nutrient
Lead	7439-92-1	1/2	2.9	2.9	3.45	0	Yes	Above BSV
Magnesium	7439-95-4	2/2	13,800	15,700	14,750	0	No	Essential nutrient
Manganese	7439-96-5	2/2	232	284	258	391	No	Below BSV
Potassium	7440-09-7	2/2	1,600	2,050	1,825	0	No	Essential nutrient
Silver	7440-22-4	1/2	1.1	1.1	1.2	0	Yes	Above BSV
Sodium	7440-23-5	2/2	5,750	5,780 J	5,765	0	No	Essential nutrient
Vanadium	7440-62-2	1/2	0.5 J	0.5 J	0.375	0	Yes	Above BSV
Zinc	7440-66-6	2/2	5.1 J	10.6 J	7.85	42	No	Below BSV
Semivolatile Organic Compounds								
Bis(2-Ethylhexyl)phthalate	117-81-7	1/2	2.1 J	2.1 J	4.1	NA	Yes	Detected organic
Di-n-Butyl Phthalate	84-74-2	1/2	3.85 J	3.85 J	4.7	NA	Yes	Detected organic
Nutrients								
Phosphorous	7803-51-2	1/1	430	430	430	NA	Yes	Detected inorganic
Nitrate/Nitrite	14797-55-8	1/1	130	130	130	NA	Yes	Detected organic

µg/L denotes micrograms per liter.
BSV denotes background screening value
CAS denotes Chemical Abstracts Service.
J denotes reported result is an estimated value.
NA denotes not available.
SRC denotes site-related chemical.

Table 4-16. Analytes detected in the surface water samples from the 2003 Removal Action.

	Station ID:	SCsw-001	SCsw-002	SCsw-003
	Sample ID:	SCSW-001-0001-SW	SCSW-002-0001-SW	SCSW-003-0001-SW
	Sample Date:	9/18/2003	9/15/2003	9/15/2003
	Parameters:	explosives, propellants, metals, SVOCs, VOCs, pesticides, PCBs, total cyanide, asbestos	metals, asbestos	metals, asbestos
Detected Analyte	BSV			
Inorganics (µg/L)				
Aluminum	*3,370*	28	94	73
Arsenic	*3.2*	<2 U	2.2	2.8
Barium	*47.5*	36	40	38
Calcium	*41,400*	62,000	61,000	60,000
Copper	*7.9*	2.8	4.2	3.5
Iron	*2,560*	580	780	780
Magnesium	*10,800*	15,000	15,000	15,000
Manganese	*391*	150	230	230
Potassium	*3,170*	1,600	1,900	1,900
Sodium	*21,300*	5,100	5,600	5,500
Zinc	*42*	16	13	18

< denotes less than
Background values taken from the Final Facility-Wide Human Health Remediation Goals at the former RVAAP, Ravenna, Ohio (March 2010).
Highlighted box denotes concentration is greater than the former RVAAP background value. The metals were not retained as SRCs since they are essential nutrients.
µg/L denotes micrograms per liter.
BSV denotes background screening value
ID denotes identification.
PCB denotes polychlorinated biphenyl.
RVAAP denotesformer Ravenna Army Ammunition Plant.
SRC denotes site-related contaminant.
SVOC denotes semivolatile organic compound.
U denotes analyte was not detected above the method detection limit.
VOC denotes volatile organic compound.

Table 4-17. Analytes detected in the surface water samples from the 2003 Facility-Wide Biological and Water Quality Study.

	Station ID:	S-7	S-7
	Sample ID:	FSW-SW-011-0000	FWS-SW-051-000
	Sample Date:	6/24/2003	9/17/2003
	Parameters:	explosives, metals, SVOCs, pesticides, PCBs, total cyanide, nutrients	explosives, metals, SVOCs
Detected Analyte	**BSV**		
Inorganics (µg/L)			
Aluminum	*3,370*	94.6	120 J
Antimony	*0*	<1.9 U	2.9 J
Arsenic	*3.2*	<4.2 UJ	6.6
Barium	*47.5*	36.9	41.8
Calcium	*41,400*	53,300	61,500
Chromium	*0*	0.66 J	1.4
Cobalt	*0*	0.4 J	<1.6 U
Copper	*7.9*	1	<3.2 U
Iron	*2,560*	1,050	1,650
Lead	*0*	2.9	<8 U
Magnesium	*10,800*	13,800	15,700
Manganese	*391*	284	232
Potassium	*3,170*	1,600	2,050
Sodium	*21,300*	5,780 J	5,750
Silver	*0*	1.1	<2.5 U
Vanadium	*0*	<0.5 U	0.5 J
Zinc	*42*	10.6 J	5.1 J
Semivolatile Organic Compounds (µg/L)			
Bis(2-Ethylhexyl)phthalate	*NA*	2.1 J	<12 U
Di-n-Butyl Phthalate	*NA*	<11 U	3.85 J
Nutrients (µg/L)			
Phosphorus (Total as P)	*NA*	430	---
Nitrate/Nitrite	*NA*	130	---

Background values taken from the Final Facility-Wide Human Health Remediation Goals at the RVAAP, Ravenna, Ohio (March 2010)
Highlighted box denotes concentration is greater than the background value. The metals were not retained as SRCs since they are essential nutrients.
--- denotes not analyzed. µg/L denotes micrograms per liter. BSV denotes background screening value
ID denotes identification. J denotes estimated value due to QC parameter out of control. NA denotes not available.
NT denotes not tested. PCB denotes polychlorinated biphenyl. QC denotes quality control. RVAAP denotes former Ravenna Army Ammunition Plant.
SRC denotes site-related contaminant. SVOC denotes semivolatile organic compound. U denotes analyte was not detected. UJ denotes analtye not detected. The detection limits and quantitation limits are approximate. VOCs denotes volatile organic compound.

5.0 CONTAMINANT FATE AND TRANSPORT

Contaminant fate and transport analyses were conducted for the chemicals detected in the impacted media (surface soil, subsurface soil, sediment, and surface water) that were investigated during the performance of the RI at the Sand Creek Site. Various SRCs were identified in each of the impacted media. The potential migration pathways and transport mechanisms for these SRCs from the impacted media to potential receptors were then evaluated and are presented in this section.

Groundwater evaluation beneath the Sand Creek Site was excluded from Shaw's scope of work for the Phase RI since it is performed on a facility-wide basis; therefore, SRCs for groundwater were not identified. Fate and transport modeling was used to estimate the potential for the SRCs present in surface and subsurface soils to migrate vertically downwards and impact groundwater quality underneath the AOC and eventually the surface water quality in the nearby Sand Creek. Computer models were used to predict which SRCs may leach to the groundwater at concentrations exceeding the groundwater standards and also predict at what time in future the impacts to groundwater are likely to occur. The model predictions provide a mechanism to establish the potential for future impacts to human health and environment arising from the documented SRCs. Model predictions can also serve as a basis for determining if follow-up remedial action is warranted, in what media the remediation needs to be performed, and to what extent will the remediation be effective in mitigation impacts to human and ecological receptors downgradient of the site.

For the purpose of fate and transport modeling, a conservative approach was utilized wherein the vertical transport of SRCs present in soils above the water table was simulated by using the greatest detected SRC concentrations in surface and subsurface soils. The model prediction identified the maximum concentrations of the SRCs expected in groundwater under the Sand Creek Landfill. The final step of predicting the horizontal transport of the SRCs in groundwater to the receptor locations could not be completed at this time because groundwater at the site has not been investigated and information on the chemicals present in the site groundwater and the flow characteristics of the groundwater underneath the Sand Creek Site are not available.

A summary of the fundamental mechanisms affecting contaminant fate and transport is provided in this section along with the results of the computer modeling performed. The procedure used to identify the SRCs is summarized in Section 5.2. Section 5.3 briefly discusses the physical and chemical properties of the SRCs that affect their fate and transport in the environment. A conceptual model of the contamination sources, migration pathways and transport mechanisms is provided in Section 5.4. Soil leachability analysis was performed

to identify the contaminant migration chemicals of potential concern (CMCOPCs) and is presented in Section 5.5. Section 5.6 describes the fate and transport modeling, followed by the presentation of the summary and conclusions of the contaminant fate and transport analyses in Section 5.7.

5.1 Identification of SRCs

A discussion of the SRCs evaluated for the environmental media at the Sand Creek Site is discussed in Section 4.0, "Nature and Extent of Contamination".

5.1.1 Physical and Chemical Properties of SRCs

The SRCs identified at the site consists of chemicals that may be classified as inorganic compounds and organic compounds (including explosives, VOCs, SVOCs, PCBs and pesticides). Each of these chemicals have unique physical and chemical properties that govern their fate and transport characteristics such as persistence in the environment (how long will the chemical last in the environment under natural conditions) and their mobility (ability to migrate through the soil and groundwater without being adsorbed to the surfaces of the solids in these media). The persistence and mobility of chemicals determines the potential for human and ecological receptors to be exposed to these contaminants at locations at a certain distance away from the source areas, and also determine the chemical concentration the receptors may be exposed to over certain time duration.

A number of chemical and biological reactions occur along the migration pathways once the chemicals are released to the environment. Examples of these reactions include hydrolysis, oxidation, reduction, isomerization, photolysis, photooxidation, biotransformation, and biodegradation. These reactions tend to reduce the concentrations of the chemicals over time and distance from the source. The reactions depend upon the properties of the chemicals as well as the properties of the media (soil, groundwater, etc.) that the chemicals are exposed to before reaching the potential receptors.

Key chemical-specific parameters that affect the fate and transport of chemicals in the environment include the organic carbon normalized soil-water partition coefficient for organic compounds (K_{oc}), the soil-water partition coefficient for inorganic chemicals (K_d), water solubility (S), Henry's Law Constant (HLC) and biodegradation rates for organic compounds along with air and water diffusivity. A compilation of these parameters is provided in the following reference sources:

- Soil Screening Guidance: Technical Background Document, EPA Document No. EPA/540/R-95/128, July 1996 (EPA, 1996a), http://www.epa.gov/superfund/health/conmedia/soil/toc.htm#p5

- Regional Screening Levels (RSLs) Chemical-Specific Parameters Supporting Table, EPA Region 9, Last Updated November 2015 (EPA, 2015), "http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/pdf/params_sl_table_bwrun_NOVEMBER2015.pdf".

The chemical-specific properties are discussed in further detail in Section 5.2.1.

Media-specific parameters that affect the fate and transport of contaminants in groundwater include depth to groundwater, groundwater flow direction, aquifer characteristics, infiltration rate in soil, organic carbon content, bulk density, and soil moisture content. These media-specific properties are discussed in further detail in Section 5.2.2.

5.1.2 Chemical Properties Affecting Fate and Transport

The following chemical-specific properties affect the fate and transport of contaminants in soil and groundwater.

5.1.2.1 Soil-Water Partition Coefficient for Organic Chemicals (K_{oc})

When an organic chemical is released to soil or groundwater, a fraction of the chemical may be adsorbed to the solid media (unsaturated soil or aquifer) due to hydrophobic effects while the remainder is dissolved in the soil moisture or groundwater. The primary adsorptive surface for organic chemicals is the fraction of organic solids in the unsaturated soil or aquifer (Fetter, 1992). Therefore, the partitioning of the chemical between the surface of the solids and soil moisture or groundwater depends upon organic carbon fraction of the soil (f_{oc}), which may be expressed as a fraction or as a percent of soil weight.

The preference of an organic chemical to partition between the solids and water is defined by the K_{oc} which is related to f_{oc} and soil sorption coefficient K_d as follows:

$$K_{oc} = \frac{K_d}{f_{oc}}$$

where:

f_{oc} is dimensionless, K_{oc} and K_d are expressed in units of L/kg.

5.1.2.2 Retardation Factor

The soil sorption coefficient K_d can be used to calculate the degree to which a chemical will tend to adsorb to the soil, and therefore, be not available to migrate with water. The lack of

mobility of the chemical caused by the adsorption to solid surfaces can be defined by a term called the Retardation Factor (R_f). The R_f is defined as follows:

$$R_f = 1 + \frac{K_d \rho_b}{\theta_w}$$

where:

ρ_b is the soil bulk density (grams per cubic centimeters)

θ_w is the water filled soil porosity (or soil water content, dimensionless)

For chemicals which move at the same velocity as groundwater, the R_f is 1. Chemicals whose mobility is slower than groundwater (i.e., are retarded as compared to the flow of groundwater) have an R_f exceeding 1. The greater the R_f, the slower the chemical will move relative to groundwater.

5.1.2.3 Soil-Water Partition Coefficient for Inorganic Chemicals (K_d)

Unlike organic compounds, the partitioning of inorganic chemicals and metals between solids and water is not dependent on the organic carbon content. The mobility of metals is defined by the distribution coefficient (K_d), which is the soil-water partition coefficient defined as the ratio of a chemical's sorbed concentration (mg/kg) to the dissolved concentration (milligrams per liter [mg/L]) in water (EPA, 1996b).

5.1.2.4 Water Solubility (S)

The water solubility of a compound is the concentration of the compound in water, and varies with the temperature of the water, pH and pressure. Compounds with higher water solubility tend to remain dissolved in water and are more likely to migrate with water as compared to compounds with low water solubility, which tend to either adsorb to soil or volatilize into air.

5.1.2.5 Henry's Law Constant

Henry's Law Constant (HLC) is the ratio of a chemical's concentration in the air (vapor pressure) to its concentration in water (aqueous solubility) at equilibrium. This parameter can vary significantly with temperature for some chemicals. The HLC can be expressed in dimensionless form or in units of cubic meters of atmosphere per molecule (atm-m^3/mol) and is used to calculate a soil concentration that is protective of groundwater (EPA, 1996b). General predictions regarding a compounds tendency to volatilize from water can be made using this parameter. If the HLC value of a compound is less than 10^{-7} atm-m^3/mol, it will tend to remain in solution and volatilize slowly, while compounds with HLC exceeding 10^{-3} atm-m^3/mol will tend to volatilize rapidly (Lyman et al., 1990).

5.1.3 Media Properties Affecting Fate and Transport

The following properties of the porous media (unsaturated soil and aquifer media) affect the fate and transport of contaminants in soil and groundwater.

5.1.3.1 Groundwater Flow Direction

The direction of groundwater flow in the aquifer underlying the source of contamination determines source length parallel to that flow, which is factor in calculating the amount of dilution and attenuation a chemical undergoes during transport between the source and the receptor.

5.1.3.2 Aquifer Parameters

Aquifer parameters needed to estimate a site-specific dilution factor including the following:

- K
- Hydraulic gradient (*i*)
- Aquifer thickness (d_a)

Site-measured values for these parameters are the preferred alternative (EPA, 1996a).

5.1.3.3 Infiltration Rate

Infiltration rate is used to calculate leachate concentration arising from contaminants present in soil. Infiltration rates are a subset of the precipitation rates in an area and can be estimated as a percentage of the recharge rates. Another method of estimating infiltration rates is to use infiltration rates determined for a better characterized site in the same hydrogeologic setting and with similar meteorological conditions as the site in question. A third alternative is to use the Hydrologic Evaluation of Landfill Performance (HELP) Model developed by Schroeder et al., 1984 (EPA, 1996a).

5.1.3.4 Average Soil Moisture Content

The soil moisture content represents fraction of total soil porosity that is filled by water. It is an important parameter in the application of the soil/water partition equation and the calculation of R_f.

5.2 Biodegradation

An additional consideration that applies to the fate and transport of organic compounds (VOCs, SVOCs, PCBs, and pesticides) is the reduction in contaminant concentration by biodegradation. Biodegradation is the transformation or breakdown of organic compounds that occurs when microorganisms use the organic compounds as a source of carbon and energy.

Biodegradation can reduce the chemical hazards related to organic compounds through the following mechanisms:

- Primary Reduction—Alteration of the chemical structure of a substance resulting in loss of a specific property of that substance
- Environmentally Acceptable Reduction—Biodegradation to such an extent as to remove undesirable properties of the compound (This often corresponds to primary biodegradation, but it depends on the circumstances under which the products are discharged into the environment.)
- Ultimate Reduction—Complete breakdown of a compound to either fully oxidized or reduced simple molecules (such as carbon dioxide/methane, nitrate/ammonium, and water)

In some cases, the products of biodegradation can be more harmful than the substance degraded (U.S. Geological Survey, 2007).

The biodegradation half-life is calculated as follows:

$$t_{1/2} = \frac{\ln 2}{\lambda} = \frac{0.693}{\lambda}$$

where:

$t_{1/2}$ is the half-life of the organic compound (days)

λ is the biodegradation rate constant

The biodegradation half-life represents the time taken by biodegradation activities to reduce the concentration of an organic chemical to 50 percent of the original concentration. It depends upon a number of factors, including the presence of microorganisms capable of degrading the chemical, the size of the microbial populations and environmental conditions like temperature.

5.3 Transformation of Explosives

Explosive and propellant SRCs were detected in surface soils at the Sand Creek Site. Only explosive SRCs were detected in subsurface soil at the AOC. Concentrations of explosives and propellants in soil and groundwater typically are attenuated by the processes of microbiological and photochemical transformation, which govern their fate and transport in the environment. In a study reported in Burrows, et al., 1989), TNT was shown to undergo rapid disappearance when incubated with activated sludge microorganism. The ring structure of the TNT was labelled with ^{14}C. No CO_2 was produced so the researchers concluded that TNT underwent transformation by the microbes but not biodegradation. It is believed that

there is successive reduction of the nitro groups into amino groups through hydroxylamine intermediates and some formation of tetranitoazyotoluenes. The products that form are dependent upon the nature of the microorganisms and other factors that would encourage nitro reduction. The researchers also observed similar transformations by thermophilic organisms. Some of the compounds that form include: 2-azodicarboxylic acid, 2,2'-azoxytoluene and 2-hydroxylamino-4,6-dinitrotoluene. Depending upon the situation, biotransformation occurs rapidly and the intermediate products are short-lived (Burrows, et al., 1989). If biodegradation was occurring, the organisms would ultimately metabolize the TNT into water, carbon dioxides, nitrogen dioxide, and carboxylic acids.

5.4 Conceptual Model for Fate and Transport

This section provides a CSM of the contamination sources at the Sand Creek Site, the contaminant migration pathways and transport mechanisms. The conceptual model represents the site-specific conditions and is derived from numerical modeling for soil leaching and groundwater transport. The numerical modeling consists of site-specific parameters that are entered into the model application. The conceptual model is based on the description of site physiographic setting, climate, topography, geology, hydrogeology, and potential receptors presented in Section 2.0. The CSM is used to identify chemical migration pathways at the Sand Creek Site for the fate and transport analysis.

The CSM serves as a basis for the model predictions during the fate and transport analysis and is dependent upon the available information and assumptions about the site conditions. The accuracy of the predictions made by the numerical models is comparative to the accuracy of these assumptions and the ability of site-specific data to accurately represent physical and chemical conditions at the Sand Creek Site. A summary of the essential elements of the conceptual model that apply to fate and transport modeling and assumptions are presented in the following subsections.

5.5 Contamination Sources

This section discusses suspected contamination source areas at the Sand Creek Site. The exact release histories of contaminants at the Sand Creek Site are largely unknown because only limited operational records are available. Additionally, only minimal environmental media samples were collected prior to the RI. Elevated concentrations of metals, VOCs, SVOCs, PCBs, pesticides, explosives, and propellants are consistent with past activities performed at the former RVAAP and would be expected as a result of historical dumping activities conducted at the AOC. A summary of the sampling performed for the 2003 RA, the 2003 FWBWQS, and the RI and the identification of SRCs in surface and subsurface soils, sediments, and surface water are presented in Section 4.0. In addition, a DGM survey was conducted at the Sand Creek Site in 2010 that identified buried anomalies which is most likely

remaining subsurface debris. SRCs have not been identified for groundwater since groundwater well installation and sampling is performed on a facility-wide basis and is not included in Shaw's scope of work for the Phase RI work. The sources of contamination in each of the impacted media are summarized below:

- Much of the native soil was reworked, removed, or used as cover material during dumping activities at the landfill. Overland surface flow from the landfill following rain events and snowmelt may have contaminated the surface soils in the vicinity of the Sand Creek.
- The SRCs in the deep soil appear to have originated from the fill material placed after the native soil was disturbed, and the fill material including coal and glass debris was placed along the embankment and slopes of the Sand Creek. However, the SRCs may be a result of subsurface anomalies that were identified during the 2010 DGM survey that may be potentially remaining debris.
- The source of the SRCs measured in the sediment may be a result of overland runoff flow from impacted surface soil. However, it may also have been impacted by surface water contaminated from upstream sources during flood conditions.
- The SRC concentrations measured in the surface water could potentially be derived from the surface soil and sediment, dissolved in the rainwater and snowmelt running off the land surface and Sand Creek slopes. They could also originate from the surface and subsurface soils, whose chemical constituents may have been dissolved in the rainwater and snowmelt infiltrating vertically downwards to the groundwater and then discharging to the Sand Creek. Surface water is obviously transient in nature, and contaminants may be easily dispersed once immersed in surface water.

Based on the above discussion, the SRCs found in the surface and subsurface soil samples were used as the primary contamination sources in the fate and transport assessment for the Sand Creek Site. For the purposes of this fate and transport discussion, it is assumed that the contamination detected in the sediments and surface water originates from these soil sources.

5.6 Hydrogeologic Setting

A description of the regional and site hydrogeologic setting is presented in Section 2.0 of this report. Salient features applicable to fate and transport analysis are presented below:

- The Sand Creek Site is located on the eastern side of Sand Creek, with the land surface sloping steeply from the edge of the landfill towards the Sand Creek. The bank slopes from east to west towards Sand Creek 40 to 60 degrees from horizontal.

- Topographic relief between the top of embankment and the surface of Sand Creek is approximately 15 to 25 feet.
- Surface water runoff (overland flow) generally follows the topography of the site and flows in a westerly direction where it enters Sand Creek, except for several small depressions with ponded water that are present along the level surface at the top of the embankment.
- No monitoring wells have been installed, and groundwater elevation data are not available.
- Groundwater was not encountered in a majority of the deep borings at the Sand Creek Site during the RI field activities. Only three of the deep borings advanced during this sample event to collect soil samples (SCsb035, SCsb036, and SCsb037) that encountered groundwater with the remainder being dry or moist, but not saturated. The depth to groundwater at these three borings was approximately 13 feet bgs. Throughout the facility, average depth to groundwater is as deep as 50 feet bgs (USACE, 2004).
- The three borings where groundwater was observed in the soil cores are located in the northern part of the AOC, at an approximate elevation of 965 ± 5 feet amsl. The approximate groundwater elevation at these locations is estimated to be 952 ± 5 feet amsl, which is higher than the surface of Sand Creek (950 ± 5 feet) indicating groundwater may be discharging to the Sand Creek.

As shown in **Table 5-1**, the groundwater exists in sand and sandy fill material, which is underlain by dense silty clay and clay. The top of the clay ranges from 0 to 5.5 feet below the elevation at which water was encountered in these three borings.

5.6.1 Contaminant Release Mechanism and Migration Pathways

The following contaminant release mechanisms and migration pathways were identified based on an analysis of the contaminant sources and hydrogeologic setting information presented above:

- One of the principal migration pathways at the Sand Creek Site is infiltration through the unsaturated soil (approximately 13 feet thick) to the underlying groundwater causing SRCs to leach from surface and subsurface soils into groundwater present in the unconsolidated water-bearing zone.
- Due to the very heterogeneous nature of the unconsolidated glacial materials, groundwater flow patterns within the unconsolidated water-bearing zone are difficult to predict. Site-specific groundwater data are not available at the AOC.

- Some of the precipitation falling as rainfall and snow leaves the site as surface runoff to the Sand Creek, carrying dissolved SRCs that are present in the surface soil to the site. The fraction of the precipitation that does not leave the AOC as surface runoff infiltrates into the subsurface. Some of the infiltrating water is lost to the atmosphere as evapotranspiration. The remainder of the infiltrating water recharges the groundwater.
- The rate of infiltration and eventual recharge of the groundwater is controlled by soil cover, ground slope, saturated hydraulic conductivity of the soil, and meteorological conditions.
- The infiltrating water leaches the contaminated soil impacted with SRCs and carries the dissolved SRCs to deeper soil and groundwater. The factors that affect the leaching rate include the amount of infiltration, the SRCs' solubility in water, and partitioning between solids and water. Insoluble compounds will precipitate out of solution in the subsurface or remain in insoluble forms with little leaching. For organic compounds, the rate of decay, either by biodegradation or biotransformation, determines whether a contaminant will leach to the groundwater and if it does, then at what concentration. Inorganic compounds are not attenuated by the decay processes. Most organic compounds decay at rates that are proportional to their half-life as described in Section 5.3. The SRCs with longer half-lives have a greater potential for contaminating groundwater than the SRCs with shorter half-lives.
- The impacted groundwater eventually discharges to the surface water in Sand Creek, carrying dissolved SRCs with it.

Figure 5-1 shows the contaminant migration conceptual model. After the SRCs leach through the unsaturated soil and reach the groundwater, they migrate with the local groundwater and potentially discharge to Sand Creek. In addition, overland flow over the AOC source soils may impact sediment which may potentially leach to Sand Creek.

5.6.2 Water Budget

Precipitation falling as rainfall and snow leaves the Sand Creek Site via the following mechanisms:

- Evapotranspiration (ET)
- Overland flow or surface runoff (R)
- Infiltration to groundwater (I)

The partitioning of precipitation (P) into the three components (ET, R, and I) of the hydrologic cycle constitutes the water budget. Evapotranspiration is the mechanism by which a fraction of the precipitation is lost to the atmosphere. The remainder of precipitation either reaches the Sand Creek as surface runoff or infiltrates to the water table. Infiltration is the mechanism that transports contaminants from soil to the groundwater by the process of leaching. The actual water budget was prepared to quantify the components of the hydrologic cycle at the Sand Creek Site. The quantified components of the water balance are used for inputs to the numerical modeling of soil leaching and groundwater transport. The components of a simple steady-state water balance model are related by the following equation:

$$P = ET + R + I$$

The water balance estimations were developed using the HELP Model (Schroeder et al., 1994). Calculations for site conditions using precipitation and temperature data for a 100-year period were generated synthetically using coefficients for Cleveland, Ohio. The annual average water balance estimates for the Sand Creek Site indicate an evapotranspiration of 28 percent (0.26 m [10.3 inches]) of total precipitation (0.94 m [37 inches]). The remaining 72 percent (0.68 m [27 inches]) of rainwater is available for surface water runoff and infiltration to groundwater. Of that 0.68 m (27 inches), groundwater recharge (infiltration) accounts for 10 percent (0.095 m [3.6 inches]), and surface runoff accounts for the remaining 62 percent (0.60 m [23 inches]).

5.6.3 Natural Attenuation of SRCs

As chemicals migrate vertically through the soil zone and then horizontally in groundwater, the SRC concentrations are reduced by several natural processes that are collectively referred to as natural attenuation. These processes include advection, dispersion, sorption, volatilization, and decay effects. The net result of natural attenuation is the reduction of SRC toxicity, mobility, and volume (mass) associated with the chemical. It is possible that for some chemicals with elevated concentrations, the concentrations are reduced to levels that are protective of human health and the ecosystem within an acceptable, site-specific time period. Therefore, natural attenuation is a viable alternative to active remediation.

Geotechnical samples were not collected from the unsaturated soil or the groundwater zone. Therefore, site-specific data regarding the soil moisture content, bulk density and porosity, and organic carbon content are not available. Data from other similar, nearby areas at the former RVAAP where investigations were conducted, such as the Ramsdell Quarry Landfill (SAIC, 2005) and Building 1200 (SAIC, 2011), were used for estimating these parameters at the Sand Creek Site. It is expected that attenuation through adsorption will occur in the unsaturated soil because of the organic carbon and clay content in the soils.

5.7 Soil Leachability Analysis

A soil leachability analysis was conducted to determine which of the SRCs found in surface and subsurface soils have the potential to leach to groundwater and eventually migrate to the Sand Creek when the groundwater discharges to it. The soil leachability analysis is a three-step screening process that includes the following:

- Amount of rainwater available for flow and infiltration to groundwater is highly variable and dependent upon soil type and climatic conditions.
  - Identifying SRCs for sample aggregates of interest.
  - Comparing the MDC of SRCs with generic soil screening levels (GSSLs) to develop initial CMCOPCs.
  - Comparing the MDC of initial CMCOPCs with site-specific soil screening levels (SSSLs) (GSSL multiplied by the site-specific Dilution Attenuation Factor [DAF]) to refine the initial CMCOPCs).

5.8 Soil Screening Analysis

This section presents the development and screening process for the CMCOPCs in soil and sediment at the Sand Creek Site that have the potential to leach to groundwater

5.8.1 Development of Initial CMCOPCs

A screening evaluation was performed to identify SRCs with the potential to leach to groundwater and potentially migrate to the surface water. These SRCs are referred to as initial CMCOPCs. The CMCOPCs are defined as the constituents that may leach to groundwater and migrate to a downgradient receptor location at a concentration exceeding the drinking water Maximum Contaminant Level (MCL) or the Regional Screening Level (RSL) for residential soil that is protective of groundwater (EPA, 2011).

Table E-1 in **Appendix E** shows the development of initial CMCOPCS for the surface soil and dry sediments. The MDCs for the SRCs were compared with the GSSLs for contaminant migration to groundwater pathway developed by EPA for application at Superfund sites. The GSSLs are available at:

"http://www.epa.gov/superfund/health/conmedia/soil/pdfs/appd_a.pdf".

The GSSL is defined as the concentration of a contaminant in soil that represents a level of contamination below which there is no concern for impacts to groundwater under CERCLA, provided conditions associated with soil screening levels are met. Generally, if contaminant concentrations in soil fall below the GSSL, and there are no significant ecological receptors of concern, then no further study or action is warranted for that area. A default DAF of 1 was

used, which assumes that there is no reduction in contaminant concentrations by dilution natural attenuation processes active between the source and the receptor location. If the MDC for a SRC was less than the GSSL, the SRC was excluded from further consideration as a CMCOPC.

For SRCs for which the GSSLs are not available, the RSLs for residential soil protective of groundwater were used to determine if the SRCs qualify as CMCOPCs (EPA, 2015). These RSLs are available at: "http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/xls/ master_sl_table_run_NOVEMBER2015.xls".

If neither the GSSL nor the RSL for residential soil protective of groundwater was available for a chemical, then no further evaluation of the chemical was performed.

The results of the initial CMCOPC screen (presented in Table E-1 in **Appendix E**) for surface soils eliminated 2 inorganics (beryllium and zinc), 17 SVOCs (bis(2-ethylhexyl)phthalate, anthracene, 1,2,4-trichlorobenzene, pyrene, 5-13 ldrin 5-13 furan, benzo(g,h,i)perylene, fluoranthene, benzo(k)fluoranthene, chrysene, benzoic acid, acenaphthene, diethyl phthalate, di-n-butyl phthalate, fluorine, naphthalene, 2-methylnaphthalene, and 1,2-dichlorobenzene), and 5 pesticides (4,4'-DDT, methoxychlor, 4,4'-DDD, 4,4'-DDE, and heptachlor) from further consideration.

The results of the initial CMCOPC screen (presented in Table E-2 in **Appendix E**) for subsurface soils eliminated 1 explosive (m-nitrotoluene), 1 inorganic (vanadium), 13 SVOCs (1,4-dichlorobenzene, bis(2-Ethylhexyl)phthalate, anthracene, pyrene, fluoranthene, chrysene, benzoic acid, acenaphthene, di-n-butyl phthalate, fluorene, naphthalene, 2-methylnaphthalene, and 1,2-dichlorobenzene), 3 VOCs (ethylbenzene, toluene, and total xylenes), 10 pesticides (4,4'-DDT, 4,4'-DDE, 5-13 ldrin, delta-BHC, Endosulfan II, Endrin aldehyde, gamma chlordane, heptachlor, heptachlor epoxide, and methoxychlor), and 1 PCB constituent (Arochlor-1254) from further consideration.

5.8.2 Refinement of Initial CMCOPCs

The third step of the screening process involves comparing the MDC of a SRC with the SSSLs. As mentioned previously, the SSSL is defined as the GSSL multiplied by the site-specific DAF. The DAF, which is defined as the ratio of soil leachate concentration to receptor point concentration, is minimally equal to 1. In the derivation of the GSSLs (a DAF of 1), direct partitioning is used, assuming groundwater is in contact with the analytes in soil and the groundwater concentration is assumed to be equal to the leachate concentration. However, as soil leachate moves through soil, contaminant concentrations are attenuated by adsorption and degradation. When the leachate reaches the water table, dilution by groundwater further

reduces leachate concentrations. This reduction in concentration can be expressed by a DAF that is greater than 1.

The DAF for the Sand Creek Site was calculated using the site data to the extent possible and assumed or literature values where site-specific data related to the hydrogeologic properties were not available. The *Soil Screening Guidance* (EPA, 1996a), protocol was used to calculated the DAF. The following equations were used:

$$DAF = 1 + \frac{(Kid)}{IL}$$

where:

DAF is the Dilution Attenuation Factor

K is the aquifer hydraulic conductivity (meters per year [m/yr])

i is the horizontal hydraulic gradient (meters per meter)

I is the infiltration rate (m/yr)

L is the source length parallel to groundwater flow (m)

d is the mixing zone depth (m) (see equation below)

$$d = \sqrt{0.012\ L^2} + d_a \left\{1 - \exp\left(\frac{-Li}{Kid_a}\right)\right\}$$

where:

d_a is aquifer thickness (m)

$d \leq d_a$

If the aquifer thickness is less than the calculated mixing zone depth, then the aquifer thickness is used for "d" in the DAF calculation.

A site-specific DAF of 1.08 was calculated for the Sand Creek Site based on the aforementioned assumptions and reference literature. The DAF calculation is presented in Table E-3 in **Appendix E**. The results of the DAF evaluation are presented in Table E-4 for surface soils and in Table E-5 for subsurface soils (**Appendix E**). Based on this screening, only those constituents that exceeded their published GSSL or calculated SSSL (GSSL multiplied by the DAF) were identified as the initial CMCOPCs, based on leaching to groundwater. The only SRC eliminated as a CMCOPC as a result of screening against DAF based SSSLs was lead in surface soils. No additional SRCs were eliminated during the SSSL screening at the Sand Creek Site. These refined CMCOPCs, presented in Tables E-4 and E-5

(**Appendix E**), include explosives, inorganic compounds, SVOCs, and pesticides. Only one VOC compound, benzene in subsurface soil, was identified as a CMCOPC.

5.8.3 Limitations and Assumptions of Soil Screening Analysis

It is important to note a limitation of the soil leachability analysis approach utilized above. The GSSLs and RSLs for residential soil protective of groundwater used in this screening are based on a number of default assumptions chosen by EPA to be protective of human health for most site conditions. The GSSLs and RSLs are expected to be more conservative than SSSLs developed based on site conditions which could be conducted if site-specific data were available. The conservative assumptions included in this analysis are as follows:

- Uniform distribution of contamination throughout the source area at concentration equal to the MDC
- No adsorption in the unsaturated soil or in the groundwater to retard the contaminated migration
- No biological degradation or transformation in the soil or in the groundwater

5.9 Fate and Transport Modeling

The conceptual model for the Sand Creek Site presented in Section 5.3 served as the basis for the numerical fate and transport modeling performed at the AOC.

A two-step modeling approach was utilized as follows:

- Screening the refined CMCOPCs (Section 5.6.1.2, Tables E-4 and E-5 [**Appendix E**]) with a travel time leaching analysis over duration 1,000 years
- Evaluating CMCOPCs that remain after the travel time screening using numerical fate and transport models to develop final CMCOPCs

Details of the two-step approaches are presented in the following subsections:

5.9.1 Travel Time Analysis

This step of the screening process involves comparing the MDCs of the refined CMCOPCs identified in the SSSL screen with a travel time evaluation. A travel time simulation for a contaminant was performed over a 1,000-year period. The time period of 1,000 years was selected assuming the time to be sufficient for the potential migration of the contaminant to the receptor locations and considering the high uncertainty associated with predicting conditions beyond that time frame. Therefore, the refined CMCOPCs at the selected sources were screened against a travel time of greater than 1,000 years. The travel time is the time required by a contaminant to travel from the base of its contamination source to the water table.

The estimated travel time for each initial CMCOPC to reach the water table is determined using the following equations:

$$T_r = \frac{T_h R_f}{V_p}$$

where:

T_r is the leachate travel time (years)

T_h is the thickness of the leaching zone, the vertical separation between soil source and water table (feet)

R_f is the Retardation Factor (unit less) described in Section 5.2.1.2

V_p is the pore water velocity (feet per year [ft/yr])

and

$$V_p = \frac{I}{\theta_w}$$

where:

I is the infiltration rate (ft/yr)

θ_w is the water filled soil porosity (unit less)

Table 5-2 presents the input parameters used in the travel time analysis.

Travel times for each of the refined CMCOPCs are presented in Table E-6 (surface soils) and Table E-7 (subsurface soils) of **Appendix E**. If the travel time for refined CMCOPCs from a source area exceeded 1,000 years, then the constituent was eliminated from the list of CMCOPCs. Initial CMCOPCs with travel times less than 1,000 years are considered to be CMCOPCs and are retained for further analysis. This screening evaluation eliminated seven inorganics, five SVOCs, and five pesticides from further consideration in the surface soil. It also eliminated 12 inorganics, 8 SVOCs, and 10 pesticides from further consideration in the subsurface soil. The constituents selected for further consideration and numerical modeling are listed below:

- Explosives and Propellants
  - 2,4,6-Trinitrotoluene
  - 2-Amino-4,6-Dinitrotoluene
  - Nitroguanidine

- Inorganics
  - Cadmium
  - Mercury
- SVOCs
  - Dibenzofuran
  - 1,4 Dichlorobenzene
  - Carbazole
  - Pentachlorophenol
- VOCs
  - Benzene
- Pesticides
  - Alpha-BHC
  - Beta-BHC
  - Lindane

Table E-8 in **Appendix E** lists the physical and chemical properties of these selected constituents.

5.9.2 SESOIL Modeling

Seasonal Soil Compartment (SESOIL) modeling (Waterloo Hydrogeologic, Inc., 2004) was performed for constituents identified as CMCOPCs after screening against the 1,000-year travel time criteria presented in Section 5.7.1. Modeling was performed to predict concentrations of constituents in the leachate immediately beneath the selected source areas, just above the water table. If the predicted groundwater concentration derived from the leachate concentration of a CMCOPC exceeded its MCL or RSL, then the CMCOPC was retained as a final CMCOPC. The CMCOPC was not evaluated further using groundwater flow and transport models (i.e., the Analytical Transient 1-,2-,3-Dimensional (AT123D) model or the BIOSCREEN model) to predict the groundwater concentrations at designated receptor locations because groundwater at the site has not been investigated and input data for groundwater modeling are not available. The receptor location identified for the source areas is the Sand Creek at its closest point downgradient of the source areas.

The SESOIL model defines the soil compartment as a soil column extending from the ground surface through the unsaturated zone and to the upper level of the saturated zone. Processes

simulated in SESOIL are categorized in three cycles: the hydrologic cycle, the sedimentation cycle, and the pollutant cycle. Each cycle is a separate submodule in the SESOIL code. The hydrologic cycle includes rainfall, R, infiltration, soil-water content, ET, and groundwater recharge. The pollutant cycle includes convective transport, volatilization, adsorption/desorption, and degradation/decay. A contaminant in SESOIL can partition in up to four phases (liquid, adsorbed, air, and pure).

Data requirements for SESOIL are not extensive and utilize a minimum of site-specific soil and chemical parameters and monthly or seasonal meteorological values as input. Output of the SESOIL model includes pollutant concentrations at various soil depths and pollutant loss from the unsaturated soil zone in terms of R, percolation to groundwater, volatilization, and degradation. The mathematical representations in SESOIL generally consider the rate at which the modeled processes occur, the interaction of different processes with each other, and the initial conditions of both the waste area and the surrounding subsurface matrix material.

The input data for SESOIL can be grouped into four types: climatic data, chemical data, soil data, and application data. There are a total of 61 separate parameters contained in these four data groups. Wherever possible, site-specific parameter values were used for the modeling. Certain parameters, however, were not available for all of the source areas, and were estimated based on pertinent scientific literature, geochemical investigations, and checks for consistency between model results and historical data. Conservative estimates were used when a range of values was indicated, or parameter values were not available.

5.9.2.1 Climate Data

The climatic data file of SESOIL consists of an array of mean monthly temperature, mean monthly cloud cover fraction, average monthly relative humidity, average monthly shortwave albedo, average daily ET, monthly P, mean number of storm events per month, mean duration of rainfall, and mean length of rainy season. The climatic data for the Sand Creek Site are presented in Table E-9 in **Appendix E**. These data were taken from the Youngstown Weather Service Office, Airport Station, Ohio, as it was determined to be nearest weather station to the former RVAAP.

5.9.2.2 Chemical Data

The pollutant fate cycle of SESOIL focuses on the various chemical transport and transformation processes that may occur in the soil zone. These processes include volatilization/diffusion, adsorption/desorption, cation exchange, biodegradation and hydrolysis, and metal complexation. The chemical-specific parameters are presented in Table E-10 in **Appendix E**.

Parameters such as S, air diffusivity, HLC, the distribution coefficients (K_{ds}) for inorganic chemicals and organic carbon-based K_{ocs} for organic compounds were obtained from the following sources:

- EPA, 1996b. Soil Screening Guidance: Technical Background Document, EPA Document Number: EPA/540/R-95/128, July.
- Baes, C.F. and R.D. Sharp, 1983. *A Proposal for Estimation of Soil Leaching Constants for Use in Assessment Models, Journal of Environmental Quality*, 12: 17–28.
- EPA, 2011. RSL Chemical-Specific Parameters Supporting Table, EPA Region 9, November.

For compounds that are subject to biodegradation and transformation, the most conservative degradation rates found in the literature (Howard et al., 1991) were used.

5.9.2.3 Soil Data

The soil data input parameters describing the physical characteristics of the soil are presented in **Table 5-3**. Site-specific data were used, if available; otherwise, SESOIL default values or data collected by SAIC as part of the former RVAAP Building 1200 geotechnical analysis (SAIC, 2011) were used.

5.9.3.4 Source Terms

Analytical data from surface and subsurface soil collected from the Sand Creek Site were used as the source term for SESOIL modeling. Samples at different depth intervals were compiled to provide a detailed loading option for the SESOIL model. The MDCs from the surface soil and subsurface soil overlying the water table were used as source term concentrations.

5.9.2.5 Application Data

The model was arranged in four layers. The first layer is equivalent to the surface soil (0 to 1 foot), with the other three layers corresponding to the subsurface soil sampling increments (1 to 5 feet, 5 to 9 feet, and 9 to 13 feet bgs) which are above the water table. Contamination loading was in one or more of layers 1, 2, and 3. Details of the model layers utilized in this modeling are presented in Table E-10 in **Appendix E**.

5.9.2.6 SESOIL Modeling Results

SESOIL modeling was performed for CMCOPCs 2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, nitroguanidine, cadmium, mercury, dibenzofuran, 1,4 dichlorobenzene, carbazole, pentachlorophenol, benzene, alpha-BHC, beta-BHC, and lindane. These CMCOPCs have the potential to reach the water table within 1,000 years based on the

screening analysis results (Tables E-7 and E-8 in **Appendix E**). **Table 5-4** presents the SESOIL predicted peak leachate concentrations beneath source areas and the corresponding time for peak leachate concentrations. The variation of leachate concentrations over time is presented graphically in **Appendix E**. The MDCs for groundwater were calculated using a DAF of 1.08 as described in Section 5.6.1.2. The MCL or the residential tap water RSL for the CMCOPCs are also shown in this table for comparison purposes. For determining if a CMCOPC would qualify as a final CMCOPC, the predicted groundwater MDC was compared to the MCL. If MCL was not available, then the residential tap water RSL value was used. The residential tap water RSL values are available at "http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/xls/restap _sl_table_run_NOVEMBER2015.xls".

Table 5-4 shows that 2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 1,4-dichlorobenzene, carbazole, pentachlorophenol, benzene, alpha-BHC, and beta-BHC are predicted to exceed MCLs or RBCs; therefore, these eight constituents were selected as the final CMCOPCs.

5.10 Uncertainties Analysis

Throughout the screening and modeling processes, a conservative approach was used to provide a moderate and cautious evaluation which may overestimate the contaminant concentration in the leachate for migration from observed soil concentrations. The important assumptions used in the fate and transport analysis and the related limitations of the analysis are as follows:

- The equations used to determine soil adsorption and contaminant retardation are based on the assumption that an equilibrium relationship exists between the solid- and solution-phase concentrations and that the relationship is linear and reversible.
- A number of literature values were used in the analysis. These values depend upon the properties of the impacted media and vary from site to site (i.e. organic carbon content, K, and soil-moisture content). The use of literature values is an approximation that may not represent the site conditions.
- This modeling used current soil concentration data collected during the RI field activities. These samples were collected years after historical operations were terminated and following an RA performed in 2003. The modeling does not account for constituents that have already leached to groundwater.
- Groundwater flow and solute transport are not affected by density variations.
- The MDC values were used as the source term concentrations for SESOIL model instead of more realistic average values.

- The water budget represents an overall average rainwater recharge and assumes an even distribution of infiltration in the modeled area. An average water budget assumes some areas will have higher or lower recharge based on the heterogeneity of the soil and varying topography.
- The effects of porous media heterogeneity and anisotropy are not addressed in these simulations.
- The effects of seasonal fluctuations in the depth to water and changes in flow directions and gradients were not considered.
- Groundwater at the site has not been investigated. The hydrogeologic parameters are either assumed values or literature values for comparable lithologies.
- The biodegradation rate constants for organic constituents are literature based values that may deviate from actual biodegradation rates at the site. Generally, higher biodegradation rates will produce lower concentrations.

5.11 Summary of Fate and Transport

Surface soil, subsurface soil, and sediment from the RI field activities and surface water samples from the 2003 RA and the 2003 FWBWQS were used to evaluate fate and transport of chemicals identified as SRCs at the Sand Creek Site. Groundwater evaluation beneath the Sand Creek Site was excluded from Shaw's scope of work for the Phase RI since it is performed on a facility-wide basis. The data identified explosive- and propellant-related compounds, inorganics, VOCs, SVOCs, PCBs, and pesticides as SRCs. The SRCs found in the surface soil and subsurface soil samples were used as the primary contamination sources in the fate and transport assessment to determine the potential for the SRCs to migrate vertically downwards and impact groundwater quality underneath the AOC and eventually the surface water quality in the nearby Sand Creek. The SRCs detected in the sediments and surface water may originate from these soil sources or may result from upstream contaminant sources. Further evaluation of groundwater at the AOC will be required to provide an accurate assessment if it has been impacted by the SRCs identified in surface and subsurface soil during the RI.

Fate and transport analysis indicates that some of these SRCs may leach from soil into the groundwater beneath the source. A soil leachability analysis was conducted to determine which of the SRCs found in surface soil and subsurface soils have the potential to leach to groundwater and eventually the Sand Creek when groundwater discharges to Sand Creek. A multistep approach was utilized that included the following:

- Identifying SRCs

- Comparing the MDCs of SRCs with GSSLs to develop initial CMCOPCs
- Comparing the MDCs of initial CMCOPCs with DAF-based SSSLs to refine the initial CMCOPCs

The refined list of CMCOPCs was used for the numerical fate and transport modeling performed for the Sand Creek Site. A two-step modeling approach was utilized as follows:

- Screening the refined CMCOPCs with a travel time leaching analysis
- Evaluating CMCOPCs that remain after the travel time screening using SESOIL to develop final CMCOCs

The final list of CMCOPCs that have the potential for impacting groundwater and surface water includes the following:

- Two explosives (2,4,6-trinitrotoluene and 2-amino-4,6-dinitrotoluene)
- Three SVOCs (1,4-dichlorobenzene, carbazole, and pentachlorophenol)
- One VOC (benzene)
- Two pesticides (alpha-BHC and beta-BHC)

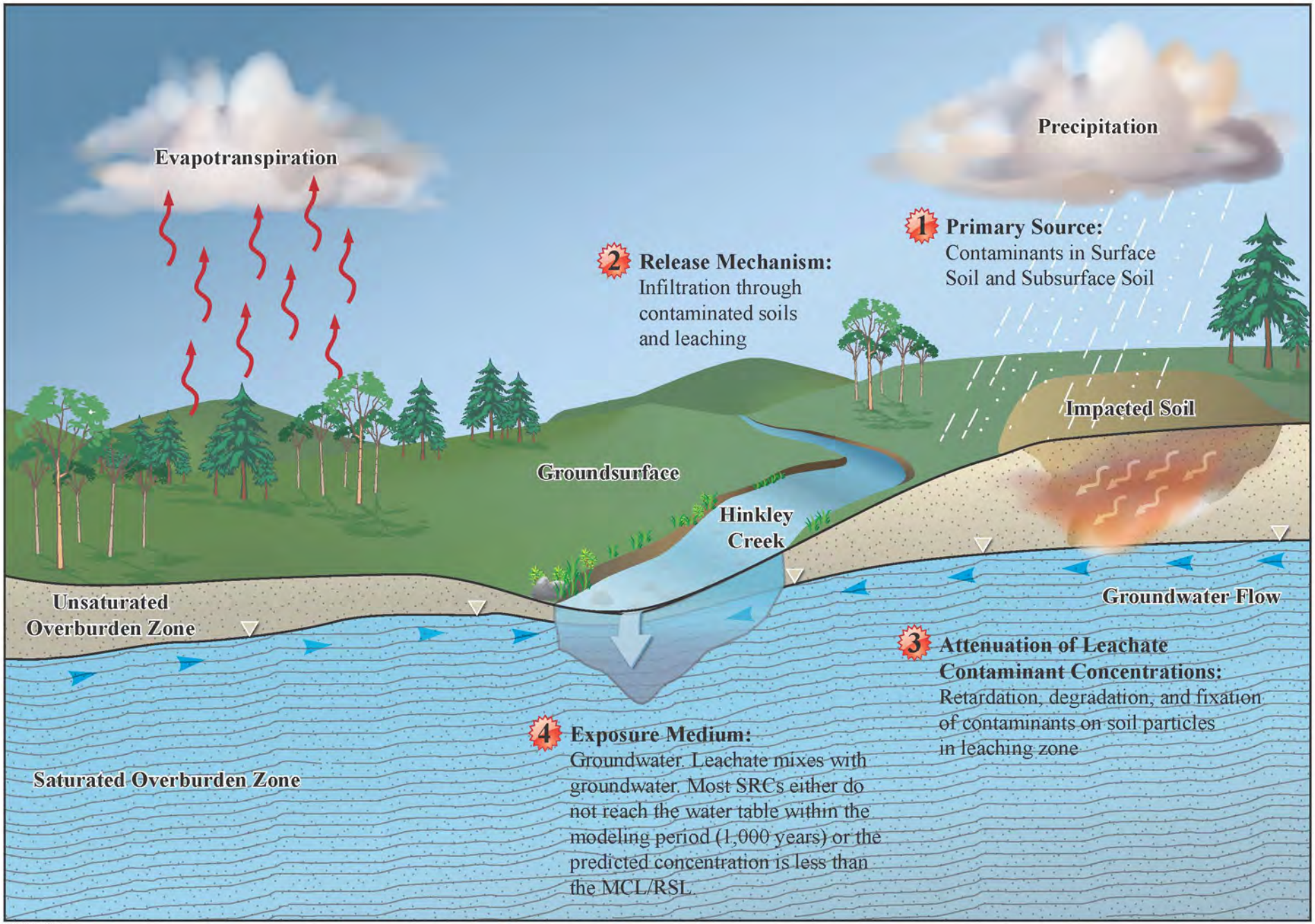

Figure 5-1. Contaminant Migration Conceptual Model

Table 5-1. Lithology, interval depths, and depth measured to ground water in soil borings.

Boring ID	Boring Date	Lithology Description	Interval Depth (feet bgs)	Depth to Water (feet bgs)[1]
SCsb-035	9/22/2010	sand and gravel	0–4	
		sand, slag, fill	4–8	
		sands with silt	8–18.5	13
		dense silty clay, clay	18.5–20	
SCsb-036	9/22/2010	sandy fill	0–4	
		sand	4–13	13
		dense silty clay, clay	13–20	
SCsb-037	9/22/2010	sandy fill	0–8	
		sand	8–17	13
		dense silty clay	17–19	
		sand	19–20	
SCsb-038	9/22/2010	sand	0–13	Dry
		dense silty clay, clay	13–20	
SCsb-039	9/21/2010	sand, silty sand, silt	0–17	Dry
		dense silty clay	17–19	
SCsb-040	9/21/2010	sand, silty sand, silt	0–17	Dry
		dense silty clay	17–19	
SCsb-041	9/21/2010	sand, silty sand, silt	0–17	Dry
		dense silty clay	17–19	
SCsb-042	9/21/2010	sand	0–9.5	
		silty clay	9.5–17	Dry
		silt, dry	17–20	
SCsb-043	9/21/2010	sand, silt	0–16	Moist but not saturated
		dense clay	16–20	

Note:

[1]*Depth to water is based on observations of saturated soil in the drill cores and were not measured. No wells were installed at any of the boring locations.*

bgs denotes below ground surface.

ID denotes identification.

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Table 5-2. Input parameters used in Travel Time Analysis for refinement of CMCOPCs.

Parameter	Symbol	Value	Units	Notes
Infiltration rate	I	0.31	ft/yr	10 percent of annual precipitation from Youngstown WSO AP, Ohio weather station
Soil-water distribution coefficient	K_d	SRC-specific	L/kg	See **Appendix E**, Tables E-6 and E-7
Organic carbon distribution coefficient	K_{oc}	SRC-specific	L/kg	See **Appendix E**, Tables E-6 and E-7
Fraction organic carbon—Surface soil	F_{oc}	0.0026	unit less	Assumed value, based on data from Ramsdell Quarry Landfill (SAIC, 2005)
Fraction organic carbon—Subsurface soil	F_{oc}	0.0012	unit less	Assumed value, based on data from Building 1200 (SAIC, 2011)
Water filled soil porosity—Surface soil	θ_w	0.30	unit less	Assumed value, based on lithology type
Bulk density (dry)—Surface soil	ρ_b	1.8		Assumed value, based on data from Ramsdell Quarry Landfill (SAIC, 2005)
Water filled soil porosity—Subsurface soil	θ_w	0.367	unit less	Assumed value, based on lithology type
Bulk density (dry)—Subsurface soil	ρ_b	1.63		Assumed value, based on data from Building 1200 (SAIC, 2011)
Thickness of leaching zone	T_h	Variable	feet	See **Appendix E**, Tables E-6 and E-7
Retardation Factor	R_f	SRC-specific	unit less	Calculated in Tables E-6 and E-7 (**Appendix E**) using equation in Section 5.2.1.2
Contaminant arrival time	T_r	SRC-specific	year	Calculated in Tables E-6 and E-7 (**Appendix E**) using equations above

CMCOPCs denotes contaminant migration chemical of potential concern.

ft/yr denotes feet per year.

L/kg denotes liters per kilogram.

SAIC denotes Science Applications International Corporation.

SRC denotes site-related contaminant.

Table 5-3. Input data used in SESOIL Model for soil properties.

Parameter	Symbol	Value	Units	Notes
Infiltration rate (Recharge Rate)	q	0.09	m/yr	10 percent of annual precipitation from Youngstown WSO AP, Ohio weather station
Intrinsic Permeability	K	1×10^{-9}	cm^2	Estimated value based on lithology
Application Area	Ap	4.05E+0	cm^2	Model calculated value
Disconnectedness Index	c	3.7	Unit less	Model calculated value
Fraction organic carbon	foc	0.0012	unit less	Assumed value, based on comparable data from Building 1200 geotechnical sample (SAIC, 2011)
Water filled soil porosity	θ_w	0.367	unit less	Assumed value, based on lithology type
Freundlich Equation Exponent	n	0.5	unit less	Model calculated value
Effective porosity	θ_e	0.30	unit less	Assumed value, based on lithology type
Bulk density (dry)—Subsurface soil	ρ_b	1.63	kg/L	Assumed value, based on data from Building 1200 (SAIC, 2011)
Thickness of leaching zone	T_h	Variable	feet	See **Appendix E**, Table E-10
Vadose Zone Thickness	Vz	13	feet	From remedial investigation boring logs (**Appendix A**)

cm^2 denotes square centimeters.

kg/L denotes kilograms per liter.

m/yr denotes meters per year.

SAIC denotes Science Applications International Corporation.

SESOIL denotes Seasonal Soil Compartment.

Table 5-4. The CMCOPCs identified from the SESOIL Model.

CMCOPC Based on Travel Time <1,000 years	Maximum Leachate Concentration (mg/L)	Time (days)	Maximum Groundwater Concentration (mg/L)	Time (Years)	MCL/RSL (mg/L)	Final CMCOPC?
Explosives						
2,4,6-Trinitrotoluene	0.25	12,410	0.23	34	0.018	Yes
2-Amino-4,6-Dinitrotoluene	0.43	1,825	0.40	5	0.073	Yes
Nitroguanidine	0.52	730	0.48	2	3.7	No
Inorganics						
Cadmium	0.00	NA	0.00	NA	0.005	No
Mercury	0.00	NA	0.00	NA	0.002	No
Semivolatile Organic Compounds						
Dibenzofuran	0.00	NA	0.00	NA	NA	No
1,4 Dichlorobenzene	0.084	2,922	0.078	8	0.075	Yes
Carbazole	0.55	14,610	0.51	40	0.003	Yes
Volatile Organic Compounds						
Pentachlorophenol	0.19	21,185	0.18	58	0.001	Yes
Benzene	0.10	1,095	0.09	3	0.005	Yes
Pesticides						
Alpha-BHC	0.00963	5,844	0.00892	16	0.000011	Yes
Beta-BHC	0.000041	15,341	0.000038	42	0.000037	Yes
Lindane	0.0000	NA	0.00	NA	0.0002	No

Table 5-4. CMCOPCs Identified from the SESOIL Model (continued).

The final CMCOPC was identified comparing predicted maximum leachate concentration to MCL/RBC. A constituent is a CMCOPC if its predicted leachate concentration exceeds its MCL/RBC within 1,000 years.

CMCOPC denotes contaminant migration chemical of potential concern.

MCL denotes Maximum Contaminant Level.

mg/L denotes milligrams per liter.

NA denotes not applicable.

RSL denotes residential tap water Regional Screening Level (EPA, 2010).

SESOIL denotes Seasonal Soil Compartment.

6.0 HUMAN HEALTH RISK ASSESSMENT

The purpose of this HHRA is to document whether concentrations of chemicals remaining on the AOC may pose a risk to current or future site receptors, and to identify if any site conditions need to be addressed in an FS. This human health risk assessment has been revised and updated per requirements in the Risk Assessment Technical Memo (NGB, 2014) to include the evaluation of three Land Uses. This risk assessment follows the streamlined approach to risk decision-making, as described in the FWCUG Report (SAIC, 2010). The FWCUGs are used in the evaluation process for the Residential Receptor (Unrestricted (Residential) Land Use) and the NGT Receptor (Military Training Land Use). These values are used since the initial screening was completed and finalized prior to the completion of the Risk Assessment Tech Memo. The USEPA's November 2015 RSLs for the Commercial Industrial Land Use are used for the Industrial Receptor. The Risk Assessment Technical Memo states that the Residential RSL should be used for a chemical lacking a FWCUG and that the Industrial RSL can be used for any chemical that lacks a FWCUG for the NGT. The Risk Assessment Technical Memo identifies two Land Uses that should be evaluated in the RI if the Unrestricted (Residential) Land Use is not obtained. These two Land Uses: Commercial/Industrial Land and the Military Training Land Use, are included in this RI since it was not known if the Unrestricted (Residential) Land Use would be achieved. The Residential RSLs have been a part of the risk assessment process since the development of the FWCUGs. The use of the RSLs follow the same process as that developed for the FWCUGs.

The *Position Paper for the Application and Use of FWCUGs* (USACE, 2012), describes the use of FWCUGs/RSLs which are used in the streamlined risk assessment in the following steps:

- Identify COPCs for the site by comparing site concentrations to soil background concentrations, eliminating essential nutrients, and comparing site concentrations to FWCUGs and RSLs.
- Identify COCs by comparing site concentrations to specific FWCUGs and RSLs, and using a “sum of ratios” approach to account for cumulative effects from exposure to multiple chemicals. This method sums the ratios of site concentration to the FWCUG and RSL for all COPCs. A sum of ratios greater than one represents an unacceptable risk, and cancer and noncancer effects are considered separately.

More details on this approach and its application at this site are provided in the following sections.

6.1 Data Used in the Human Health Risk Assessment

As described in Section 1.3.1, “Operational History,” the Sand Creek Disposal Road Landfill is located in the eastern portion of the former RVAAP and is a former open dump area (**Figure**

1-2). A C&D type material were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek Site. The Sand Creek Site extends along the embankment of Sand Creek for approximately 1,200 feet, and occupies a total area of approximately 1 acre. The bank slopes from east to west towards the Sand Creek 40 to 60 degrees from horizontal. Prior to the 2003 RA, the site was overgrown with mature trees and ground level vegetation. The RA cleared large areas of vegetation, which were then reseeded with hydroseed and then mulched. The RI field activities included areas adjacent to the top of the slopes and along the floodplain at the bottom of the slopes adjacent to the AOC. The total area investigated for the RI consisted of the 1 acre AOC (approximate) and about an additional acre of land adjacent to the AOC.

Section 1.3.2, "Previous Investigations and Removal Actions," describes the previous activities and investigations conducted at the Sand Creek Site. The inclusion or exclusion of these data in the risk assessment is described below:

- **USACHPPM RRSE (1996)**—The 1996 USACHPPM RRSE Report identified surface soil and sediments to be potential media for contaminant migration at the Sand Creek Site due to the lack of any physical barriers/fence around the site and its proximity to Sand Creek. Three shallow soil samples and one sediment sample were collected from the site during the RRSE; however, the data from this investigation are not available. These samples are considered limited in nature due to the minimal number of samples that were collected across the entire site for the RRSE. A more comprehensive and current soil and sediment sampling program was conducted for the RI, as described in Section 3.0. Based on these considerations, there is negligible impact to the risk assessment by not including the RRSE samples.
- **2003 FWBWQS (USACE, 2005a)**—Two surface water samples and one sediment sample were collected at the intersection of the Sand Creek and the former railroad that transects the site as described in Section 1.3.2.4, "2003 Facility-Wide Biological and Water Quality Study." The surface water samples were collected on different collection dates during the summer. The collection of the aforementioned data provided (1) aquatic life use attainment status of streams regarding the Warm Water Habitat or other applicable aquatic life use designation codified in the OWQS, (2) an assessment if whether chemical contamination within the streams is adversely affecting the biological communities, and (3) an ecological assessment report summarizing the sediment, surface water, and aquatic biological results. The sediment data from this report were not used in this RI since more recent ISM sediment data (2010) are available for the site and are described in Section 3.3, "Sediment Characterization." Additionally, the nutrients detected in the sediment

sample from this event (phosphorus and nitrate/nitrite) are not typically used to evaluate human health risks and is provided in this assessment for informational purposes only. The surface water data from the 2003 sampling event are used in this evaluation and will be used in conjunction with the surface water data from the 2003 RA to support the DQO Report (Shaw, 2009) assessment that the Sand Creek has not been impacted by previous site activities.

- **2003 RA (MKM, 2004)**—Confirmatory soil, surface water, and sediment samples were collected in and around the site by MKM following the 2003 RA, as described in Section 1.3.2.6, "2003 Removal Action Sample Collection." Thirty soil samples were collected from the base of the excavation at a depth of 1 foot. Surface water was collected at 3 locations and sediment samples were collected at 12 locations within the Sand Creek and neighboring floodplains, respectively, to characterize potential impact associated with surface water runoff from the site. Surface soil and sediment data from this report were not used in this RI, since more recent data (2010) for surface soil and sediment are available for the entire area of the site as discussed in Section 3.2, "Surface Soil Characterization" and Section 3.3, "Sediment Characterization," respectively. The surface water data from the 2003 RA are used in this evaluation to support the DQO Report (Shaw, 2009) assessment that the Sand Creek has not been impacted by previous site activities.
- **RI Sampling (Section 3.0)**—Soil sampling was conducted for the RI from the surface and subsurface. Surface soils were collected from the 0- to 1-foot bgs interval using ISM. Subsurface samples were collected at the following intervals: 1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet using a modified ISM sampling approach as directed by USACE in the SOW and presented in the approved SAP Addendum No. 1 (Shaw, 2010). In general, 30 increments of soil were collected from the soil column for each interval to generate a modified ISM sample. Even though these samples consisted of 30 increments that were processed similar to ISM samples collected over a surface soil sampling unit, they are still representative of a depth interval at a distinct location and are therefore, considered as discrete samples and are referenced as such for the purposes of this evaluation.

The samples included in the risk assessment data sets are provided in **Tables 6-1** through **6-6**. Sample lists for soil are included for four depth intervals (0 to 1 foot, 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet) to account for the different intervals used to evaluate receptors, as discussed in Section 6.2.

6.2 Human Receptors and Land Use

The Sand Creek Site is located in the eastern central portion of the facility. The AOC is not currently used for military training activities but may receive periodic foot traffic during maintenance, restoration, and security activities. The most likely future land use for the AOC is the Military Training since it is within the facility's boundary. The Representative Receptor for this Land Use is the NGT per the *USACE's Facility-Wide Human Health Risk Assessment Manual* (HHRAM - USACE, 2005b) and the 2014 Risk Assessment Tech Memo. This anticipated future Land Use, in conjunction with the evaluation of Unrestricted (Residential) Land Use form the basis for identifying chemicals of concern (COCs) in this RI. Unrestricted (Residential) Land Use, specifically the Resident Receptor (Adult and Child) scenario, is included to evaluate COCs for Unrestricted (Residential) Land Use at the AOC as required by the CERCLA process and as outlined in the HHRAM (USACE, 2005b).

A third Land Use was also included in this revised RI. The third Land Use, Commercial Industrial Land Use was identified in the Risk Assessment Tech Memo as a means to evaluate the site to determine if the site is suitable for full-time, permanent occupational exposure by employees. According to the Risk Assessment Tech Memo (NGB, 2014), if the criteria for the Commercial Industrial Land Use is met, then no additional remedial actions are required except for the development of Land Use Controls (non-residential use) through the CERCLA process (FS, PP, ROD, etc.). The Military Training Land Use is the primary Land Use and is protective of all activities that the OHARNG may conduct on the site except for full-time, permanent occupational use. Evaluation of the three Land Uses in the RI will allow better risk management decisions in an FS if needed.

The Sand Creek Site was considered as a single EU based on the future land use. Although the site is being evaluated as a single EU, soil data collected within and adjacent to the AOC were aggregated by depth intervals since different future use receptors with different depths of potential exposure are required to be evaluated. This RI includes analyses to assess potential risks at various depths to assess whether or not the most likely receptor to deep surface soil and subsurface soil, the NGT, would be able to dig and to what depth. The soil intervals for Unrestricted (Residential) Land Use and Commercial Industrial Land Use were also assessed. Sediment samples collected for the RI and previously collected surface water samples were evaluated in the same manner for the identified receptors. The purpose of evaluating the receptors in this manner is to provide information for further evaluation in the FS, if required, as to whether there is a need for restrictions or potential land-use controls based on the future land use. The COPC identification was completed for the following data sets:

- Resident Receptor (Adult and Child)—Surface soil (0–1 foot bgs) (**Table 6-7**)
- Industrial Receptor—Surface soil (0–1 foot bgs) (**Table 6-8**)

- National Guard Trainee —Deep Surface soil (0–4 feet bgs) (**Table 6-9**)
- Resident Receptor (Adult/Child)—Subsurface soil (1–13 feet bgs) (**Table 6-10**)
- Industrial Receptor —Subsurface soil (1–13 feet bgs) (**Table 6-11**)
- National Guard Trainee—Subsurface soil (4–7 feet bgs) (**Table 6-12**)
- Resident Receptor (Adult and Child), Industrial Receptor, and National Guard Trainee—Sediment (**Table 6-13**)
- Resident Receptor (Adult and Child), Industrial Receptor, and National Guard Trainee—Surface water (**Table 6-13**).

The exposure scenarios for RVAAP-specific receptors (Resident Receptor and NGT) are presented in the FWCUG Report (SAIC, 2010). The exposure parameters for the Industrial Receptor (Composite Indoor and Outdoor Worker) can be found on the USEPA's RSL website and are those used to calculate Industrial RSLs. There is no depth or intrusive activity associated with the Industrial Receptor so in this HHRA, they are assumed to be exposed to depths similar to that of the Resident Receptor.

6.3 Selection of COPCs

The section presents the evaluation of site data and the identification of COPCs for the intended receptors based on future land use. The data for this RI Report was evaluated in accordance with the initial evaluation steps presented in the Position Paper (USACE, 2012) to identify SRCs as presented in Section 4.1, "Data Evaluation Method." The evaluation incorporates the same criteria described in Section 4.1.3, "Data Reduction and Screening" to eliminate chemicals that are not SRCs (i.e., infrequently detected chemicals, background comparisons, and essential nutrients). To establish COPCs, all chemicals that had not been eliminated to this point were evaluated using the following steps

- The FWCUGs developed for the Resident Receptor (Adult and Child) and the National Guard Trainee human health receptors and the USEPA's RSLs for the Industrial Receptor for each chemical are used. If there are no FWCUGs developed for a particular chemical, then the Residential RSL is used for the Resident Receptor and the Industrial RSL is used for the NGT (Risk Assessment Tech Memo, 2014). The FWCUGs are currently presented in the FWCUG Report (SAIC, 2010).
- The FWCUGs at the 1×10^{-6} (one in a million) excess cancer risk level and noncarcinogenic risk HQ using the 0.1 risk value for each of the receptors are used.
- A comparison of the selected final FWCUG to the EPC will be completed. The EPC for the identification of COPCs is the MDC.

- The chemical will be retained as a COPC if the EPC exceeds the risk value for that receptor for either one of the 1×10^{-6} excess cancer risk and the noncarcinogenic HQ using the 0.1 risk value. The Industrial RSL is used similarly for the Industrial Receptor to determine COPCs, using the same risk levels.

Screening the FWCUGs for the Resident Receptor (Adult and Child) and the NGT and the RSLs for the Industrial Receptor against the MDC, is used to determine COPCs. The screening values used to evaluate for the identified human receptors are presented in the data summary tables in **Appendix D.**

Tables 6-7 and **6-14** present the screening results for COPCs for the Resident Receptor (Adult and Child), Industrial Receptor, and the National Guard Trainee in accordance with the process outlined in the FWCUG Report (SAIC, 2010) and the USACE Position Paper (2012). For the Unrestricted (Residential) Land Use screening tables, both the adult and child final FWCUGs are shown for the relevant depth interval and media. The values shown are the most stringent of the carcinogenic and noncarcinogenic FWCUGs taken from the FWCUG Report (SAIC, 2010). As directed by the Position Paper (USACE, 2012), the carcinogenic FWCUG to be used is at the 1×10^{-6} (one in a million) excess cancer risk and the noncarcinogenic FWCUG is based on a HQ of 0.1. If a chemical was detected for which there was no FWCUG, the USEPA RSL (EPA, 2015) was used. These values are only shown in the tables if there are no FWCUGs available for the Resident Receptor. The RSLs are based on the lower of values derived considering a cancer risk of 1×10^{-6} and noncancer hazard considering a HQ of 1. As a result, RSLs derived based on noncancer risk were adjusted to a HQ of 0.1 in order to be consistent with the noncancer final FWCUGs. The RSL for lead, however, was not adjusted in this manner, since it was not derived using the hazard index (HI) approach. The RSL for lead in soil is based on the value recommended by USEPA as generally safe for residential settings.

In some cases, the FWCUGs or RSLs were not available for the SRC, and values for a closely related compound are used. All such substitutions are noted in the tables. They are discussed further in the "Uncertainty Analysis" section of this HHRA.

For SRCs in surface water where no FWCUGs were available, the RSLs for tap water were used for evaluation of COPCs (EPA, 2015). In the case of lead, there is no RSL for tap water. Instead, the EPA drinking water action limit of 15 µg/L was used for screening surface water concentrations (EPA, 2012).

For SRCs in sediment, the NGT FWCUGs were used for the Industrial Receptor since there are no Industrial RSLs for sediment. This approach is overly conservative but provides an idea of potential chemicals that could pose risks.

In summary, the COPCs are identified by comparing the MDC to the applicable screening criteria. Substances that are considered SRCs as identified in Section 4.0, and for which the MDC is greater than the respective FWCUG, or the RSL (if no FWCUGs are available for the Resident Receptor or NGT; or the Industrial RSL for the Industrial Receptor), are considered COPCs. A summary of the COPCs identified for the Residential and National Guard Land Use receptors and depth intervals is presented in **Table 6-15**.

This is a very conservative approach for this AOC since there were so many ISM surface samples taken and numerous soil borings (also called vertical ISM samples). Generally, each ISM should be treated separately. Using the MDC is conservative but assures that all possible COPCs are identified for the soil samples.

Another factor affecting the data and distribution of the COPCs for the Military Training Land Use evaluation is the depth of the data. Ideally, data use dot estimate the COPCs for the NGT in the deep surface soil is generated from samples for the entire interval (0-to 4 foot) rather than form ISM sample results 0-to 1 foot and discrete samples from 1-to 5 feet. This conservative approach likely overestimates the actual exposure for this receptor. Potential impacts from this overestimate and other effects are discussed later in this risk assessment.

6.3.1 COPCs in Surface Soil and Deep Surface Soil

Surface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 0- to 1-foot interval.

- The COPCs identified for the Unrestricted (Residential) Land Use receptors in surface soil are antimony, arsenic, cadmium, copper, mercury, silver, thallium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and ideno(1,2,3-cd) pyrene. These chemicals are highlighted in **Table 6-7**, which also lists all the SRCs. All SRCs were screened. Rationale for the determination of COPCs is provided in in **Table 6-7**.

- The COPCs identified for the Commercial Industrial Land Use receptors in surface soil are arsenic, thallium, and benzo(a)pyrene. These chemicals are highlighted in **Table 6-8**, which also lists all the SRCs. All SRCs were screened. Rationale for the determination of COPCs is provided in in **Table 6-8.**

Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. Samples from this interval include the ISM surface soil samples from 0 to 1 foot and the subsurface samples from the 1- to 5-foot interval.

- The COPCs identified for this interval and NGT Receptor are arsenic, barium, cadmium, cobalt, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h) anthracene. These chemicals are highlighted in **Table 6-9**, which also lists all the SRCs. All SRCs were screened. Rationale for the determination of COPCs is provided in **Table 6-9**.

A summary of results for the screening process used to evaluate for COPCs in surface soil for the Resident Receptor, Industrial Receptor, and deep surface soils for the National Guard is presented in **Table 6-15**.

6.3.2 COPCs in Subsurface Soil

Subsurface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 1- to 13-foot interval. Samples from this interval include the subsurface samples from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet.

- The COPCs identified for the Unrestricted (Residential) Land Use receptors identified in subsurface soils based on the MDC are antimony, arsenic, copper, lead, thallium, vanadium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene. These chemicals are highlighted in **Table 6-10**, which also lists all the SRCs. All SRCs were screened. Rationale for the determination of COPCs is provided in **Table 6-10**.

- The COPCs identified for the Commercial Industrial Land Use in subsurface soil are arsenic, lead, thallium, benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene. These chemicals are highlighted in **Table 6-11**, which also lists all the SRCs. All SRCs were screened. Rationale for the determination of COPCs is provided in **Table 6-11**.

Subsurface soil for the National Guard Trainee is defined as the 4- to 7-foot interval. Samples from the 4- to 7-foot interval include the subsurface samples from 5 to 9 feet since the sample intervals overlap.

- Arsenic was the only COPC identified for this interval for Commercial Industrial Land Use. All SRCs were screened. Rationale for the determination of COPCs is provided in **Table 6-12**.

A summary of results for the screening process used to evaluate for COPCs in subsurface soil for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use is presented in **Table 6-15**.

6.3.3 COPCs in Sediment

The COPCs identified in sediment for the Unrestricted (Residential) Land Use are antimony, silver, thallium, and benzo(a)pyrene. Only benzo(a)pyrene was identified as a COPC in sediment for the Commercial Industrial and the Military Training Land Use. Sediment is not considered an exposure medium for the Industrial Receptor. Therefore, no Industrial RSLs were developed for this receptor. For this risk assessment, it was assumed that an Industrial Receptor would be exposed similarly as the NGT receptor. The FWCUGs for the NGT were used to determine COPCs in the sediment for the Commercial Industrial Land Use.

A summary of results for the screening process used to evaluate for COPCs in sediment is provided in **Table 6-13** for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors. A summary of the COPCs identified for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use Receptors in sediment is presented in **Table 6-15**.

6.3.4 COPCs in Surface Water

Arsenic is the only COPC identified in surface water for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors. Surface water is not considered an exposure medium for the Industrial Receptor. Therefore, no Industrial RSLs were developed for this receptor for surface water. For this risk assessment, it was assumed that an Industrial Receptor would be exposed similarly as the NGT receptor. The FWCUGs for the NGT were used to determine COPCs in the surface water for the Commercial Industrial Land Use.

A summary of results for the screening process used to evaluate for COPCs in surface water is provided in **Table 6-14** for all three Land Uses. A summary of the COPCs identified for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors in surface water is presented in **Table 6-15**.

6.4 Selection of COCs

6.4.1 Process

This section presents the COC evaluation process for the human health risk receptors. The COCs are identified through additional screening of the COPCs identified in Section 6.3 and summarized per media for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors in **Table 6-15**. The determination of COCs for the AOC was conducted in accordance with the Position Paper (USACE, 2012) as follows:

- The FWCUG values for the Residential Receptors and the NGT for the Military Training Land Use as well as the Industrial Receptor's RSLs (Commercial Industrial

Land Use) were selected using the 1×10^{-5} (one in one hundred thousand) excess cancer risk and noncarcinogenic risk value at an HQ of 1.

- All carcinogenic and noncarcinogenic risk values for all receptors and all critical effect and target organs for each of the noncarcinogenic risk values are reported.
- A comparison of the FWCUG to the EPC was conducted. The EPC was either the ISM result for RI ISM sampling, or the 95-percent upper confidence limit (UCL) of the mean or the MDC for discrete samples. If the 95-percent UCL could not be calculated, the MDC was used as the EPC.
- For carcinogens and noncarcinogens, the EPCs were compared to the target risk FWCUG using the sum of ratios method presented in the Position Paper (USACE, 2012).
- The chemical was retained as a COC for Unrestricted Land Use if (1) the EPC exceeds the Resident Receptor for either one of the 1×10^{-5} (one in one hundred thousand) excess cancer risk and the noncarcinogenic risk value termed HQ using the 1.0 risk value and/or (2) the sum of ratios for all carcinogens or all noncarcinogens that may affect the same organ are greater than 1 and the chemical contributes at least 5 to 10% percent to the sum. The same process was completed for the COC determination for Commercial Industrial Land Use using the same risk values as stated above for the Resident Receptor for the Industrial Receptor's RSLs (USEPA, 2015). The same process was also followed for the Military Training Land Use using the FWCUGs developed for the NGT.

The use of the sum of ratios approach is intended to account for additive effects from exposure to multiple chemicals that can cause the same effect (i.e., cancer) or affect the same target organ. The sum of ratios approach develops a ratio for each chemical by comparing the chemical concentration (i.e., mean concentration or concentration in confirmation samples, the EPC) of the COC to the individual FWCUG and then adds those ratios for chemicals with similar effects (USACE, 2012). These chemicals are further assessed using a weight of evidence evaluation.

Each of these steps presented herein are discussed in further detail in the following sections. Additional information can be obtained from the Position Paper (USACE, 2012).

6.4.2 Identification of Cleanup Goals

The FWCUGs used for identification of COCs include those for the resident Receptor to evaluate COCs for the Unrestricted (Residential) Land Use and the NGT's FWCUGs for the Military Training Land Use. The future use of the AOC will be by the OHARNG. As discussed in Section 2, "Human Receptors", potential human exposure is limited. The AOC

is located at the eastern central portion of the facility. It is not currently used for OHARNG training activities but receives periodic foot traffic during maintenance, restoration, and security activities.

The NGT is the most applicable receptors for the evaluation of COCs at the Sand Creek Site given the potential for greater exposure for these receptors. The NGT was conservatively evaluated for potential exposure for surface soil, subsurface soil, sediment and surface water. The Industrial Receptor does not have RSLs for sediment or surface water so the FWCUGs for the NGT were used to determine potential risks. The FWCUGs for the NGT should be considered to be protective to the Industrial Receptor although no exposure would be expected to surface water or sediment by this receptor. The USEPA's CSM for the RSLs for the Composite Receptor does not consider surface water and sediment as complete exposure pathways since there is no contact point. The approach taken in this risk assessment is to assume that the Industrial Receptor will be exposed to all media similarly as the NGT, thereby ensuring that evaluation represents the most conservative approach for the Industrial Receptor.

The FWCUGs/RSLs selected are those based on a 10^{-5} (one in one hundred thousand) excess cancer risk for carcinogenic effects, and an HQ of 1 for noncarcinogenic effects. A summary of results for the screening processes used to evaluate for COCs for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use in surface soil, subsurface soil, sediment, and surface water is presented in **Tables 6-16** through **6-38**.

6.4.3 EPC Development

The COPCs in the surface soil ISM samples and subsurface discrete samples are evaluated separately. For the ISM samples, the MDC for each relevant depth interval is used as the EPC because these samples represent an average concentration over the area sampled. Therefore, additional statistical evaluation of these samples is not appropriate. For the subsurface discrete samples, the lower of the MDC and the 95-percent UCL on the mean is used as the EPC. The 95-percent UCLs were derived using results for the COPCs for all the subsurface discrete samples identified in **Tables 6-2**, **6-3**, and **6-4**. They were calculated using ProUCL Version 4.00.04, which is software package developed by the EPA designed to calculate various statistical measures, including UCLs. It contains several parametric, nonparametric and bootstrap methods for calculating UCLs, and some methods are capable of handling nondetect results, including multiple detection limits. The data sets for UCL derivation include detected results, and nondetect results. The nondetect results are included as such, with the reporting limit. The ProUCL outputs are provided in **Appendix F**.

The recommended 95-percent UCL value is used as the EPC unless it is greater than the MDC. If more than one value is recommended, the greatest value was selected. The EPCs used for

evaluation of COCs for the Residential Receptor, Industrial Receptor, and the NGT receptors in surface soil, deep surface soil, subsurface soil, sediment, and surface water are provided in **Tables 6-16** through **6-38**.

6.4.4 Comparison of EPCs to Cleanup Goals

As described in the Position Paper (USACE, 2012), EPCs are compared to the applicable final FWCUGs for cancer and noncancer effects through the development of a ratio. These ratios are summed to account for potential cumulative effects. In the case of noncancer effects, ratios are summed for each target organ. The COCs are identified if the following occur:

- The cancer or noncancer ratio for a given COPC is greater than 1.
- The sum of the ratios for cancer or noncancer effects for any target organ is greater than 1, and the COPC contributes more than 5 percent to the sum.
- The Weight of Evidence Evaluation (WOE Evaluation) indicates that the COPCs is at concentrations that need some additional remedial action. The WOE allows for an assessment of the concentration and severity of the COPC as it occurs with other chemicals. For example, if a COPC is from a single ISM location and another COPC is from a different location, it would be inappropriate to assume multiple chemical exposure by a receptor if the ISM sample decision unit was comparable to that of the receptor's EU. For Sand Creek, there were numerous surface soil ISM samples taken over just one acre, which is not really relevant to an actual exposure area. This step is a refinement step that is used to identify true COCs that need remedial action and investigation per the CERCLA process.

Tables 6-16 through **6-38** present the comparison of the EPCs to the FWCUGs/RSLs and identify which COPCs have been identified as COCs for the receptors in surface soil, deep surface soil, subsurface soil, sediment, and surface water. Summaries of the COCs identified for the Residential and National Guard Land Use receptors in the environmental media are presented in **Table 6-38**.

6.4.5 COCs in Surface Soil and Deep Surface Soil

Surface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 0- to 1-foot interval. The COC determination for each receptor is presented separately for noncancer (by target organ/critical effect) and for cancer risks. The table identification and information is described below for each Land Use/representative receptor.

These COCs were identified using the maximum detected concentration for each COPC at any of the ISM locations and not by individual ISM location.

- Arsenic was the only chemical identified as a COC based on noncancer effects were identified for the Unrestricted (Residential) Land Use receptors in surface soil using the maximum (**Table 6-16**). This was due to potential impacts to the child Resident Receptor. None were identified for the adult.Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These chemicals are highlighted in **Table 6-17**, which also lists all the COPCs evaluated for the Unrestricted (Residential) Land Use. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC.

- No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in surface soil (**Table 6-18**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These chemicals are highlighted in **Table 6-19**, which also lists all the COPCs evaluated for the Commercial Industrial Land Use. These COCs were based on the maximum detected concentration for each COPC at any of the ISM locations and not by ISM location.

Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. Samples from this interval include the ISM surface soil samples from 0 to 1 foot and the subsurface samples from the 1- to 5-foot interval were also used.

- No COCs based on noncancer effects were identified for the Military Training Land use in the surface samples using ISM maximum sample concentrations in the 0- to 1 foot interval (**Table 6-20**). Three COCs were identified based on cancer risks and using the SOR. These were arsenic, cobalt, and benzo(a)pyrene. These chemicals are highlighted in **Table 6-21**, which also lists all the COPCs evaluated for the Military Training Land Use.

- In the discrete samples from the 1 to 5 foot interval, the 95% UCL was estimated and used in the calculations. The number of samples were limited so the statistical type of test varies from chemical to chemical depending upon how many actual detections were made of the chemical and the Standard Deviation. The output from ProUCL is provided in **Appendix F**. No COCs based on noncancer effects were identified for the Military Training Land use in the deep surface samples (1-to 5 foot interval) using the 95% UCL (**Table 6-22**). Four COCs were identified based on cancer risks and using the SOR for this interval. These were arsenic, cobalt, benzo(a)pyrene, and

benzo(b)fluoranthene. These chemicals are highlighted in **Table 6-23**, which also lists all the COPCs evaluated for the Military Training Land Use.

A summary of results for the screening process used to evaluate for COCs in surface soil for the Unrestricted (Residential) Land Use and Commercial Industrial Land Use and deep surface soil for the Military Training Land Use is presented in **Tables 6-16** through **6-23**. Summaries of the COCs identified for the Unrestricted Land Use, Commercial Industrial Land Use, and Military Training Land Use receptors in surface soil and deep surface soil, are presented in **Table 6-38**.

6.4.6 COCs in Subsurface Soil

Subsurface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 1- to 13-foot interval. Samples from this interval include the subsurface samples from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet.

- No COCs based on noncancer effects were identified for the Unrestricted (Residential) Land Use receptors in subsurface soil (**Table 6-24**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These chemicals are highlighted in **Table 6-25**, which also lists all the COPCs evaluated for the Unrestricted (Residential) Land Use. These were determined using the 95% UCL of the discrete subsurface sample results for each COPC.

- No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in subsurface soil (**Table 6-26**). Four COCs were identified based on cancer risks and using the SOR. These were arsenic, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene. These chemicals are highlighted in **Table 6-27**, which also lists all the COPCs evaluated for the Commercial Industrial Land Use. These COCs were based on the maximum detected concentration for each COPC at any of the ISM locations and not by ISM location.

Subsurface soil for the National Guard Trainee is defined as the 4- to 7-foot interval. Samples from the 4- to 7-foot interval include the subsurface samples from 5 to 9 feet since the sample intervals overlap.

- No COCs were identified for the Military Training Land Use in the subsurface interval for the NGT (should have been only 4-to 7 feet but this also included data from 5-to 9 feet). **Table 6-28** presents the screening for COCs based noncancer effects and **Table 6-29** presents the screening summary for the determination of COC based on carcinogenic effects.

A summary of results for the screening process used to evaluate for COCs in subsurface soil for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use is presented in **Table 6-38**.

6.4.7 COCs in Sediment

Sediment at the former RVAAP is defined as the 0 to 0.5 foot interval for the applicable receptors identified in the FWCUG Report (SAIC, 2010). For the Sand Creek Site, the receptors include the Resident Receptor and the NGT. Additionally, it was assumed (in this risk assessment) that the Industrial Receptor may be exposed similarly as the NGT. The USEPA's RSLs do not include sediment as an exposure medium for either the Resident Receptor or the Industrial Receptor. The FWCUGs developed for the NGT were considered protective of the Industrial receptor.

None of the COPCs identified in sediment for the Unrestricted (Residential) Land Use. **Table 6-30** presents the screening for COCs based noncancer effects and **Table 6-31** presents the screening summary for the determination of COC based on carcinogenic effects.

No COCs identified in sediment were identified in the Commercial Industrial Land Use or the Military Training Land Use. **Table 6-32** presents the screening for COCs based noncancer effects and **Table 6-33** presents the screening summary for the determination of COC based on carcinogenic effects.

A summary of results for the screening process used to evaluate for COCs in sediment is provided in **Table 6-38** for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use receptors.

6.4.8 COCs in Surface Water

Arsenic was the only COPC identified in surface water. It was not identified as a COC for any of the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or the Military Training Land Use as concentrations detected in surface water were less than the FWCUGs or the sums of ratios were less than 1 for cancer and noncancer effects.

Table 6-34 presents the screening for COCs based noncancer effects and **Table 6-35** presents the screening summary for the determination of COC based on carcinogenic effects for the Unrestricted (Residential) Land Use. **Table 6-34** presents the screening for COCs based noncancer effects and **Table 6-35** presents the screening summary for the determination of COC based on carcinogenic effects for the Unrestricted (Residential) Land Use. **Table 6-36** presents the screening for COCs based noncancer effects and **Table 6-37** presents the screening summary for the determination of COC based on carcinogenic effects for the Unrestricted (Residential) Land Use. A summary of results of the COC evaluation for surface

water for the Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and the Military Training Land Use is presented in **Table 6-38**.

6.5 Conclusions of the HHRA and Discussion

6.5.1 Surface Soil Summary

Unrestricted (Residential) Land Use

Based on the results of this HHRA, there are several COCs identified in the surface soil for the Unrestricted (Residential) Land Use. Subsurface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 1- to 13-foot interval. Samples from this interval include the subsurface samples from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet. Only arsenic was identified as a COC for the Resident Receptor (Child) based on noncancer effects for the Unrestricted (Residential) Land Use receptors in surface soil. **Two COCs** were identified based on cancer risks and using the SOR. These were **arsenic** and **benzo(a)pyrene**. These were determined using the 95% UCL of the discrete subsurface sample results for each COPC.

Commercial Industrial Land Use

The same two COCs that were identified in the surface soil for the Unrestricted (Residential) Land Use were also identified as COCs for the surface soil Commercial Industrial Land Use. The **two COCs** were identified based on cancer risks and using the SOR approach. These were **arsenic** and **benzo(a)pyrene**. These COCs were derived using the maximum detected concentration for each COC at any of the ISM locations and not for each individual ISM locations. This type of assessment should be completed in the FS, so that the minimum area to be evaluated can be focused where there is the most contamination. This would help streamline the FS so that only areas where COCs occur are the areas that are fully evaluated in the FS.

Military Training Land Use

Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. Samples from this interval include the ISM surface soil samples from 0 to 1 foot and the subsurface samples from the 1- to 5-foot interval were also used. Three COCs were identified based on cancer risks and using the SOR. These were **arsenic**, **cobalt**, and **benzo(a)pyrene**. These three COCs were identified in the surface soil ISMs are were only for the 0-to1 foot interval. It is very likely a site-wide weighted average (combining the 0-to1 foot results and the 1-to 5 foot results) could be calculated for these three COCs. This would likely limit locations where these COCs occur that would be evaluated in an FS.

In the discrete samples from the 1 to 5 foot interval, the 95% UCL was estimated and used in the calculations. The number of samples were limited so the statistical type of test varies from chemical to chemical depending upon how many actual detections were made of the

chemical and the Standard Deviation. **Four COCs** were identified based on cancer risks and using the SOR for this interval. These were **arsenic**, **cobalt**, **benzo(a)pyrene**, and b**enzo(b)fluoranthene**.

6.5.2 Subsurface Soil Summary

Unrestricted (Residential) Land Use

Based on the results of this HHRA, there are several COCs identified in the subsurface soil for the Unrestricted (Residential) Land Use. These were identified using the 95% UCL or the MDC (if it was larger than the 95% UCL) for each COPCs regardless of location. No COCs based on noncancer effects were identified for the Unrestricted (Residential) Land Use receptors in subsurface soil. ISM DU. This would help focus the FS so that only the contaminated areas are evaluated.

Commercial Industrial Land Use

No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in subsurface soil. **Four COCs** were identified based on cancer risks and using the SOR. These were **arsenic**, **benzo(a)anthracene**, **dibenzo(a,h)anthracene**, and **benzo(a)pyrene**. These COCs were derived using the 95% UCL for each COC at any of the ISM locations and not for each individual ISM locations. This type of re-assessment should be completed in the FS, so that the minimum area to be evaluated can be focused where there is the most contamination. This would help focus the FS so that only the contaminated areas where COCs occur are evaluated.

Military Training Land Use

Subsurface soil for the National Guard Trainee is defined as the 4- to 7-foot interval. Samples from the 4- to 7-foot interval include the subsurface samples from 5 to 9 feet since the sample intervals overlap. **No COCs** were identified for the Military Training Land Use in the subsurface interval for the NGT (should have been only 4-to 7 feet but this also included data from 5-to 9 feet).

6.5.3 Sediment Summary

No COCs were identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or Military Training Land Use in the sediment at the AOC. This media does not require further evaluation in an FS. A "No further Action" (NFA) determination is obtained for sediment at the Sand Creek Site.

6.5.4 Surface Water Summary

No COCs were identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or Military Training Land Use in the surface water. This media does not require

further evaluation in an FS. A NFA determination is obtained for surface water at the Sand Creek Site.

6.5.5 Conclusions

Results of the HHRA indicate the presence of several COCs in surface soil and subsurface soil for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use. Arsenic and benzo(a)pyrene are the primary risk drivers. These COCs should be further evaluated in an FS to determine the appropriate remedial actions for soil at this AOC.

No COCs were identified in sediment or surface water at the Sand Creek Disposal Road Landfill. An NFA determination is indicated for both sediment and surface water and an FS is not warranted for either of these media.

6.6 Uncertainty Analysis

There are inherent sources of uncertainty in the evaluation of exposure and risk that are common to all risk assessments. These general sources of uncertainty are not described here. However, those specific to this assessment are discussed in the following sections. These uncertainties generally relate to sampling considerations, the determination of EPCs, and the selection of appropriate receptors. There are numerous uncertainties related to the final FWCUGs, including exposure assumptions and toxicity values. These uncertainties are inherent to the use of these values, and are similar for all assessments using them. Therefore, these uncertainties are not discussed here unless there is a particular issue relevant to this evaluation.

Uncertainty can arise from sampling techniques or approaches. In this assessment surface soil and sediment were sampled using ISM techniques. These techniques provide a good representation of average concentrations over the area sampled. While it may not identify small areas of higher concentrations, this approach is useful for estimating exposure, which is expected to occur over an area and not discrete locations. Although sampling of subsurface soil was conducted using a modified ISM sampling technique, the samples are still representative of a discrete location and should be evaluated using a statistical approach. As a result, there is more variability in these results. However, if sample numbers are sufficient, 95 percent UCLs on the mean can be calculated to provide an upper limit on the mean concentration for use in exposure assessment, thus limiting the uncertainty associated with this sampling technique.

The identification of COPCs and COCs is based on the identification of SRCs. The identification of SRCs is largely based on the site-specific BSVs. As shown in **Table 6-38**, a number of metals were identified as COCs. The identification of these metals as SRCs in some

cases is based on small differences in MDCs compared to BSVs (**Tables 6-7** to **6-14**). This comparison is subject to uncertainties in both the site data and background data sets. Arsenic was identified as a COCs in soil for at least one of the receptors and depth intervals. Maximum concentrations of arsenic are greater than twice the BSV, suggesting that the identification of this substances as an SRC does not represent a large uncertainty to the risk assessment.

The evaluation of chromium in this assessment is based on the FWCUGs for trivalent chromium. This assumption was made since samples of both soil and sediment were analyzed for hexavalent chromium, and it was not detected in any sample. Therefore, this assumption represents a minor uncertainty to the risk assessment.

The FWCUGs were developed from all chemicals that have been detected at the former RVAAP during previously completed studies. Therefore, if a chemical lacks a FWCUG then it has not been frequently detected at the former RVAAP. In these cases when no FWCUGs were available, the RSLs (EPA, 2015) were used as the screening values for all receptors. This provides a conservative evaluation, since the RSLs are based on a generic residential exposure and are not site-specific values. In some cases, if no FWCUGs or RSLs were available, screening values for closely related chemicals were used. This assumption represents an uncertainty to the risk assessment, although concentrations of most substances without FWCUGs or RSLs were quite low. The presence of these compounds represents an uncertainty to the risk assessment, although it is likely to be small, since the concentrations of these chemicals are low compared to others detected at the site.

The selection of the MDC as the EPC for the ISM samples provides a conservative evaluation of potential exposures in the area with the greatest concentrations. For modified ISM samples that were evaluated as discrete samples, the 95-percent UCL of the mean is used as the EPC unless it is higher than the MDC. There is uncertainty associated with the calculation and selection of the 95-percent UCL. In some cases, UCLs were calculated for data sets of less than 10 samples. These values represent a greater uncertainty than those calculated with more samples. In addition, the 95-percent UCL on data sets skewed by a few high values are more uncertain. However, the UCLs recommended in this circumstance are conservative to reflect the uncertainty.

The selection of receptors and their exposure assumptions also represents an uncertainty to the risk assessment. The NCP requires the evaluation for Unrestricted Land Use that have been identified as the Resident Receptor for the former RVAAP. However, since the exposure scenarios for the Resident Receptor and the NGT are based on long term continuous exposure to the MDC, it is likely that any uncertainty does not underestimate risks.

Table 6-1. Surface Soil (0 to 1 foot) Human Health Risk Assessment Data Set for Residential Land Use and Commercial Industrial Land Use.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
Incremental Samples (Except VOCs)					
SCss-057	SCss-057D-0001-SO	9/24/10	0	1	VOCs
SCss-057	SCss-057M-0001-SO	9/24/10	0	1	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCss-058	SCss-058M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-059	SCss-059M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-060	SCss-060M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-061	SCss-061M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-062	SCss-062M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-063	SCss-063M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs
SCss-064	SCss-064M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-065	SCss-065M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs
SCss-066	SCss-066M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-067	SCss-067M-0001-SO	9/21/10	0	1	Explosives, Metals, SVOCs
SCss-068	SCss-068D-0001-SO	9/21/10	0	1	VOCs
SCss-068	SCss-068M-0001-SO	9/21/10	0	1	Explosives, Metals, SVOCs
SCss-069	SCss-069M-0001-SO	9/24/10	0	1	Explosives, Metals, SVOCs
SCss-072	SCss-072M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-073	SCss-073M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-074	SCss-074M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-075	SCss-075M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs

Table 6-1. Surface Soil (0 to 1 foot) Human Health Risk Assessment Data Set for Residential Land Use and Commercial Industrial Land Use (continued).

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCss-076	SCss-076M-0001-SO	11/9/10	0	1	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome

bgs denotes below ground surface.
Exp denotes explosives.
Hex. Chrome denotes hexavalent chromium.
PCB denotes polychlorinated biphenyl.
Prop denotes propellants.
SVOC denotes semivolatile organic compound.
VOC denotes volatile organic compound.

Table 6-2. Subsurface Soil (1 to 13 feet) Human Health Risk Assessment Data Set for Residential Land Use and Commercial Industrial Land Use.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCsb-035	SCsb-035M-0001-SO	9/22/10	1	5	Explosives, Metals, SVOCs
SCsb-036	SCsb-036M-0001-SO	9/22/10	1	5	Explosives, Metals, SVOCs, Hex. Chrome
SCsb-037	SCsb-037D-0001-SO	9/22/10	1	5	VOCs
SCsb-037	SCsb-037M-0001-SO	9/22/10	1	5	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide
SCsb-038	SCsb-038M-0001-SO	9/22/10	1	5	Explosives, Metals, SVOCs
SCsb-039	SCsb-039M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-040	SCsb-040M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-041	SCsb-041M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-042	SCsb-042M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-043	SCsb-043M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-044	SCsb-044M-0001-SO	9/24/10	1	5	Explosives, Metals, SVOCs
SCsb-045	SCsb-045M-0001-SO	9/25/10	1	5	Explosives, Metals, SVOCs
SCsb-046	SCsb-046M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs, Hex. Chrome
SCsb-047	SCsb-047M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-048	SCsb-048M-0001-SO	9/29/10	1	5	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCsb-049	SCsb-049M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-050	SCsb-050M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-051	SCsb-051M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-052	SCsb-052M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs

Table 6-2. Subsurface Soil (1 to 13 feet) Human Health Risk Assessment Data Set for Residential Land Use and Commercial Industrial Land Use (continued).

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCsb-053	SCsb-053M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-054	SCsb-054M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-055	SCsb-055M-0001-SO	9/25/10	1	5	Explosives, Metals, SVOCs
SCsb-056	SCsb-056M-0001-SO	9/25/10	1	5	Explosives, Metals, SVOCs, Hex. Chrome
SCsb-035	SCsb-035M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-036	SCsb-036M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-037	SCsb-037M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-038	SCsb-038M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-039	SCsb-039M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-040	SCsb-040D-0002-SO	9/21/10	5	9	VOCs
SCsb-040	SCsb-040M-0002-SO	9/21/10	5	9	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide
SCsb-041	SCsb-041M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-042	SCsb-042M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-043	SCsb-043M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-035	SCsb-035M-0003-SO	9/22/10	9	13	Explosives, Metals, SVOCs
SCsb-036	SCsb-036M-0003-SO	9/22/10	9	13	Explosives, Metals, SVOCs
SCsb-037	SCsb-037M-0003-SO	9/22/10	9	13	Explosives, Metals, SVOCs
SCsb-038	SCsb-038M-0003-SO	9/22/10	9	13	Explosives, Metals, SVOCs
SCsb-039	SCsb-039M-0003-SO	9/21/10	9	13	Explosives, Metals, SVOCs
SCsb-040	SCsb-040M-0003-SO	9/21/10	9	13	Explosives, Metals, SVOCs

Table 6-2. Subsurface Soil (1 to 13 feet) Human Health Risk Assessment Data Set for Residential Land Use and Commercial Industrial Land Use (continued).

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCsb-041	SCsb-041M-0003-SO	9/21/10	9	13	Explosives, Metals, SVOCs
SCsb-042	SCsb-042D-0003-SO	9/21/10	9	13	VOCs
SCsb-042	SCsb-042M-0003-SO	9/21/10	9	13	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide
SCsb-043	SCsb-043M-0003-SO	9/21/10	9	13	Explosives, Metals, SVOCs

bgs denotes below ground surface.
Exp denotes explosives.
Hex. Chrome denotes hexavalent chromium.
PCB denotes polychlorinated biphenyl.
Prop denotes propellants.
SVOC denotes semivolatile organic compound.
VOC denotes volatile organic compound.

Table 6-3. Deep Surface Soil (0 to 4 feet) Human Health Risk Assessment Data Set for Military Training Land Use.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
Incremental Samples (Except VOCs)					
SCss-057	SCss-057D-0001-SO	9/24/10	0	1	VOCs
SCss-057	SCss-057M-0001-SO	9/24/10	0	1	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCss-058	SCss-058M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-059	SCss-059M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-060	SCss-060M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-061	SCss-061M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-062	SCss-062M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-063	SCss-063M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs
SCss-064	SCss-064M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-065	SCss-065M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs
SCss-066	SCss-066M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-067	SCss-067M-0001-SO	9/21/10	0	1	Explosives, Metals, SVOCs
SCss-068	SCss-068D-0001-SO	9/21/10	0	1	VOCs
SCss-068	SCss-068M-0001-SO	9/21/10	0	1	Explosives, Metals, SVOCs
SCss-069	SCss-069M-0001-SO	9/24/10	0	1	Explosives, Metals, SVOCs
SCss-072	SCss-072M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-073	SCss-073M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-074	SCss-074M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs

Table 6-3. Deep Surface Soil (0 to 4 feet) Human Health Risk Assessment Data Set for Military Training Land Use.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCss-075	SCss-075M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-076	SCss-076M-0001-SO	11/9/10	0	1	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
Modified Incremental Samples (Except VOCs)					
SCsb-035	SCsb-035M-0001-SO	9/22/10	1	5	Explosives, Metals, SVOCs
SCsb-036	SCsb-036M-0001-SO	9/22/10	1	5	Explosives, Metals, SVOCs, Hex. Chrome
SCsb-037	SCsb-037D-0001-SO	9/22/10	1	5	VOCs
SCsb-037	SCsb-037M-0001-SO	9/22/10	1	5	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide
SCsb-038	SCsb-038M-0001-SO	9/22/10	1	5	Explosives, Metals, SVOCs
SCsb-039	SCsb-039M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-040	SCsb-040M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-041	SCsb-041M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-042	SCsb-042M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-043	SCsb-043M-0001-SO	9/21/10	1	5	Explosives, Metals, SVOCs
SCsb-044	SCsb-044M-0001-SO	9/24/10	1	5	Explosives, Metals, SVOCs
SCsb-045	SCsb-045M-0001-SO	9/25/10	1	5	Explosives, Metals, SVOCs
SCsb-046	SCsb-046M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs, Hex. Chrome
SCsb-047	SCsb-047M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-048	SCsb-048M-0001-SO	9/29/10	1	5	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCsb-049	SCsb-049M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-050	SCsb-050M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs

Table 6-3. Deep Surface Soil (0 to 4 feet) Human Health Risk Assessment Data Set for Military Training Land Use (continued).

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCsb-051	SCsb-051M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-052	SCsb-052M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-053	SCsb-053M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-054	SCsb-054M-0001-SO	9/29/10	1	5	Explosives, Metals, SVOCs
SCsb-055	SCsb-055M-0001-SO	9/25/10	1	5	Explosives, Metals, SVOCs
SCsb-056	SCsb-056M-0001-SO	9/25/10	1	5	Explosives, Metals, SVOCs, Hex. Chrome

bgs denotes below ground surface.
Exp denotes explosives.
Hex. Chrome denotes hexavalent chromium.
PCB denotes polychlorinated biphenyl.
Prop denotes propellants.
SVOC denotes semivolatile organic compound.
VOC denotes volatile organic compound.

Table 6-4. Subsurface Soil (4 to 7 feet) Human Health Risk Assessment Data Set for Military Training Land Use.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
Modified Incremental Samples (Except VOCs)					
SCsb-035	SCsb-035M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-036	SCsb-036M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-037	SCsb-037M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-038	SCsb-038M-0002-SO	9/22/10	5	9	Explosives, Metals, SVOCs
SCsb-039	SCsb-039M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-040	SCsb-040D-0002-SO	9/21/10	5	9	VOCs
SCsb-040	SCsb-040M-0002-SO	9/21/10	5	9	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide
SCsb-041	SCsb-041M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-042	SCsb-042M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs
SCsb-043	SCsb-043M-0002-SO	9/21/10	5	9	Explosives, Metals, SVOCs

bgs denotes below ground surface.

Exp denotes explosives.

PCB denotes polychlorinated biphenyl.

Prop denotes propellants.

SVOC denotes semivolatile organic compound.

VOC denotes volatile organic compound.

Table 6-5. Sediment Human Health Risk Assessment Data Set for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)			Analyses
			Incremental Samples (Except VOCs)			
SCsd-070	SCsd-070M-0001-SD	9/28/10	0	0.5		Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCsd-071	SCsd-071D-0001-SD	9/28/10	0	0.5		VOCs
SCsd-071	SCsd-071M-0001-SD	9/28/10	0	0.5		Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome

bgs denotes below ground surface.

Exp denotes explosives.

Hex. Chrome denotes hexavalent chromium.

PCB denotes polychlorinated biphenyl.

Prop denotes propellants.

SVOC denotes semivolatile organic compound.

VOC denotes volatile organic compound.

Table 6-6. Surface Water Human Health Risk Assessment Data Set for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use.

Sample Location	Sample Number	Sample Date	Analyses
S-7	FSW-SW-011-0000	6/24//03	Explosives, Metals, PCBs, Pesticides, SVOCs, Total Cyanide, Ammonia, Phosphorus, Nitrate
S-7	FSW-SW-051-0000	9/17/03	Explosives, Metals, SVOCs
SCsw-001	SCsw-001-0001-SW	9/18/03	Exp/Prop, Field Tests[a], Gen Chem[b], Metals, PCBs, Pesticides, SVOCs, VOCs
SCsw-002	SCsw-002-0001-SW	9/15/03	Field Tests[a], Gen Chem[b], Metals
SCsw-003	SCsw-003-0001-SW	9/15/03	Field Tests[a], Gen Chem[b], Metals

[a] denotes field tests for surface water included conductivity, pH, oxygen, temperature, and turbidity
[b] denotes general chemistry included analysis for asbestos.
Exp denotes explosives.
Gen Chem denotes general chemistry.
PCB denotes polychlorinated biphenyl.
Prop denotes propellants.
SVOC denotes semivolatile organic compound.
VOC denotes volatile organic compound.

Table 6-7. Summary of Screening Results for COPCs in Surface Soil (0 to 1 foot) for Residential Land Use.

	Range of Values, mg/kg							Use HQ - 0.1 or 10-6 cancer risk					
Site-Related Chemical	**Detected Concentrations**				**Detection Limit**		**Background**	**RRA FWCUGa**	**RRC FWCUGa (mg/kg)**	**RSLb**	**COPC?**	**COPC Justification**	**Loci of MDC**
	Min	**VQ**	**Max**	**QQ**	**Min**	**Max**	**BSV a**	**(mg/kg)**		**(mg/kg)**			
General Chemistry							(mg/kg)						
Cyanide, Total	0.3	J	0.39	J	0.39	0.39	---			0.27	No	Estimated value near criteria	SCss-076
Inorganics													
Antimony	0.75		17.1		0.28	5.5	0.96	13.6	2.82		Yes	MDC exceeds risk value	SCss-061
Arsenic	4.5		36.6		0.46	9.1	15.4	0.425	0.524		Yes	MDC exceeds risk value	SCss-062
Barium	1.5		764		0.028	0.55	88.4	8,966	1,413		No		SCss-061
Beryllium	0.41		1.1		0.024	0.24	0.88			16	No		SCss-062
Cadmium	0.057		12.9		0.021	0.43	0	22.3	6.41		Yes	MDC exceeds risk value	SCss-061
Chromium	0.26		188		0.064	1.3	17.4	19,694	8,147		No		SCss-076
Cobalt	6.7		19.7		0.05	1	10.4	803	131		No		SCss-074
Copper	0.49		726		0.2	4.1	17.7	2,714	311		Yes	MDC exceeds risk value	SCss-064
Lead	0.88		405		0.14	2.8	26.1			400	No	Estimated value near criteria	SCss-061
Mercury	0.026		24.6		0.008	0.85	0.036	16.5	2.27		Yes	MDC exceeds risk value	SCss-059
Nickel	0.083	J	48.2		0.062	1.2	21.1	1,346	155		No		SCss-064
Selenium	0.13		3.1		0.43	8.5	1.4			39	No		SCss-062
Silver	0.095		256		0.057	60	0	324	38.6		Yes	MDC exceeds risk value	SCss-061
Thallium	0.14	J	3.2	J	0.28	2.8	0	4.76	0.612		Yes	MDC exceeds risk value	SCss-057
Zinc	0.96		373		0.12	2.4	61.8	19,659	2,321		No		SCss-061
Explosives and Propellants													
2,4,6-Trinitrotoluene	0.26	J	3.9		0.43	0.44	---	21.1	3.9		No		SCss-069
2-Amino-4,6-Dinitrotoluene	0.26	J	0.26	J	0.43	0.44	---	12.8	1.54	15	No		SCss-069
Nitroguanidine	0.64		0.64		0.16	0.25	---			630	No		SCss-057
Pesticides													
4,4'-DDD	0.0014	J	0.0023	J	0.0024	0.0024	---			2.3	No		SCss-076
4,4'-DDT	0.0015	J	0.0017	J	0.0024	0.0024	---			1.9	No		SCss-076
alpha-Chlordane	0.0015	J	0.0015	J	0.0024	0.0041	---			1.7 Chlordane	No		SCss-076
Heptachlor	0.001	J	0.0081	J	0.0024	0.0024	---	0.308	0.198	0.13	No		SCss-057
Lindane	0.0013	J	0.0013	J	0.0024	0.0024	---			0.57	No		SCss-076
Methoxychlor	0.0016	J	0.0024	J	0.0024	31	---			32	No		SCss-076
Semivolatile Organic Compounds													
1,2,4-Trichlorobenzene	0.027	J	0.027	J	0.41	0.43	---			5.8	No		SCss-061
1,2-Dichlorobenzene	0.028	J	0.11	J	0.41	0.43	---			180	No		SCss-061
1,3-Dichlorobenzenee	0.031	J	0.031	J	0.41	0.43	---			180*	No		SCss-061
1,4-Dichlorobenzene	0.022	J	0.27	J	0.41	0.43	---			2.6	No		SCss-061
2-Methylnaphthalene	0.045	J	0.53		0.41	0.43	---	238	30.6	24	No		SCss-074
Acenaphthene	0.029	J	0.44		0.41	0.43	---			360	No		SCss-059
Acenaphthylene	0.029	J	0.16	J	0.41	0.43	---			360*	No		SCss-058
Anthracene	0.026	J	1.1		0.41	0.43	---			1,800	No		SCss-060

Table 6-7. Summary of Screening Results for COPCs in Surface Soil (0 to 1 foot) for Residential Land Use (continued).

	Range of Values, mg/kg							Use HQ - 0.1 or 10-6 cancer risk					
Site-Related Chemical	**Detected Concentrations**				**Detection Limit**		**Background**	**RRA FWCUGa**	**RRC FWCUGa (mg/kg)**	**RSLb**	**COPC?**	**COPC Justification**	**Loci of MDC**
	Min	**VQ**	**Max**	**QQ**	**Min**	**Max**	**BSV a**	**(mg/kg)**		**(mg/kg)**			
General Chemistry							(mg/kg)						
Benzo(a)anthracene	0.027	J	2.6		0.41	0.43	---	0.221	0.65		Yes	MDC exceeds risk value	SCss-060
Benzo(a)pyrene	0.026	J	2.4		0.41	0.43	---	0.022	0.065		Yes	MDC exceeds risk value	SCss-060
Benzo(b)fluoranthene	0.039	J	4.8		0.41	0.43	---	0.221	0.65		Yes	MDC exceeds risk value	SCss-060
Benzo(g,h,i)perylene	0.031	J	0.69		0.41	0.43	---	2.22*	6.5*		No		SCss-060
Benzo(k)fluoranthene	0.027	J	1.4		0.41	0.43	---	2.21	6.5		No		SCss-060
Benzoic Acid	0.39	J	0.57	J	0.99	2.1	---			25,000	No		SCss-065
Bis(2-Ethylhexyl)phthalate	0.1	J	1.7		1	1.1	---			39	No		SCss-072
Carbazole	0.034	J	0.61		0.41	0.43	---	69.4	44.6		No		SCss-059
Chrysene	0.049	J	2.7		0.41	0.43	---	22.1	65		No		SCss-060
Dibenzo(a,h)anthracene	0.055	J	0.28	J	0.41	0.43	---	0.22	0.65		No		SCss-060
Dibenzofuran	0.027	J	0.33	J	0.41	0.43	---	119	15.3		No		SCss-060
Diethyl Phthalate	0.069	J	0.14	J	0.41	0.43	---			5100	No		SCss-075
Di-n-Butyl Phthalate	0.082	J	0.47		0.41	0.43	---			630	No		SCss-060
Fluoranthene	0.04	J	4.3		0.41	0.43	---	276	163		No		SCss-060
Fluorene	0.031	J	0.47		0.41	0.43	---	737	243		No		SCss-060
Indeno(1,2,3-cd)pyrene	0.025	J	0.81		0.41	0.43	---	0.221	0.65		Yes	MDC exceeds risk value	SCss-060
Isophorone	0.051	J	0.2	J	0.41	0.43	---			570	No		SCss-063
Naphthalene	0.028	J	0.33	J	0.41	0.43	---	368	122		No		SCss-063
Pentachlorophenol	0.4	J	0.52	J	1	1.1	---	2.12	4.91		No		SCss-060
Phenanthrene	0.026	J	3.4		0.41	0.43	---			360*	No		SCss-059
Pyrene	0.035	J	4		0.41	0.43	---	207	122		No		SCss-060

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of 1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

[d] denotes RSL for cyanide used for total cyanide.

[e] denotes RSL for 1,4-dichlorobenzene used for 1,3-dichlorobenzene.

[f] denotes RSL for acenaphthene used for acenaphthylene.

--- denotes no BSV available.

BSV denotes background screening value.

COPC denotes chemical of potential concern.

EPA denotes U.S. Environmental Protection Agency.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for Resident Receptor Adult (RFA) and Child (RFC).

HQ denotes hazard quotient.

ISM denotes incremental sampling method.

J denotes result should be considered estimated. MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

RSL denotes EPA Regional Screening Level (November 2015).

SAIC denotes Science Applications International Corporation.

VQ denotes validation qualifier.

Table 6-8. Summary of Screening Results for COPCs in Surface Soil (0 to 1 foot) for Commercial Industrial Land Use.

All concentrations in mg/kg	Range of Values, mg/kg				Detection Limits, mg/kg						
Site-Related Chemical							**Background**	**Industrial Receptor RSLb**	**COPC?**	**COPC Justification**	**Loci of MDC**
	Min	**VQ**	**Max**	**QQ**	**Min**	**Max**	**BSV a**	**(mg/kg)**			
General Chemistry											
Cyanide, Total	0.3	J	0.39	J	0.39	0.39	---	1.2	No		SCss-076
Inorganics											
Antimony	0.75		17.1		0.28	5.5	0.96	47			SCss-061
Arsenic	4.5		36.6		0.46	9.1	15.4	3.0	Yes	MDC exceeds risk value	SCss-062
Barium	1.5		764		0.028	0.55	88.4	22,000			SCss-061
Beryllium	0.41		1.1		0.024	0.24	0.88	230			SCss-062
Cadmium	0.057		12.9		0.021	0.43	0	98			SCss-061
Chromium	0.26		188		0.064	1.3	17.4	180,000			SCss-076
Cobalt	6.7		19.7		0.05	1	10.4	35			SCss-074
Copper	0.49		726		0.2	4.1	17.7	4,700			SCss-064
Lead	0.88		405		0.14	2.8	26.1	800			SCss-061
Mercury	0.026		24.6		0.008	0.85	0.036	35			SCss-059
Nickel	0.083	J	48.2		0.062	1.2	21.1	2,200			SCss-064
Selenium	0.13		3.1		0.43	8.5	1.4	580			SCss-062
Silver	0.095		256		0.057	60	0	580			SCss-061
Thallium	0.14	J	3.2	J	0.28	2.8	0	2.3	Yes	MDC exceeds risk value	SCss-057
Zinc	0.96		373		0.12	2.4	61.8	35,000			SCss-061
Explosives and Propellants											
2,4,6-Trinitrotoluene	0.26	J	3.9		0.43	0.44	---	51	No		SCss-069
2-Amino-4,6-Dinitrotoluene	0.26	J	0.26	J	0.43	0.44	---	230	No		SCss-069
Nitroguanidine	0.64		0.64		0.16	0.25	---	8,200	No		SCss-057
Pesticides											
4,4'-DDD	0.0014	J	0.0023	J	0.0024	0.0024	---	9.6	No		SCss-076
4,4'-DDT	0.0015	J	0.0017	J	0.0024	0.0024	---	8.5	No		SCss-076
alpha-Chlordane	0.0015	J	0.0015	J	0.0024	0.0041	---	7.5 Chlordane	No		SCss-076
Heptachlor	0.001	J	0.0081	J	0.0024	0.0024	---	0.63	No		SCss-057
Lindane	0.0013	J	0.0013	J	0.0024	0.0024	---	2.5	No		SCss-076
Methoxychlor	0.0016	J	0.0024	J	0.0024	31	---	410	No		SCss-076
Semivolatile Organic Compounds											
1,2,4-Trichlorobenzene	0.027	J	0.027	J	0.41	0.43	---	26	No		SCss-061
1,2-Dichlorobenzene	0.028	J	0.11	J	0.41	0.43	---	930	No		SCss-061
1,3-Dichlorobenzenee	0.031	J	0.031	J	0.41	0.43	---	930*	No		SCss-061
1,4-Dichlorobenzene	0.022	J	0.27	J	0.41	0.43	---	610	No		SCss-061
2-Methylnaphthalene	0.045	J	0.53		0.41	0.43	---	300	No		SCss-074
Acenaphthene	0.029	J	0.44		0.41	0.43	---	4,500	No		SCss-059
Acenaphthylene	0.029	J	0.16	J	0.41	0.43	---	4,500*	No		SCss-058
Anthracene	0.026	J	1.1		0.41	0.43	---	23,000	No		SCss-060
Benzo(a)anthracene	0.027	J	2.6		0.41	0.43	---	2	No		SCss-060

Table 6-8. Summary of Screening Results for COPCs in Surface Soil (0 to 1 foot) for Commercial Industrial Land Use (continued).

All concentrations in mg/kg	Range of Values, mg/kg				Detection Limits, mg/kg						
Site-Related Chemical							Background	Industrial Receptor RSLb	COPC?	COPC Justification	Loci of MDC
	Min	VQ	Max	QQ	Min	Max	BSV a	(mg/kg)			
Benzo(a)pyrene	0.026	J	2.4		0.41	0.43	---	..29	Yes	MDC exceeds risk value	SCss-060
Benzo(b)fluoranthene	0.039	J	4.8		0.41	0.43	---	2.9	No		SCss-060
Benzo(g,h,i)perylene	0.031	J	0.69		0.41	0.43	---	0.45*	No		SCss-060
Benzo(k)fluoranthene	0.027	J	1.4		0.41	0.43	---	45	No		SCss-060
Benzoic Acid	0.39	J	0.57	J	0.99	2.1	---	330,000	No		SCss-065
Bis(2-Ethylhexyl)phthalate	0.1	J	1.7		1	1.1	---	160	No		SCss-072
Carbazole	0.034	J	0.61		0.41	0.43	---	835*NGT FWCUG	No		SCss-059
Chrysene	0.049	J	2.7		0.41	0.43	---	290	No		SCss-060
Dibenzo(a,h)anthracene	0.055	J	0.28	J	0.41	0.43	---	0.45	No		SCss-060
Dibenzofuran	0.027	J	0.33	J	0.41	0.43	---	100	No		SCss-060
Diethyl Phthalate	0.069	J	0.14	J	0.41	0.43	---	66,000	No		SCss-075
Di-n-Butyl Phthalate	0.082	J	0.47		0.41	0.43	---	8,200	No		SCss-060
Fluoranthene	0.04	J	4.3		0.41	0.43	---	3,000	No		SCss-060
Fluorene	0.031	J	0.47		0.41	0.43	---	3,000	No		SCss-060
Indeno(1,2,3-cd)pyrene	0.025	J	0.81		0.41	0.43	---	2.9	No		SCss-060
Isophorone	0.051	J	0.2	J	0.41	0.43	---	2,400	No		SCss-063
Naphthalene	0.028	J	0.33	J	0.41	0.43	---	17	No		SCss-063
Pentachlorophenol	0.4	J	0.52	J	1	1.1	---	4	No		SCss-060
Phenanthrene	0.026	J	3.4		0.41	0.43	---	4,500*	No		SCss-059
Pyrene	0.035	J	4		0.41	0.43	---	2,300	No		SCss-060

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of 1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

[d] denotes RSL for cyanide used for total cyanide.

[e] denotes RSL for o-nitrotoluene used for m-nitrotoluene.

[f] denotes RSL for technical hexachlorocyclohexane (HCH) used for delta-BHC.

[g] denotes RSL for endosulfan used for endosulfan II.

[h] denotes RSL for endrin used for endrin aldehyde.

[i] denotes RSL for chlordane used for gamma-chlordane.

[j] denotes RSL for acenaphthene used for acenaphthylene.

[k] denotes RSL for pyrene used for benzo(g,h,i)perylene. --- denotes no BSV available. BSV denotes background screening value.

COPC denotes chemical of potential concern.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for the National Guard Trainee (NGT).

HQ denotes hazard quotient.

ISM denotes incremental sampling method.

J denotes result should be considered estimated.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram. NG denotes National Guard Trainee

RSL denotes EPA Regional Screening Level. (November 2015).

VQ denotes validation qualifier.

Table 6-9. Summary of Screening Results for COPCs in Deep Surface Soil (0 to 4 feet) for Military Training Land Use.

Site-Related Chemical	Detected Concentrations				Detection Limits		Background	NGT FWCUG	Soil Industrial RSL	COPC?	COPC Justification	Location of MDC
All concentrations in mg/kg	Min	VQ	Max	VQ	Min	Max	BSV (mg/kg)					
General Chemistry												
Cyanide, Total	0.3	J	0.76		0.38	0.39	---	none	1.2	No		SCsb-048
Inorganics												
Antimony	0.11	J	17.1		0.27	5.5	0.96	175		No		SCss-061
Arsenic	4.5		182		0.46	9.1	15.4	2.78		Yes	MDC exceeds risk value	SCsb-037
Barium	1.5		932		0.027	0.55	88.4	351		Yes	MDC exceeds risk value	SCsb-037
Beryllium	0.4		3.9		0.012	0.24	0.88	none	230	No		SCsb-037
Cadmium	0.057		12.9		0.021	0.43	0	10.9		Yes	MDC exceeds risk value	SCss-061
Chromium	0.26		188		0.064	1.3	17.4	329,763		No		SCss-076
Cobalt	4.8		22.3		0.05	1	10.4	7.03		Yes	MDC exceeds risk value	SCsb-038
Copper	0.49		726		0.2	4.1	17.7	25,568		No		SCss-064
Lead	0.88		405		0.14	2.8	26.1	none	800	No		SCss-061
Manganese	2.2		1,640		0.051	1	1,450	35.1	2600 (Industrial)	No	MDC near BSV and much less than Industrial RSL. Will address in the Uncertainty section.	SCsb-049
Mercury	0.0068	J	24.6		0.008	0.85	0.036	172		No		SCss-059
Nickel	0.083	J	88.1		0.062	1.2	21.1	12,639		No		SCsb-048
Selenium	0.13		3.1		0.43	8.5	1.4	none	580	No		SCss-062
Silver	0.095	J	256		0.057	60	0	3,105		No		SCss-061
Thallium	0.14	J	5.5		0.28	2.8	0	47.7		No		SCsb-037
Vanadium	12.8		41		0.034	0.69	31.1	2,304		No		SCsb-037
Zinc	0.96		373		0.12	2.4	61.8	187,269		No		SCss-061
Explosives and Propellants												
2,4,6-Trinitrotoluene	0.1		3.9		0.43	0.44	---	464		No		SCss-069
2-Amino-4,6-Dinitrotoluene	0.26	J	0.26	J	0.43	0.44	---	124		No		SCss-069
4-Nitrotoluene	0.32	J	0.32	J	0.43	0.44	---	982		No		SCsb-049
Nitroguanidine	0.64		0.64		0.16	0.25	---	none	8,200	No		SCss-057
Polychlorinated Biphenyls												
PCB-1254	0.14	J	0.14	J	0.051	0.1	---	3.46		No		SCss-069
Pesticides												
4,4'-DDD	0.0014	J	0.0023	J	0.0024	0.012	---	none	9.6	No		SCss-076
4,4'-DDE	0.0051		0.0069	J	0.0024	0.02	---	49.1		No		SCsb-048
4,4'-DDT	0.0015	J	0.013		0.0024	0.012	---	none	8.5	No		SCsb-048
Aldrin	0.0012	J	0.0012	J	0.0024	0.012	---	0.788		No		SCss-076
alpha-BHC	0.011		0.011		0.0024	0.02	---	none	7.42*	No		SCsb-037
alpha-Chlordane	0.0015	J	0.0015	J	0.0024	0.02	---	none	7.5 Chlordane	No		SCss-076
beta-BHC	0.0032	J	0.0032	J	0.0024	0.02	---	7.42		No		SCsb-037
delta-BHC	0.0016	J	0.0016	J	0.0024	0.012	---	none	7.42*	No		SCsb-037
Dieldrin	0.0034	J	0.0034	J	0.0024	0.012	---	0.839		No		SCsb-037
Endosulfan II	0.0036	J	0.0036	J	0.0024	0.012	---	none	7.42*	No		SCsb-048
Endrin Aldehyde	0.005	J	0.005	J	0.004	0.02	---	none	7.42*	No		SCsb-037
gamma-Chlordane	0.0054	J	0.0054	J	0.0024	0.02	---	none	7.42*	No		SCsb-037

Table 6-9. Summary of Screening Results for COPCs in Deep Surface Soil (0 to 4 feet) for Military Training Land Use (continued).

Site-Related Chemical	Detected Concentrations				Detection Limits		Background	NGT FWCUG	Soil Industrial RSL	COPC?	COPC Justification	Location of MDC
All concentrations in mg/kg	Min	VQ	Max	VQ	Min	Max	BSV (mg/kg)					
Heptachlor	0.001	J	0.0081	J	0.0024	0.012	---	2.98		No		SCss-057
Heptachlor Epoxide	0.00071	J	0.00071	J	0.0024	0.02	---	1.48		No		SCsb-037
Lindane	0.0013	J	0.0013	J	0.0024	0.012	---	none	2.5	No		SCss-076
Methoxychlor	0.0016	J	0.0058	J	0.0024	0.012	---	none	410	No		SCss-076
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	0.027	J	0.027	J	0.4	0.43	---	none	26	No		SCss-061
1,2-Dichlorobenzene	0.024	J	0.11	J	0.4	0.43	---	none	930	No		SCss-061
1,3-Dichlorobenzene	0.031	J	0.031	J	0.4	0.43	---	none	930*	No		SCss-061
1,4-Dichlorobenzene	0.022	J	0.27	J	0.4	0.43	---	none	11	No		SCss-061
2-Methylnaphthalene	0.026	J	0.7		0.4	0.43	---	2,384		No		SCsb-050
Acenaphthene	0.029	J	0.7		0.4	0.43	---	none	4,500	No		SCsb-049
Acenaphthylene	0.029	J	0.16	J	0.4	0.43	---	none	4,500*	No		SCss-058
Anthracene	0.026	J	3.1		0.4	0.43	---	none	23,000	No		SCsb-049
Benzo(a)anthracene	0.027	J	8.2		0.4	2	---	4.77		No		SCsb-049
Benzo(a)pyrene	0.026	J	8.3		0.4	2	---	0.477		Yes	MDC exceeds risk value	SCsb-049
Benzo(b)fluoranthene	0.039	J	13		0.4	2	---	4.77		Yes	MDC exceeds risk value	SCsb-049
Benzo(g,h,i)perylenek	0.023	J	1.3		0.4	0.43	---	none	4.77*	No		SCsb-049
Benzo(k)fluoranthene	0.027	J	4.4		0.4	0.43	---	47.7		No		SCsb-049
Benzoic Acid	0.32	J	0.57	J	0.99	2.1	---	none	330,000	No		SCss-065
Bis(2-Ethylhexyl)phthalate	0.088	J	1.7		1	1.1	---	none	160	No		SCss-072
Carbazole	0.033	J	2.2		0.4	0.43	---	835		No		SCsb-049
Chrysene	0.034	J	7.6		0.4	2	---	477		No		SCsb-049
Dibenzo(a,h)anthracene	0.032	J	0.55		0.4	0.43	---	0.477		Yes	MDC exceeds risk value	SCsb-049
Dibenzofuran	0.027	J	0.84		0.4	0.43	---	1,192		No		SCsb-049
Diethyl Phthalate	0.069	J	0.14	J	0.4	0.43	---	none	66,000	No		SCss-075
Di-n-Butyl Phthalate	0.082	J	0.47		0.4	0.43	---	none	8,200	No		SCss-060
Fluoranthene	0.031	J	17		0.4	2	---	5,087		No		SCsb-049
Fluorene	0.031	J	1.1		0.4	0.43	---	11,458		No		SCsb-049
Indeno(1,2,3-cd)pyrene	0.024	J	1.6		0.4	0.43	---	4.77		No		SCsb-049
Isophorone	0.051	J	0.5		0.4	0.43	---	none	2,400	No		SCsb-037
Naphthalene	0.028	J	0.98		0.4	0.43	---	1,541		No		SCsb-049
Pentachlorophenol	0.38	J	0.52	J	1	1.1	---	44.0		No		SCss-060
Phenanthrene	0.026	J	11		0.4	2	---	none	4,500*	No		SCsb-049
Pyrene	0.029	J	13		0.4	2	---	3,815		No		SCsb-049
Volatile Organic Compounds												
1,2-Dimethylbenzene	0.013	J	0.35		0.053	0.07	---	none	280	No		SCsb-048
Benzene	0.06		0.06		0.053	0.07	---	none	5.1	No		SCsb-048
Ethylbenzene	0.15		0.15		0.053	0.07	---	none	25	No		SCsb-048
Toluene	0.012	J	0.31		0.053	0.07	---	none	4700	No		SCsb-048
Xylene (Total)	0.36		0.36		0.11	0.14	---	none	250	No		SCsb-048

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of 1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

[d] denotes RSL for cyanide used for total cyanide.

[e] denotes RSL for o-nitrotoluene used for m-nitrotoluene.

[f] denotes RSL for technical hexachlorocyclohexane (HCH) used for delta-BHC.

[g] denotes RSL for endosulfan used for endosulfan II.

[h] denotes RSL for endrin used for endrin aldehyde.

[i] denotes RSL for chlordane used for gamma-chlordane.

[j] denotes RSL for acenaphthene used for acenaphthylene.

[k] denotes RSL for pyrene used for benzo(g,h,i)perylene.

--- denotes no BSV available.

BSV denotes background screening value.

COPC denotes chemical of potential concern.

EPA denotes U.S. Environmental Protection Agency.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for the National Guard Trainee (NGT).a

HQ denotes hazard quotient.

ISM denotes incremental sampling method.

J denotes result should be considered estimated.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

ND denotes not detected.

NG denotes National Guard

RSL denotes EPA Regional Screening Level. (November 2015).

SAIC denotes Science Applications International Corporation

VQ denotes validation qualifier.

Table 6-10. Summary of Screening Results for COPCs in Subsurface Soil (1 to 13 feet) for Unrestricted (Residential) Land Use.

Site-Related Chemical	Range of Values, mg/kg				Reporting Limits		BSV (mg/kg)	RRA FWCUG[a] (mg/kg)	RRC FWCUG[a] (mg/kg)	RSL[b] (mg/kg)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations												
	Min	VQ	Max	VQ	Min	Max							
General Chemistry													
Cyanide, Total[d]	0.76		0.76		0.38	0.39	---			0.27	No	MDC below screening criteria	SCsb-048
Inorganics													
Antimony	0.11	J	11.2		0.27	1.4	0.96	13.6	2.82		Yes	MDC above screening criteria	SCsb-050
Arsenic	6		182		0.45	2.4	19.8	0.425	0.524		Yes	MDC above screening criteria	SCsb-037
Barium	33.4		932		0.027	0.14	124	8,966	1,413		No	MDC below screening criteria	SCsb-037
Beryllium	0.31		3.9		0.012	0.063	0.88			16	No	MDC below screening criteria	SCsb-037
Cadmium	0.062		5.5		0.021	0.11	0	22.3	6.41		No	MDC below screening criteria	SCsb-037
Chromium[c]	14		186		0.063	0.33	27.2	19,694	8147		No	MDC below screening criteria	SCsb-043
Copper	11.5		2,020		0.2	1	32.3	2,714	311		Yes	MDC above screening criteria	SCsb-036
Lead	6.6		907		0.14	0.73	19.1			400	Yes	MDC above screening criteria	SCsb-036
Mercury	0.0042	J	2		0.0079	0.08	0.044	16.5	2.27		No	MDC below screening criteria	SCsb-044
Nickel	14.9		88.1		0.061	0.32	60.7	1346	155		No	MDC below screening criteria	SCsb-048
Selenium	0.14	J	5.7		0.42	2.2	1.5			39	No	MDC below screening criteria	SCsb-037
Silver	0.13		13.5		0.056	0.29	0	324	38.6		No	MDC below screening criteria	SCsb-045
Thallium	0.34		17.3		0.28	0.73	0.91	4.76	0.612		Yes	MDC above screening criteria	SCsb-037
Vanadium	12.6		173		0.034	0.18	37.6	156	44.9		Yes	MDC above screening criteria	SCsb-037
Zinc	38.9		1,350		0.12	0.63	93.3	19,659	2321		No	MDC below screening criteria	SCsb-036
Explosives and Propellants													
2,4,6-Trinitrotoluene	0.1		0.1		0.43	0.49	---	21.1	3.65		No	MDC below screening criteria	SCsb-049
2-Amino-4,6-Dinitrotoluene	0.26		0.26		0.43	0.49	---	12.8	1.54		No	MDC below screening criteria	SCsb-049
m-Nitrotoluene[e]	0.32	J	0.32	J	0.43	0.49	---	6.03	3.88		No	MDC below screening criteria	SCsb-049
Polychlorinated Biphenyls													
Ar+L29+A29:N29+A29:N29	0.14	J	0.14	J	0.051	0.1	---	0.203	0.12		No	MDC near child FWCUG but < Adult FWCUG	SCsb-037
Pesticides													
4,4'-DDE	0.0051		0.0069	J	0.0024	0.02	---	4.08	2.63		No		SCsb-037
4,4'-DDT	0.009	J	0.013		0.0024	0.012	---			1.9	No		SCsb-048
Aldrin	0.0012	J	0.0012	J	0.0024	0.012	---	0.082	0.053		No		SCsb-037
alpha-BHC	0.0013	J	0.011	J	0.0024	0.02	---			0.086	No		SCsb-037
beta-BHC	0.0032	J	0.0032	J	0.0024	0.02	---	0.77	0.496		No		SCsb-037
delta-BHC[f]	0.0016	J	0.0016	J	0.0024	0.012	---			0.086 Alpha, 0.3 Beta	No		SCsb-037
Dieldrin	0.0034	J	0.0034	J	0.0024	0.012	---	0.087	0.056		No		SCsb-037
Endosulfan II[g]	0.0036		0.0036		0.0024	0.012	---			47 Endosulfan	No		SCsb-048
Endrin Aldehyde[h]	0.005	J	0.005	J	0.004	0.02	---	1.77	1.12		No		SCsb-037

Table 6-10. Summary of Screening Results for COPCs in Subsurface Soil (1 to 13 feet) for Unrestricted (Residential) Land Use (continued).

Site-Related Chemical	Range of Values, mg/kg				Reporting Limits		BSV (mg/kg)	RRA FWCUG[a] (mg/kg)	RRC FWCUG[a] (mg/kg)	RSL[b] (mg/kg)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations												
	Min	VQ	Max	VQ	Min	Max							
gamma-Chlordane[i]	0.0054	J	0.0054	J	0.0024	0.02	---			1.7 Chlordane	No		SCsb-037
Heptachlor	0.0009	J	0.0058	J	0.0024	0.012	---	0.308	0.198		No		SCsb-037
Heptachlor Epoxide	0.00071	J	0.00071	J	0.0024	0.02	---	0.152	0.098		No		SCsb-037
Methoxychlor	0.001	J	0.0058	J	0.0024	0.012	---			32	No		SCsb-037
Semivolatile Organic Compounds													
1,2-Dichlorobenzene	0.024	J	0.049	J	0.4	0.42	---			180	No		SCsb-037
1,4-Dichlorobenzene	0.022	J	0.022	J	0.4	0.42	---			2.6	No		SCsb-037
2-Methylnaphthalene	0.026	J	0.7		0.4	0.42	---	238	30.6		No		SCsb-050
Acenaphthene	0.029	J	0.7		0.4	0.42	---			360	No		SCsb-049
Acenaphthylene[j]	0.034	J	0.14	J	0.4	0.42	---			360*	No		SCsb-049
Anthracene	0.03	J	3.1		0.4	0.42	---			1,800	No		SCsb-049
Benzo(a)anthracene	0.046	J	8.2		0.4	2	---	0.221	0.65		Yes	MDC above screening criteria	SCsb-049
Benzo(a)pyrene	0.035		8.3		0.4	2	---	0.022	0.065		Yes	MDC above screening criteria	SCsb-049
Benzo(b)fluoranthene	0.039		13		0.4	2	---	0.221	0.65		Yes	MDC above screening criteria	SCsb-049
Benzo(g,h,i)perylene[k]	0.022	J	1.7		0.4	0.42	---			180 Pyrene	No		SCsb-036
Benzo(k)fluoranthene	0.027	J	4.4		0.4	0.42	---	2.21	6.5		No		SCsb-049
Benzoic Acid	0.32	J	0.32	J	0.98	2.1	---			25,000	No		SCsb-051
Bis(2-Ethylhexyl)phthalate	0.088	J	0.85	J	1	1.1	---			39	No		SCsb-040
Carbazole	0.033	J	2.2		0.4	0.42	---	69.4	44.6		No		SCsb-049
Chrysene	0.034	J	7.6		0.4	2	---	22.1	65		No		SCsb-049
Dibenzo(a,h)anthracene	0.032	J	0.55		0.4	0.42	---	0.022	0.065		Yes	MDC above screening criteria	SCsb-049
Dibenzofuran	0.035	J	0.84		0.4	0.42	---	119	15.3		No		SCsb-049
Di-n-Butyl Phthalate	0.081	J	0.27	J	0.4	0.42	---			630	No		SCsb-037
Fluoranthene	0.027	J	17		0.4	2	---	276	163		No		SCsb-049
Fluorene	0.034	J	1.1		0.4	0.42	---	737	243		No		SCsb-049
Indeno(1,2,3-cd)pyrene	0.024	J	1.6		0.4	0.42	---	0.221	0.65		Yes		SCsb-049
Isophorone	0.053	J	1.2		0.4	0.42	---			570	No		SCsb-036
Naphthalene	0.028	J	0.98		0.4	0.42	---	368	122		No		SCsb-049
Pentachlorophenol	0.38	J	0.38	J	1	1.1	---	2.12	4.91		No		SCsb-050
Phenanthrene	0.027	J	11		0.4	2	---			360*	No		SCsb-049
Pyrene	0.029	J	13		0.4	2	---	207	122		No		SCsb-049
Volatile Organic Compounds													
1,2-Dimethylbenzene	0.013	J	0.35		0.048	0.07	---			65	No		SCsb-048
Benzene	0.06		0.06		0.048	0.07	---			1.2	No		SCsb-048
Ethylbenzene	0.15		0.15		0.048	0.07	---			5.8	No		SCsb-048
Toluene	0.012	J	0.31		0.048	0.07	---			490	No		SCsb-048
Xylene (Total)	0.36		0.36		0.096	0.14	---			58	No		SCsb-048

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of 1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

[d] denotes RSL for cyanide used for total cyanide.

[e] denotes RSL for o-nitrotoluene used for m-nitrotoluene.

[f] denotes RSL for technical hexachlorocyclohexane (HCH) used for delta-BHC.

[g] denotes RSL for endosulfan used for endosulfan II.

[h] denotes RSL for endrin used for endrin aldehyde RSL for chlordane used for gamma-chlordane.

[j] denotes RSL for acenaphthene used for acenaphthylene.

[k] denotes RSL for pyrene used for benzo(g,h,i)perylene.

--- denotes no BSV available.

BSV denotes background screening value.

COPC denotes chemical of potential concern.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for Resident Receptor Adult (RRA) and Child (RRC).

HQ denotes hazard quotient.

J denotes result should be considered estimated.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

RSL denotes EPA Regional Screening Level (November 2015).

VQ denotes validation qualifier

Table 6-11. Summary of Screening Results for COPCs in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use.

Site-Related Chemical	Range of Values, mg/kg				Reporting Limits		BSV (mg/kg)	Industrial RSL[b] (mg/kg)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations										
	Min	VQ	Max	VQ	Min	Max					
General Chemistry											
Cyanide, Total[d]	0.76		0.76		0.38	0.39	---	1.2	No		SCsb-048
Inorganics											
Antimony	0.11	J	11.2		0.27	1.4	0.96	47	No		SCsb-050
Arsenic	6		182		0.45	2.4	19.8	3.0	Yes	MDC above screening criteria	SCsb-037
Barium	33.4		932		0.027	0.14	124	22,000	No		SCsb-037
Beryllium	0.31		3.9		0.012	0.063	0.88	230	No		SCsb-037
Cadmium	0.062		5.5		0.021	0.11	0	98	No		SCsb-037
Chromium[c]	14		186		0.063	0.33	27.2	180,000	No		SCsb-043
Copper	11.5		2,020		0.2	1	32.3	4,700	No		SCsb-036
Lead	6.6		907		0.14	0.73	19.1	800	Yes	MDC above screening criteria	SCsb-036
Mercury	0.0042	J	2		0.0079	0.08	0.044	35	No		SCsb-044
Nickel	14.9		88.1		0.061	0.32	60.7	2,200	No		SCsb-048
Selenium	0.14	J	5.7		0.42	2.2	1.5	580	No		SCsb-037
Silver	0.13		13.5		0.056	0.29	0	580	No		SCsb-045
Thallium	0.34		17.3		0.28	0.73	0.91	2.3	Yes	MDC above screening criteria	SCsb-037
Vanadium	12.6		173		0.034	0.18	37.6	580	No		SCsb-037
Zinc	38.9		1,350		0.12	0.63	93.3	35,000	No		SCsb-036
Explosives and Propellants											
2,4,6-Trinitrotoluene	0.1		0.1		0.43	0.49	---	51	No		SCsb-049
2-Amino-4,6-Dinitrotoluene	0.26		0.26		0.43	0.49	---	230	No		SCsb-049
m-Nitrotoluene[e]	0.32	J	0.32	J	0.43	0.49	---	8.2	No		SCsb-049
Polychlorinated Biphenyls											
Aroclor-1254	0.14	J	0.14	J	0.051	0.1	---	0.97	Yes		SCsb-037
Pesticides											
4,4'-DDE	0.0051		0.0069	J	0.0024	0.02	---	9.6	No		SCsb-037
4,4'-DDT	0.009	J	0.013		0.0024	0.012	---	8.5	No		SCsb-048
Aldrin	0.0012	J	0.0012	J	0.0024	0.012	---	0.18	No		SCsb-037
alpha-BHC	0.0013	J	0.011	J	0.0024	0.02	---	0.36	No		SCsb-037
beta-BHC	0.0032	J	0.0032	J	0.0024	0.02	---	1.3	No		SCsb-037
delta-BHC[f]	0.0016	J	0.0016	J	0.0024	0.012	---	0.36 Alpha. 1.3 Beta	No		SCsb-037
Dieldrin	0.0034	J	0.0034	J	0.0024	0.012	---	0.14	No		SCsb-037
Endosulfan II[g]	0.0036		0.0036		0.0024	0.012	---	700 Endosulfan	No		SCsb-048

Table 6-11. Summary of Screening Results for COPCs in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use (continued).

Site-Related Chemical	Range of Values, mg/kg				Reporting Limits		BSV (mg/kg)	Industrial RSL[b] (mg/kg)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations										
	Min	VQ	Max	VQ	Min	Max					
General Chemistry											
Endrin Aldehyde[h]	0.005	J	0.005	J	0.004	0.02	---	25 Endrin	No		SCsb-037
gamma-Chlordane[i]	0.0054	J	0.0054	J	0.0024	0.02	---	7.5 Chlordane	No		SCsb-037
Heptachlor	0.0009	J	0.0058	J	0.0024	0.012	---	0.63	No		SCsb-037
Heptachlor Epoxide	0.00071	J	0.00071	J	0.0024	0.02	---	0.33	No		SCsb-037
Methoxychlor	0.001	J	0.0058	J	0.0024	0.012	---	410	No		SCsb-037
Semivolatile Organic Compounds											
1,2-Dichlorobenzene	0.024	J	0.049	J	0.4	0.42	---	930	No	MDC below screening criteria	SCsb-037
1,4-Dichlorobenzene	0.022	J	0.022	J	0.4	0.42	---	11	No	MDC below screening criteria	SCsb-037
2-Methylnaphthalene	0.026	J	0.7		0.4	0.42	---	300	No	MDC below screening criteria	SCsb-050
Acenaphthene	0.029	J	0.7		0.4	0.42	---	4,500	No	MDC below screening criteria	SCsb-049
Acenaphthylene[j]	0.034	J	0.14	J	0.4	0.42	---	4,500*	No	MDC below screening criteria	SCsb-049
Anthracene	0.03	J	3.1		0.4	0.42	---	23,000	No	MDC below screening criteria	SCsb-049
Benzo(a)anthracene	0.046	J	8.2		0.4	2	---	2.9	Yes	MDC above screening criteria	SCsb-049
Benzo(a)pyrene	0.035		8.3		0.4	2	---	0.29	Yes	MDC above screening criteria	SCsb-049
Benzo(b)fluoranthene	0.039		13		0.4	2	---	2.9	No		SCsb-049
Benzo(g,h,i)perylene[k]	0.022	J	1.7		0.4	0.42	---	0.29*	No		SCsb-036
Benzo(k)fluoranthene	0.027	J	4.4		0.4	0.42	---	29	No		SCsb-049
Benzoic Acid	0.32	J	0.32	J	0.98	2.1	---	33,000	No		SCsb-051
Bis(2-Ethylhexyl)phthalate	0.088	J	0.85	J	1	1.1	---	160	No		SCsb-040
Carbazole	0.033	J	2.2		0.4	0.42	---	835* FWCUG	No		SCsb-049
Chrysene	0.034	J	7.6		0.4	2	---	290	No		SCsb-049
Dibenzo(a,h)anthracene	0.032	J	0.55		0.4	0.42	---	0.29	Yes	MDC above screening criteria	SCsb-049
Dibenzofuran	0.035	J	0.84		0.4	0.42	---	100	No		SCsb-049
Di-n-Butyl Phthalate	0.081	J	0.27	J	0.4	0.42	---	8,200	No		SCsb-037
Fluoranthene	0.027	J	17		0.4	2	---	3,000	No		SCsb-049
Fluorene	0.034	J	1.1		0.4	0.42	---	3,000	No		SCsb-049
Indeno(1,2,3-cd)pyrene	0.024	J	1.6		0.4	0.42	---	2.9	No		SCsb-049
Isophorone	0.053	J	1.2		0.4	0.42	---	2,400	No		SCsb-036
Naphthalene	0.028	J	0.98		0.4	0.42	---	17	No		SCsb-049
Pentachlorophenol	0.38	J	0.38	J	1	1.1	---	4	No		SCsb-050
Phenanthrene	0.027	J	11		0.4	2	---	4,500*	No		SCsb-049
Pyrene	0.029	J	13		0.4	2	---	2,300	No		SCsb-049
Volatile Organic Compounds											
1,2-Dimethylbenzene	0.013	J	0.35		0.048	0.07	---	280	No		SCsb-048
Benzene	0.06		0.06		0.048	0.07	---	5.1	No		SCsb-048
Ethylbenzene	0.15		0.15		0.048	0.07	---	25	No		SCsb-048
Toluene	0.012	J	0.31		0.048	0.07	---	4,700	No		SCsb-048

Table 6-11. Summary of Screening Results for COPCs in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use (continued).

Site-Related Chemical	Range of Values, mg/kg				Reporting Limits		BSV (mg/kg)	Industrial RSL[b] (mg/kg)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations										
	Min	VQ	Max	VQ	Min	Max					
Xylene (Total)	0.36		0.36		0.096	0.14	---	250	No		SCsb-048

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of 1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

[d] denotes RSL for cyanide used for total cyanide.

[e] denotes RSL for o-nitrotoluene used for m-nitrotoluene.

[f] denotes RSL for technical hexachlorocyclohexane (HCH) used for delta-BHC.

[g] denotes RSL for endosulfan used for endosulfan II.

[h] denotes RSL for endrin used for endrin aldehyde RSL for chlordane used for gamma-chlordane.

[j] denotes RSL for acenaphthene used for acenaphthylene.

[k] denotes RSL for pyrene used for benzo(g,h,i)perylene.

--- denotes no BSV available.

BSV denotes background screening value.

COPC denotes chemical of potential concern.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for Resident Receptor Adult (RRA) and Child (RRC).

HQ denotes hazard quotient.

J denotes result should be considered estimated.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

RSL denotes EPA Regional Screening Level (November 2015).

VQ denotes validation qualifier

Table 6-12. Summary of Screening Results for COPCs in Subsurface Soil (1 to 4 feet) for the Military Training Land Use using the maximum detected concentration.

Site-Related Chemical	Range of Values, mg/kg				Reporting Limits		BSV (mg/kg)	NGT FWCUG[a] (mg/kg)	RSL[b] (mg/kg)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations											
	Min	VQ	Max	VQ	Min	Max						
Inorganics												
Antimony	0.58		1.5		0.27	1.1	0.96	175		No		SCsb-037
Arsenic	6		155		0.45	1.8	19.8	2.78		Yes	MDC above screening criteria	SCsb-037
Barium	40.7		326		0.027	0.11	124	351		No		SCsb-037
Beryllium	0.33		2		0.012	0.049	0.88		230	No		SCsb-037
Cadmium	0.067		5.5		0.021	0.085	0	10.9		No		SCsb-037
Chromium[c]	30.6		186		0.064	0.26	27.2	329,763		No		SCsb-037
Copper	16.3		209		0.2	0.81	32.3	25,368		No		SCsb-037
Lead	6.6		507		0.14	0.57	19.1		800	No		SCsb-037
Mercury	0.0042	J	0.3		0.008	0.0081	0.044	172		No		SCsb-037
Selenium	0.14	J	5.7		0.42	1.7	1.5		580	No		SCsb-037
Silver	0.29		0.29		0.057	0.23	0	3,105		No		SCsb-037
Thallium	0.7		17.3		0.28	0.57	0.91	47.7		No		SCsb-037
Vanadium	12.6		173		0.034	0.14	37.6	2,304		No		SCsb-037
Zinc	54.1		490		0.12	0.49	93.3	187,269		No		SCsb-037
Pesticides												
alpha-BHC	0.0013	J	0.0013	J	0.0024	0.0024	---		7.42*	No		SCsb-040
Heptachlor	0.00091	J	0.00091	J	0.0024	0.0024	---	2.98		No		SCsb-040
Methoxychlor	0.001	J	0.001	J	0.0024	0.0024	---		410	No		SCsb-040
Semivolatile Organic Compounds												
1,2-Dichlorobenzene	0.043	J	0.043	J	0.4	0.41	---		930	No		SCsb-037
1,4-Dichlorobenzene	0.022	J	0.022	J	0.4	0.41	---		11	No		SCsb-037
2-Methylnaphthalene	0.19	J	0.28	J	0.4	0.41	---	2384		No		SCsb-035
Benzo(a)anthracene	0.053	J	0.053	J	0.4	0.41	---	4.77		No		SCsb-037
Benzo(a)pyrene	0.036	J	0.048	J	0.4	0.41	---	0.477		No		SCsb-037
Benzo(b)fluoranthene	0.062	J	0.12	J	0.4	0.41	---	4.77		No		SCsb-037
Benzo(g,h,i)perylene	0.038	J	0.14	J	0.4	0.41	---		4.77*	No		SCsb-035
Benzo(k)fluoranthene	0.027	J	0.027	J	0.4	0.41	---	47.7		No		SCsb-037
Bis(2-Ethylhexyl)phthalate	0.85	J	0.85	J	1	1	---		160	No		SCsb-040
Chrysene	0.089	J	0.089	J	0.4	0.41	---	477		No		SCsb-037
Dibenzofuran	0.035	J	0.055	J	0.4	0.41	---	1,192		No		SCsb-037
Di-n-Butyl Phthalate	0.081	J	0.27	J	0.4	0.41	---		8,200	No		SCsb-037
Fluoranthene	0.027	J	0.17	J	0.4	0.41	---	5,087		No		SCsb-037
Fluorene	0.034	J	0.044	J	0.4	0.41	---	11,458		No		SCsb-035
Indeno(1,2,3-cd)pyrene	0.025	J	0.025	J	0.4	0.41	---	4.77		No		SCsb-037
Isophorone	0.062	J	0.5		0.4	0.41	---		2,400	No		SCsb-039
Naphthalene	0.053	J	0.15	J	0.4	0.41	---	1,541		No		SCsb-037
Phenanthrene	0.11	J	0.19	J	0.4	0.41	---		360*	No		SCsb-037
Pyrene	0.072	J	0.15	J	0.4	0.41	---	3,815		No		SCsb-037

Table 6-12. Summary of Screening Results for COPCs in Subsurface Soil (1 to 4 feet) for the Military Training Land Use using the maximum detected concentration (continued).

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

--- denotes no BSV available.

BSV denotes background screening value.

COPC denotes chemical of potential concern.

EPA denotes U.S. Environmental Protection Agency.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for National Guard Trainee (NGT).

HQ denotes hazard quotient.

J denotes result should be considered estimated.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

RSL denotes EPA Regional Screening Level (November 2015).

SAIC denotes Science Applications International Corporation.

VQ denotes validation qualifier.

Table 6-13. Summary of Screening Results for COPCs in Sediment (0 to 0.5 foot) for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use.

Site-Related Chemical	Range of Values, mg/kg						BSV (mg/kg)	RRA FWCUG[a] (mg/kg)	RRC FWCUG[a] (mg/kg)	NGT FWCUG[a] (mg/kg)	RSL[b] (mg/kg)	COPC	COPC Justification	Location of MDC
	Detected Concentrations				Reporting Limits									
	Min	VQ	Max	VQ	Min	Max								
General Chemistry														
Cyanide, Total[d]	0.32	J	0.36	J	0.39	0.39	---				160	No		SCsd-070
Inorganics														
Antimony	0.45	J	8.4		1.4	1.4	0	13.6	2.82	175		Yes	MDC above screening criteria for Resident Child	SCsd-070
Barium	75.7		231		0.14	0.14	123	8,966	1,413	351		No		SCsd-070
Beryllium	0.41		0.47		0.061	0.061	0.38				16	No		SCsd-071
Cadmium	0.19		2.7		0.11	0.11	0	22.4	6.41	10.9		No		SCsd-070
Chromium[c]	40.9		107		0.32	0.32	18.1	19,694	8147	329,763		No		SCsd-071
Copper	16.6		53.7		1	1	27.6	2714	311	25,368		No		SCsd-070
Lead	7.2		104		0.71	0.71	27.4				400	No		SCsd-070
Mercury	0.049		0.3		0.008	0.0081	0.059	16.5	2.27	172		No		SCsd-070
Nickel	20		21.1		0.31	0.31	17.7	1,346	155	12,639		No		SCsd-070
Silver	116		116		0.29	57	0	324	38.6	3,105		Yes	MDC above screening criteria for Resident Child	SCsd-070
Thallium	1.1		1.2		0.71	0.71	0.89	4.76	0.612	47.7		Yes	MDC above screening criteria for Resident Child	SCsd-070
Explosives and Propellants														
Nitroguanidine	0.69		1.2	J	0.16	0.16	---				610	No		SCsd-071
Polychlorinated Biphenyls														
Aroclor-1262	0.094		0.094		0.051	0.051	---	0.203	0.349	3.46		No		SCsd-070
Aroclor-1254	0.15	J	0.15	J	0.051	0.051	---	0.203	0.12	3.46		No	MDC below screening criteria for Resident Adult, similar to FWCUG for Resident Child	SCsd-070
Pesticides														
4,4'-DDD	0.00061	J	0.0034		0.0024	0.0024	---				2	No		SCsd-070
4,4'-DDE	0.0043		0.0043		0.004	0.0041	---	4.08	2.63	49.1		No		SCsd-070
4,4'-DDT	0.00091	J	0.0068	J	0.0024	0.0024	---				1.7	No		SCsd-070
alpha-Chlordane	0.0023	J	0.0023	J	0.004	0.0041	---				1.6	No		SCsd-070
beta-BHC	0.0012	J	0.0012	J	0.004	0.0041	---				0.27	No		SCsd-070
delta-BHC[e]	0.0017		0.0017		0.0024	0.0024	---				0.27	No		SCsd-070
Dieldrin	0.0046		0.0046		0.0024	0.0024	---	0.087	0.056	0.839		No		SCsd-070

Table 6-13. Summary of Screening Results for COPCs in Sediment (0 to 0.5 foot) for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use (continued).

Site-Related Chemical	Range of Values, mg/kg						BSV (mg/kg)	RRA FWCUG[a] (mg/kg)	RRC FWCUG[a] (mg/kg)	NGT FWCUG[a] (mg/kg)	RSL[b] (mg/kg)	COPC	COPC Justification	Location of MDC
	Detected Concentrations				Reporting Limits									
	Min	VQ	Max	VQ	Min	Max								
Endosulfan Sulfate	0.0055	J	0.0055	J	0.004	0.0041	---				37	No		SCsd-070
Endrin Aldehyde[f]	0.0063		0.0063		0.004	0.0041	---	1.77	1.12			No		SCsd-070
gamma-Chlordane[g]	0.0078		0.0078		0.004	0.0041	---				1.6	No		SCsd-070
Heptachlor	0.002	J	0.0057	J	0.0024	0.0024	---	0.308	0.198	2.98		No		SCsd-070
Methoxychlor	0.0016	J	0.0021	J	0.0024	0.0024	---				31	No		SCsd-070
Semivolatile Organic Compounds														
1,2-Dichlorobenzene	0.044	J	0.044	J	0.4	0.41	---				19	No		SCsd-070
1,4-Dichlorobenzene	0.04	J	0.04	J	0.4	0.41	---				2.4	No		SCsd-070
2-Methylnaphthalene	0.043	J	0.043	J	0.4	0.41	---	238	30.6	2384		No		SCsd-070
Benzo(a)anthracene	0.057	J	0.057	J	0.4	0.41	---	0.221	0.65	4.77		No		SCsd-070
Benzo(a)pyrene	0.067	J	0.067	J	0.4	0.41	---	0.022	0.065	0.477		Yes	MDC above Residential screening criteria	SCsd-070
Benzo(b)fluoranthene	0.046	J	0.11	J	0.4	0.41	---	0.221	0.65	4.77		No		SCsd-070
Benzo(g,h,i)perylene[h]	0.026	J	0.026	J	0.4	0.41	---	0.221	0.65	4.77		No		SCsd-070
Benzo(k)fluoranthene	0.047	J	0.047	J	0.4	0.41	---	2.21	6.5	47.7		No		SCsd-070
Chrysene	0.027	J	0.07	J	0.4	0.41	---	22.1	65	477		No		SCsd-070
Di-n-Butyl Phthalate	0.11	J	0.3	J	0.4	0.41	---				610	No		SCsd-070
Fluoranthene	0.047	J	0.089	J	0.4	0.41	---	276	163	5,087		No		SCsd-070
Indeno(1,2,3-cd)pyrene	0.026	J	0.026	J	0.4	0.41	---	0.221	0.65	47.7		No		SCsd-070
Naphthalene	0.029	J	0.029	J	0.4	0.41	---	368	122	1,541		No		SCsd-070
Phenanthrene	0.027	J	0.053	J	0.4	0.41	---	276*	163*	477*		No		SCsd-070
Pyrene	0.04	J	0.089	J	0.4	0.41	---	207	122	3,815		No		SCsd-070

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.

[b] denotes RSL for residential soil based on noncancer risk adjusted to HQ of 0.1 (as opposed to published value based on HQ of 1) except for lead.

[c] denotes total chromium assumed to be trivalent, since hexavalent chromium was not detected.

[d] denotes RSL for cyanide used for total cyanide.

[e] denotes RSL for technical hexachlorocyclohexane (HCH) used for delta BHC.

[f] denotes FWCUG for endrin used for endrin aldehyde.

[g] denotes RSL for chlordane used for gamma chlordane.

[h] denotes RSL for pyrene used for benzo(g,h,i)perylene. --- denotes no BSV available.

BSV denotes background screening value.

COPC denotes chemical of potential concern.

EPA denotes U.S. Environmental Protection Agency.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for Resident Farmer Adult (RFA) and Child (RFC) and National Guard Trainee (NGT).

HQ denotes hazard quotient.

ISM denotes incremental sampling method.

J denotes result should be considered estimated. MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

RSL denotes EPA Regional Screening Level (November 2015).

SAIC denotes Science Applications International Corporation.

VQ denotes validation qualifier.

Table 6-14. Summary of Screening Results for COPCs in Surface Water for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land.

Chemical	Range of Values, µg/L						BSV (µg/L)	RRA FWCUG[a] (µg/L)	RRC FWCUG[a] (µg/L)	NGT FWCUG[a] (µg/L)	RSL (µg/L)	COPC?	COPC Justification	Location of MDC
	Detected Concentrations				Reporting Limits									
	Min	VQ	Max	VQ	Min	Max								
Inorganics														
Antimony	2.9		2.9		1.9	6	0	17.1	4.91	6.45		No		S-7
Arsenic	2.2		6.6		2	4.9	3.2	1.1	1.2	4.17		Yes	MDC above screening criteria	S-7
Chromium	0.66		1.4		10	10	0	28,442	11,173	6,165		No		S-7
Cobalt	0.4		0.4		1.6	5	0				4.7	No		S-7
Lead	2.9		2.9		2	8	0				15[b]	No		S-7
Silver	1.1		1.1		2.5	5	0	348	76.8	900		No		S-7
Vanadium	0.5		0.5		0.5	5	0	211	70.6	57.2		No		S-7
Semivolatile Organic Compounds														
Bis(2-Ethylhexyl)Phthalate	2.1		2.1		4.9	12	---	3.49	2,68	6.79		No		S-7
Di-n-Butyl Phthalate	3.85		3.85		4.9	11	---				670	No		S-7
Nutrients														
Phosphorus (Total as P)	430		430		NA	NA	---					No	No algae present	S-7
Nitrate-N + Nitrite-N	130		130		NA	NA	---				10,000[b]	No		S-7

[a] denotes the FWCUG used is the lower of the noncarcinogenic FWCUG at HQ of 0.1 and carcinogenic FWCUG at 10^{-6} risk.
[b] denotes the EPA Maximum Contaminant Limit (EPA, 2012) was used since no RSL is available.
[c] denotes total phosphorus as P shall be limited to the extent necessary to prevent nuisance growths of algae, weeds, and slimes in violation of the OAC 3745-1-04.
µg/L denotes micrograms per liter.
--- denotes no BSV available.
BSV denotes background screening value.
COPC denotes chemical of potential concern.
EPA denotes U.S. Environmental Protection Agency.
FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010) for Resident Receptor Adult (RRA) and Child (RRC) and National Guard Trainee (NGT).
HQ denotes hazard quotient.
J denotes results should be considered estimated.
MDC denotes maximum detected concentration.
NA denotes the reporting limits were not provided for the 2003 FWBWQS.
OAC denotes Ohio Administrative Code.
RSL denotes EPA Regional Screening Levels (November 2015).
SAIC denotes Science Applications International Corporation.
VQ denotes validation qualifier.

Table 6-15. Summary of COPCs in identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Uses.

Receptor/Exposure Point	COPCs Identified[a]	
Surface Soil (0 to 1 foot bgs)		
Unrestricted (Residential) Land Use	Antimony	Benzo(a)anthracene
	Arsenic	Benzo(a)pyrene
	Cadmium	Benzo(b)fluoranthene
	Copper	Indeno(1,2,3-cd)pyrene
	Mercury	Silver
	Thallium	
Surface Soil (0 to 1 foot bgs)		
Commercial Industrial Land Use	Arsenic	Benzo(a)pyrene
	Thallium	
Deep Surface Soil (0 to 4 feet bgs)		
Military Training Land Use	Arsenic	Benzo(a)pyrene
	Barium	Benzo(b)fluoranthene
	Cadmium	Dibenzo(a,h)anthracene
	Cobalt	
Subsurface Soil (1 to 13 feet bgs)		
Unrestricted (Residential) Land Use	Antimony	Benzo(a)anthracene
(1 to 13 feet bgs)	Arsenic	Benzo(a)pyrene
	Copper	Benzo(b)fluoranthene
	Lead	Dibenzo(a,h)anthracene
	Thallium	Vanadium
	Vanadium	
Subsurface Soil (1 to 13 feet bgs)		
Commercial Industrial Land Use	Arsenic	Benzo(a)anthracene
(1 to 13 feet bgs)	Lead	Benzo(a)pyrene
	Thallium	Dibenzo(a,h)anthracene
Subsurface Soil (4 to 7 feet bgs)		
Military Training Land Use	Arsenic	
(4 to 7 feet bgs)		
Sediment (0 to 0.5 foot bgs)		
Unrestricted (Residential) Land Use No COPCs in sediment for Commercial Industrial or Military Training Land Uses	Antimony	Benzo(a)pyrene
	Silver	
	Thallium	
Surface Water		
Unrestricted (Residential) Land Use, Commercial Industrial, and Military Training Land Uses	Arsenic	

*[a] denotes COPCs identified by screening **Tables 6-7** through **6-15**.*

COPC denotes chemical of potential concern.

bgs denotes below ground surface.

Table 6-16. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Unrestricted (Residential) Land Use (Resident Receptor Adult and Child) for using the maximum detected concentration at the Sand Creek Disposal Road Landfill.

Parameter	EPC[a] (mg/kg)	RRA/RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRA/RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Mercury	24.6	165/68.2	Hand tremor, memory disturbance, objective autonomic dysfunction	0.14/0.36		No	Sum of ratios by target organ < 1
Thallium	1.21	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.025/0.065		No	Sum of ratios by target organ < 1
		Neurotoxicity Effects Sum of Ratios RRA:		**0.16**	**Neurotoxicity Effects Sum of Ratios RRC: 0.43**		
Gastrointestinal Effects							
Copper	726	27,138/3106	Gastrointestinal, hepatic, and renal effects	0.026/		No	Sum of ratios by target organ <
Silver	256	3240/386	Gastrointestinal effects	0.079		No	Sum of ratios by target organ <
Thallium	3.2	47.6/.18.4	Gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.067		No	Sum of ratios by target organ <
		Gastrointestinal Effects Sum of Ratios RRA:		**0.17**	**Gastrointestinal Effects Sum of Ratios RRC: 1.0**		

Table 6-16. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Unrestricted (Residential) Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill (continued).

Parameter	EPC[a] (mg/kg)	RRA /RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRA/RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Vascular Effects							
Antimony	17.10	136/28.2	Longevity, blood glucose, and cholesterol	0.125/0.42		No	Sum of ratios by target organ ≤ 1
Arsenic	36.6	82.1/20.2	Hyperpigmentation, keratosis, and possible vascular complications	0.43/0.53		No	Sum of ratios by target organ ≤ 1
			Vascular Effects Sum of Ratios RRA:	**0.55**	**Vascular Effects Sum of Ratios RRC:**		**0.95**
Renal Effects							
Cadmium	12.9	223/64.1	Significant proteinuria	0.057/0.20		No	Sum of ratios by target organ ≤ 1
Copper	726	27,138/3106	Gastrointestinal, hepatic, and renal effects	0.026/0.23		No	Sum of ratios by target organ ≤ 1
Thallium	1.21	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.025/0.067		No	Sum of ratios by target organ ≤ 1
			Renal Effects Sum of Ratios RRA:	**0.18**	**Renal Effects Sum of Ratios RRC:**		**0.49**

Table 6-16. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Unrestricted (Residential) Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill (continued).

Parameter	EPC[a] (mg/kg)	RRA /RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRC /RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Liver Effects							
Copper	726	27,138/3106	Gastrointestinal, hepatic, and renal effects	0.026/0.23		No	Sum of ratios by target organ ≤ 1
Thallium	1.21	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.025/0.067		No	Sum of ratios by target organ ≤ 1
			Liver Effects Sum of Ratios for Adult RR:	**0.051**	**Liver Effects Sum of Ratios for Child RR:**		**0.29**
Skin and Eye Effects							
Arsenic	36.6	82.1/20.2	Hyperpigmentation, keratosis, and possible vascular complications	0.43/0.56		No	Sum of ratios by target organ > 1
			Skin and Eye Effects Sum of Ratio:	**0.43**	**Skin and Eye Effects Sum of Ratio (child):**		**0.56**

[a] denotes the EPC is the maximum concentration.

[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1, only decisions based on FWCUG for the Adult since these are chronic non-cancer effects although the child is lower for noncancer effects; the EPA RSL (2015) is used for lead. [c] denotes lead is considered separately due to is unique effects. COC denotes chemical of concern. EPA denotes U.S. Environmental Protection Agency. EPC denotes exposure point concentration. FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010). HQ denotes hazard quotient. mg/kg denotes milligrams per kilogram. RRC denotes Residential Receptor Child. RSL denotes Regional Screening Level. SAIC denotes Science Applications International Corporation.

Table 6-17. Summary of COC Evaluation for Cancer Risk in Surface Soil (0 to 1 foot) for Unrestricted (Residential) Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	RRA FWCUG [b] (mg/kg)	Ratio of EPC to RRA FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Antimony	17	0.96	NA	NA	NA	No	Not carcinogenic
Arsenic	36.60	15.4	4.25	2.3 (used BG)	13.6%	Yes	Contribution to sum > 5%
Cadmium	12.9	0	12,491	0.001	0.005%	No	Contribution to sum ≤ 5%
Copper	726	17.7	NA	NA	NA	No	Not carcinogenic
Mercury	24.6	0.036	NA	NA	NA	No	Not carcinogenic
Silver	256	0	NA	NA	NA	No	Not carcinogenic
Thallium	3.20	0	NA	NA	NA	No	Not carcinogenic
Benzo(a)anthracene	2.6	---	2.2	1.18	6.9%	Yes	Ratio > 1
Benzo(a)pyrene	2.4	---	0.221	10.9	64.5%	Yes	Contribution to sum > 5%
Benzo(b)fluoranthene	4.8	---	2.21	2.17	12.8%	Yes	Contribution to sum > 5%
Indeno(1,2,3-cd)pyrene	0.81	---	2.21	0.367	2.17%	No	Contribution to sum ≤ 5%
	Cancer Risk Sum of Ratios: 16.9						

[a] denotes the EPC is the maximum concentration.

[c] denotes phenanthrene is shown with its maximum concentration. It could not be evaluated due to lack of screening values and toxicity values to develop screening values.

--- denotes no BSV is available for this analyte. BSV denotes background screening value. COC denotes chemical of concern. EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram. NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

RRA denotes Residential Receptor Adult. The RRA was used to make decisions instead of the RRC since the effects are long term and chronic. SAIC denotes Science Applications International Corporation. RSL denotes USEPA Regional Screening Value (November, 2015).

Table 6-18. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Commercial Industrial Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill.

Parameter	EPC[a] (mg/kg)	Industrial Receptor RSL[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Thallium	1.21	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.05		No	Sum of ratios by target organ < 1
			Neurotoxicity Effects Sum of Ratios:	**0.05**			
Gastrointestinal Effects							
Thallium	1.21	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.05		No	Sum of ratios by target organ < 1
			Gastrointestinal Effects Sum of Ratios:	**0.05**			
Vascular Effects							
Arsenic	36.6	480	Hyperpigmentation, keratosis, and possible vascular complications	0.07		No	Sum of ratios by target organ $\leq$ 1
			Vascular Effects Sum of Ratios:	**0.07**			

Table 6-18. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Commercial Industrial Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill (continued).

Parameter	EPC[a] (mg/kg)	Industrial Receptor RSL[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Renal Effects							
Thallium	1.21	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.025		No	Sum of ratios by target organ < 1
			Renal Effects Sum of Ratios:	**0.36**			
Liver Effects							
Thallium	1.21	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.025		No	Sum of ratios by target organ < 1
			Liver Effects Sum of Ratios:	**0.14**			
Skin and Eye Effects							
Arsenic	36.6	480	Hyperpigmentation, keratosis, and possible vascular complications	0.04		No	Sum of ratios by target organ ≤ 1
			Skin and Eye Effects Sum of Ratios:	**0.18**			

Table 6-18. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Commercial Industrial Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill (continued).

[a] denotes EPC is the maximum concentration.

[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1; the EPA RSL (2011) is used for lead.

[c] denotes lead is considered separately due to its unique effects.

BSV denotes background screening value.

COC denotes chemical of concern.

EPA denotes U.S. Environmental Protection Agency.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for noncancer effects or no FWCUG or other risk-screening criteria.

NGT denotes National Guard Trainee.

RSL denotes Regional Screening Level (November, 2015)l.

SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

Table 6-19. Summary of COC Evaluation for Cancer Risk in Surface Soil (0 to 1 foot) for Commercial Industrial Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	Industrial Receptor RSL[b] (mg/kg)	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	36.6	15.4	30	1.2	56.7 %	Yes	Contribution to sum > 5%
Thallium	1.21	0	NA	NA	NA	No	Not carcinogenic
Benzo(a)pyrene	2.4	---	2.62	0.91	43.3%	Yes	Contribution to sum > 5%
Cancer Risk Sum of Ratios: 2.1							

[a] *denotes EPC is 95 percent of the UCL. See* ***Appendix F****.*

[b] *denotes FWCUG is excess cancer risk at* 10^{-5}.

[c] *denotes phenanthrene is shown with its maximum concentration. It could not be evaluated due to lack of screening values and toxicity values to develop screening values.*

--- denotes no BSV is available for this analyte.

BSV denotes background screening value.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

NGT denotes National Guard Trainee.

RMS denotes Range Maintenance Soldier.

SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

RSL denotes Regional Screening Level (November, 2015).

Table 6-20. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Military Training Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill.

Parameter	EPC[a] (mg/kg)	NGT FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Cobalt	19.7	140	NA	0.14		No	Sum of ratios by target organ ≤ 1
			Neurotoxicity Effects Sum of Ratios:	**0.14**			
Gastrointestinal Effects							
Cobalt	19.7	140	NA	0.14		No	Sum of ratios by target organ ≤ 1
			Gastrointestinal Effects Sum of Ratios:	**0.14**			
Vascular Effects							
Arsenic	36.6	1140	Hyperpigmentation, keratosis, and possible vascular complications	0.04		No	Sum of ratios by target organ ≤ 1
Cobalt	19.7	140	NA	0.14	78%	No	Sum of ratios by target organ ≤ 1
			Vascular Effects Sum of Ratios:	**0.18**			

Table 6-20. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Military Training Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill (continued).

Parameter	EPC[a] (mg/kg)	NGT FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Renal Effects							
Barium	764	3,506	Nephropathy	0.22		No	Sum of ratios by target organ $\leq$ 1
Cadmium	12.9	3,292	Significant proteinuria	0.005		No	Sum of ratios by target organ $\leq$ 1
Cobalt	19.7	140	NA	0.14		No	Sum of ratios by target organ $\leq$ 1
			Renal Effects Sum of Ratios:	**0.36**			
Liver Effects							
Cobalt	19.7	140	NA	0.14		No	Sum of ratios by target organ $\leq$ 1
			Liver Effects Sum of Ratios:	**0.14**			

Table 6-20. Summary of COC Evaluation for Noncancer Effects in Surface Soil (0 to 1 foot) for Military Training Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill (continued).

Parameter	EPC[a] (mg/kg)	NGT FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Skin and Eye Effects							
Arsenic	36.6	1140	Hyperpigmentation, keratosis, and possible vascular complications	0.03		No	Sum of ratios by target organ ≤ 1
Cobalt	19.7	140	NA	0.14		No	Sum of ratios by target organ ≤ 1
			Skin and Eye Effects Sum of Ratios:	**0.17**			

[a] *denotes EPC is the maximum concentration.*

[b] *denotes FWCUG is noncarcinogenic FWCUG at HQ of 1; the EPA RSL (2011) is used for lead.*

[c] *denotes lead is considered separately due to its unique effects.*

BSV denotes background screening value. COC denotes chemical of concern.

EPA denotes U.S. Environmental Protection Agency.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for noncancer effects or no FWCUG or other risk-screening criteria.

NGT denotes National Guard Trainee. RMS denotes Range Maintenance Soldier. RSL denotes Regional Screening Level. SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

RSL denotes Regional Screening Level (November, 2015).

Table 6-21. Summary of COC Evaluation for Cancer Risk in Deep Surface Soil (0 to 1 foot) for Military Training Land Use using the maximum detected concentration at the Sand Creek Disposal Road Landfill.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	NGT FWCUG[b] (mg/kg)	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	36.6	15.4	27.8	1.3	56%	Yes	Contribution to sum > 5%
Barium	764	88.4	NA	NA	NA	No	Not carcinogenic
Cadmium	12.9	ND	109	0.118	5.0%	No	Contribution to sum ≤ 5%
Cobalt	19.7	10.4	70.3	0.28	12.0%	Yes	Contribution to sum > 5%
Benzo(a)pyrene	2.4	---	4.7	0.51	22.0%	Yes	Contribution to sum > 5%
Benzo(b)fluoranthene	4.8	---	47.7	0.10	4.0%	No	Contribution to sum ≤ 5%
Dibenz(a,h)anthracene	0.28	---	4.77	0.059	2.0 %	No	Contribution to sum ≤ 5%
		Cancer Risk Sum of Ratios:		**2.3**			

[b] *denotes FWCUG is excess cancer risk at 10^{-5}.*

[c] *denotes phenanthrene is shown with its maximum concentration. It could not be evaluated due to lack of screening values and toxicity values to develop screening values.*

--- denotes no BSV is available for this analyte.

BSV denotes background screening value.

COC denotes chemical of concern. EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram. NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

NGT denotes National Guard Trainee.

SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

RSL denotes Regional Screening Level (November, 2015)

Table 6-22. Summary of COC Evaluation for Noncancer Effects in Deep Surface Soil (1 to 4 feet) for National Guard Land Use using the 95% UCL for the Exposure Point Concentration.

Parameter	EPC[a] (mg/kg)	NGT FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Cobalt	11.09	140	NA	0.08		No	Sum of ratios by target organ ≤ 1
			Neurotoxicity Effects Sum of Ratios:	**0.08**			
Gastrointestinal Effects							
Cobalt	11.09	140	NA	0.08		No	Sum of ratios by target organ ≤ 1
			Gastrointestinal Effects Sum of Ratios:	**0.08**			
Vascular Effects							
Arsenic	28.9*	1140	Hyperpigmentation, keratosis, and possible vascular complications	0.047		No	Sum of ratios by target organ ≤ 1
Cobalt	11.09	140	NA	0.08		No	Sum of ratios by target organ ≤ 1
			Vascular Effects Sum of Ratios:	**0.127**			

Table 6-22. Summary of COC Evaluation for Noncancer Effects in Deep Surface Soil (1 to 4 feet) for National Guard Land Use using the 95% UCL for the Exposure Point Concentration (continued).

Parameter	EPC[a] (mg/kg)	NGT FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Renal Effects							
Barium	295	3,506	Nephropathy	0.08	51%	No	Sum of ratios by target organ ≤ 1
Cadmium	0.366	2,424	Significant proteinuria	0.0002	0.09%	No	Sum of ratios by target organ ≤ 1
Cobalt	11.09	140	NA	0.08	48%	No	Sum of ratios by target organ ≤ 1
			Renal Effects Sum of Ratios:	**0.16**			
Liver Effects							
Cobalt	11.09	140	NA	0.08	100%	No	Sum of ratios by target organ ≤ 1
			Liver Effects Sum of Ratios:	**0.08**			
Skin and Eye Effects							
Arsenic	28.9*	924	Hyperpigmentation, keratosis, and possible vascular complications	0.04	33%	No	Sum of ratios by target organ ≤ 1
Cobalt	11.09	140	NA	0.08	67%	No	Sum of ratios by target organ ≤ 1
			Skin and Eye Effects Sum of Ratios:	**0.12**			

Table 6-22. Summary of COC Evaluation for Noncancer Effects in Deep Surface Soil (1 to 4 feet) for National Guard Land Use using the 95% UCL for the Exposure Point Concentration (continued).

*[a] denotes EPC is 95 percent of the UCL. See **Appendix F**.*

[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1; the EPA RSL (2011) is used for lead.

[c] denotes lead is considered separately due to its unique effects.

BSV denotes background screening value.

COC denotes chemical of concern.

EPA denotes U.S. Environmental Protection Agency.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for noncancer effects or no FWCUG or other risk-screening criteria.

NGT denotes National Guard Trainee.

RMS denotes Range Maintenance Soldier.

RSL denotes Regional Screening Level.

SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

Table 6-23. Summary of COC Evaluation of Cancer Risk in Deep Surface Soil (1 to 4 feet) for Military Training Land Use using the 95% UCL as the Exposure Point Concentration.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	NGT FWCUG[b] (mg/kg)	Ratio of EPC to FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	28.9*	15.4	27.8	1.03	49.1%	Yes	Contribution to sum > 5%
Barium	295	88.4	NA	NA	NA	No	Not carcinogenic
Cadmium	0.366	ND	109	0.003	0.11%	No	Contribution to sum ≤ 5%
Cobalt	11.09	10.4	70.3	0.15	7.1%	Yes	Contribution to sum > 5%
Benzo(a)pyrene	2.99	---	4.7	0.63	30.1%	Yes	Contribution to sum > 5%
Benzo(b)fluoranthene	13	---	47.7	0.27	12.4%	Yes	Contribution to sum > 5%
Dibenz(a,h)anthracene	0.128	---	4.77	0.026	1.2%	No	Contribution to sum ≤ 5%
			Cancer Risk Sum of Ratios:	**2.08**			

** Mean was used because only 9 data points and calculation of 95%UCL unreliable.*

*[a] denotes EPC is 95 percent of the UCL. See **Appendix F**.*

[b] denotes FWCUG is excess cancer risk at 10^{-5}.

[c] denotes phenanthrene and 1,2-dimethylbenzene are shown with their maximum concentration. They could not be evaluated due to lack of screening values and toxicity values to develop screening values.

--- denotes no BSV is available for this analyte. BSV denotes background screening value. COC denotes chemical of concern. EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram. NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

NGT denotes National Guard Trainee. SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

RSL denotes Regional Screening Level (November, 2015).

Table 6-24. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (1 to 13 feet) for Unrestricted (Residential) Land Use using the 95% UCL for the Resident Adult Receptor and the Resident Child Receptor.

Parameter	EPC[a] (mg/kg)	RRA/RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRA/RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Lead	329	400/400	Neurotoxicity, behavioral effects	0.81/0.81		No	Ratio <1[c]
Thallium	2.6	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.017/0.14		No	Ratio <1[c]
Neurotoxicity Effects Sum of Ratios RRA:				**0.82**	**Neurotoxicity Effects Sum of Ratios RRC: 0.95**		
Gastrointestinal Effects							
Copper	297	27,138/3106	Gastrointestinal, hepatic, and renal effects	0.010/0.095		No	Sum of ratios by target organ $\leq$ 1
Thallium	2.6	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.017/0.14		No	Sum of ratios by target organ $\leq$ 1
Gastrointestinal Effects Sum of Ratios RRA:				**0.027**	**Gastrointestinal Effects Sum of Ratios RRC: 0.23**		

Table 6-24. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (1 to 13 feet) for Unrestricted (Residential) Land Use using the 95% UCL (continued).

Parameter	EPC[a] (mg/kg)	RRA/RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRA/RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Vascular Effects							
Antimony	1.6	136/28.2	Longevity, blood glucose, and cholesterol	0.011/0.05		No	Sum of ratios by target organ ≤ 1
Arsenic	45	82.1/20.2	Hyperpigmentation, keratosis, and possible vascular complications	0.548/2.3		No for Adult Yes for Child	Sum of ratios by target organ >1 for child
			Vascular Effects Sum of Ratios RRA	**0.559**		**Vascular Effects Sum of Ratios RRC: 2.4**	
Renal Effects							
Copper	297.5	27,138/3106	Gastrointestinal, hepatic, and renal effects	0.010/0.08		No	Sum of ratios by target organ ≤ 1
Thallium	2.6	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.017/0.14		No	Sum of ratios by target organ ≤ 1
			Renal Effects Sum of Ratios RRA:	**0.027**		**Renal Effects Sum of Ratios RRC: 0.22**	

Table 6-24. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (1 to 13 feet) for Unrestricted (Residential) Land Use using the 95% UCL (continued).

Parameter	EPC[a] (mg/kg)	RRA/RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Liver Effects							
Copper	297.5	27,138/3106	Gastrointestinal, hepatic, and renal effects	0.010/0.09		No	Sum of ratios by target organ ≤ 1
Thallium	2.6	47.6/18.4	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.017/0.014		No	Sum of ratios by target organ ≤ 1
			Liver Effects Sum of Ratios RRA:	**0.027**		**Liver Effects Sum of Ratios RRC: 0.10**	
Skin and Eye Effects							
Arsenic	45	82.1/20.2/	Hyperpigmentation, keratosis, and possible vascular complications	0.548/2.3		No for Adult Yes for Child	Sum of ratios by target organ >1 for child
Vanadium	28	1558/449	Lungs, throat and eyes	0.017/0.06		No	Sum of ratios by target organ ≤ 1
			Skin and Eye Effects Sum of Ratios RRA:	**0.608**		**Skin and Eye Effects Sum of Ratios RRC: 2.36**	

*[a] denotes EPC is 95 percent of the UCL. See **Appendix F** .[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1, only child FWCUG is shown as this is lower than adult for noncancer effects; the EPA RSL (2011) is used for lead. [c] denotes while lead and thallium are both listed as affecting the central nervous system, they do not have similar effects and are considered separately. COC denotes chemical of concern. EPC denotes exposure point concentration. FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010). HQ denotes hazard quotient. mg/kg denotes milligrams per kilogram. RRC denotes Residential Receptor Adult. RSL denotes Regional Screening Level. SAIC denotes Science Applications International Corporation. UCL denotes Upper Confidence Limit.*

Table 6-25. Summary of COC Evaluation of Cancer Risk in Subsurface Soil (1 to 13 feet) for Unrestricted (Residential) Land Use using the 95% UCL.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	RRA FWCUG[b] (mg/kg)	Ratio of EPC to RRA FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Antimony	1.6	0.96	NA	NA	NA	No	Not carcinogenic
Arsenic	45	15.4	4.25	10.59	56.1%	Yes	Contribution to sum > 5%
Copper	297.5	17.7	NA	NA	NA	No	Not carcinogenic
Lead	329	26.1	NA	NA	NA	No	Not carcinogenic
Thallium	2.6	ND	NA	NA	NA	No	Not carcinogenic
Vanadium	28	31.1	NA	NA	NA	No	Not carcinogenic
Benzo(a)anthracene	1.35	---	2.21	0.61	3.2%	No	Contribution to sum ≤ 5%
Benzo(a)pyrene	1.36	---	0.221	6.2	32.8%	Yes	Contribution to sum > 5%
Benzo(b)fluoranthene	1.24	---	2.21	0.56	2.9%	No	Contribution to sum ≤ 5%
Dibenzo(a,h)anthracene	0.22	---	0.221	1.00	5.01%	No	Contribution to sum ≤ 5%
Cancer Risk Sum of Ratios:	**18.87**						

*[a] denotes EPC is 95 percent of the UCL. See **Appendix F**. EPC for PCB-1254 is the maximum concentration due to low number of samples.*

[b] denotes FWCUG is excess cancer risk at 10^{-5}; only RRA FWCUG is shown as this is lower than child for noncancer effects.

[c] denotes phenanthrene and 1,2-dimethylbenzene are shown with their maximum concentration. They could not be evaluated due to lack of screening values and toxicity values to develop screening values. --- denotes no BSV is available for this analyte. BSV denotes background screening value. COC denotes chemical of concern.

EPC denotes exposure point concentration. FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010). mg/kg denotes milligrams per kilogram. NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

RRA denotes Residential Receptor Adult. SAIC denotes Science Applications International Corporation. UCL denotes Upper Confidence Limit.

Table 6-26. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use using the 95% UCL.

Parameter	EPC[a] (mg/kg)	Industrial RSL[b] (mg/kg)	Target Organ	Ratio of EPC to Industrial RSL	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Lead	329	800	Neurotoxicity, behavioral effects	0.41		No	Sum of ratios by target organ ≤ 1
Thallium	2.6	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.11		No	Sum of ratios by target organ ≤ 1
		Neurotoxicity Effects Sum of Ratios:		**0.52**			
Gastrointestinal Effects							
Thallium	2.6	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.11		No	Sum of ratios by target organ ≤ 1
		Gastrointestinal Effects Sum of Ratios:		**0.11**			

Table 6-26. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use using the 95% UCL (continued).

Parameter	EPC[a] (mg/kg)	Industrial RSL[b] (mg/kg)	Target Organ	Ratio of EPC to Industrial RSL	% Contribution to the Total Sum	COC?	COC Justification
Vascular Effects							
Arsenic	45	480	Hyperpigmentation, keratosis, and possible vascular complications	0.093		No	Sum of ratios by target organ ≤ 1
			Vascular Effects Sum of Ratios:	**0.093**			
Renal Effects							
Thallium	2.6	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.11		No	Sum of ratios by target organ ≤ 1
			Renal Effects Sum of Ratios:	**0.11**			

Table 6-26. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use using the 95% UCL (continued).

Parameter	EPC[a] (mg/kg)	Industrial RSL[b] (mg/kg)	Target Organ	Ratio of EPC to Industrial RSL	% Contribution to the Total Sum	COC?	COC Justification
Liver Effects							
Thallium	2.6	23	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.11		No	Sum of ratios by target organ ≤ 1
			Liver Effects Sum of Ratios:	**0.11**			
Skin and Eye Effects							
Arsenic	45	480	Hyperpigmentation, keratosis, and possible vascular complications	0.093		No	Sum of ratios by target organ ≤ 1
			Skin and Eye Effects Sum of Ratios:	**0.093**			

*[a] denotes EPC is 95 percent of the UCL. See **Appendix F** .[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1, only child FWCUG is shown as this is lower than adult for noncancer effects; the EPA RSL (2011) is used for lead. [c] denotes while lead and thallium are both listed as affecting the central nervous system, they do not have similar effects and are considered separately. COC denotes chemical of concern. EPC denotes exposure point concentration. FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010). HQ denotes hazard quotient. mg/kg denotes milligrams per kilogram. RRC denotes Residential Receptor Adult. RSL denotes Regional Screening Level. SAIC denotes Science Applications International Corporation. UCL denotes Upper Confidence Limit.*

Table 6-27. Summary of COC Evaluation of Cancer Risk in Subsurface Soil (1 to 13 feet) for Commercial Industrial Land Use using the 95% UCL.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	Industrial RSL[b] (mg/kg)	Ratio of EPC to Industrial RSL	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	45	19.8	3.0 (19.8)	2.27.	27.4%	Yes	Contribution to sum > 5%
Lead	329	26.1	NA	NA	NA	No	Not carcinogenic
Thallium	2.6	ND	NA	NA	NA	No	Not carcinogenic
Benzo(a)anthracene	1.35	---	2.29	0.58	7.0%	Yes	Contribution to sum > 5%
Benzo(a)pyrene	1.36	---	.29	4.68	56.5%	Yes	Contribution to sum > 5%
Dibenzo(a,h)anthracene	0.22	---	0.29	0.75	9.0%	Yes	Contribution to sum > 5%
Cancer Risk Sum of Ratios: 8.28							

*[a] denotes EPC is 95 percent of the UCL. See **Appendix F**. EPC for PCB-1254 is the maximum concentration due to low number of samples.*

[b] denotes FWCUG is excess cancer risk at 10^{-5}; only RRA FWCUG is shown as this is lower than child for noncancer effects.

[c] denotes phenanthrene and 1,2-dimethylbenzene are shown with their maximum concentration. They could not be evaluated due to lack of screening values and toxicity values to develop screening values. --- denotes no BSV is available for this analyte. BSV denotes background screening value. COC denotes chemical of concern.

EPC denotes exposure point concentration. FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010). mg/kg denotes milligrams per kilogram. NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

RRA denotes Residential Receptor Adult. SAIC denotes Science Applications International Corporation. UCL denotes Upper Confidence Limit.

Table 6-28. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (4-to 7 feet - using 5-to 9 data) for the Military Training Land Use using the 95% UCL.

Parameter	EPC[a] (mg/kg)	NGT FWCUG [b] (mg/kg)	Target Organ	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
None							
		Neurotoxicity Effects Sum of Ratios:					
Vascular Effects							
Arsenic	97.8	1,140	Hyperpigmentation, keratosis, and possible vascular complications	0.09		No	Sum of ratios by target organ $\leq$ 1
			Vascular Effects Sum of Ratios:	**0.09**			
Skin and Eye Effects							
Arsenic	97.8	1,140	Hyperpigmentation, keratosis, and possible vascular complications	0.09		No	Sum of ratios by target organ $\leq$ 1
			Skin and Eye Effects Sum of Ratios:	**0.09**			

Table 6-28. Summary of COC Evaluation of Noncancer Effects in Subsurface Soil (4 to 7 feet) for the Military Training Land Use using the 95% UCL (continued).

[a] **denotes EPC is 95 percent of the UCL for arsenic. See** Appendix F**. Lead UCL was greater than maximum concentration; maximum is used for EPC.**

[b] *denotes FWCUG is noncarcinogenic FWCUG at HQ of 1; the EPA RSL (2011) is used for lead.*

COC denotes chemical of concern.

EPA denotes U.S. Environmental Protection Agency.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

mg/kg denotes milligrams per kilogram.

NGT denotes National Guard Trainee.

RSL denotes Regional Screening Level.

SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

Table 6-29. Summary of COC Evaluation of Cancer Risk in Subsurface Soil (4 to 7 feet) for the Military Training Land Use using the 95% UCL.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	NGT FWCUG[b] (mg/kg)	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	97.8	15.4	27.8	3.52	100.00%	Yes	Ration > 1
	Cancer Risk Sum of Ratios:	**3.52**					

*[a] denotes EPC is 95 percent of the UCL for arsenic. See **Appendix F**. Lead UCL was greater than maximum concentration; maximum is used for EPC.*

[b] denotes FWCUG is excess cancer risk at 10^{-5}.

[c] denotes phenanthrene is shown with its maximum concentration. It could not be evaluated due to lack of screening values and toxicity values to develop screening values.

--- denotes no BSV is available for this analyte.

> denotes greater than.

BSV denotes background screening value.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

NGT denotes National Guard Trainee.

SAIC denotes Science Applications International Corporation.

UCL denotes Upper Confidence Limit.

Table 6-30. Summary of COC Evaluation of Noncancer Effects in Sediment (0 to 0.5 foot) for Unrestricted (Residential) Land Use.

Parameter	EPC[a] (mg/kg)	RRC FWCUG [b] (mg/kg)	Target Organ	Ratio of EPC to RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Thallium	1.2	6.12	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.20		No	Sum of ratios by target organ ≤ 1
			Neurotoxicity Effects Sum of Ratios:	**0.20**			
Gastrointestinal Effects							
Silver	116	386	Gastrointestinal effects	0.30		No	Sum of ratios by target organ ≤ 1
Thallium	1.2	6.12	Gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.20		No	Sum of ratios by target organ ≤ 1
			Gastrointestinal Effects Sum of Ratios:	**0.50**			
Vascular Effects							
Antimony	8.4	28.2	Longevity, blood glucose, and cholesterol	0.30		No	Sum of ratios by target organ ≤ 1
			Vascular Effects Sum of Ratios:	**0.30**			

Table 6-30. Summary of COC Evaluation of Noncancer Effects in Sediment (0 to 0.5 foot) for Residential Land Use (continued).

Parameter	EPC[a] (mg/kg)	RRC FWCUG [b] (mg/kg)	Target Organ	Ratio of EPC to RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Renal Effects							
Thallium	1.2	6.12	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.20		No	Sum of ratios by target organ ≤ 1
			Renal Effects Sum of Ratios:	**0.20**			
Liver Effects							
Thallium	1.2	6.12	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.20		No	Sum of ratios by target organ ≤ 1
			Liver Effects Sum of Ratios:	**0.20**			
Skin and Eye Effects							
None							
			Skin and Eye Effects Sum of Ratios:	**0.13**			

[a] denotes EPC is the maximum concentration. [b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1, only child FWCUG is shown as this is lower than adult for noncancer effects.

$\leq$ denotes less than or equal to. COC denotes chemical of concern. EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient. mg/kg denotes milligrams per kilogram. RRC denotes Residential Receptor Child. SAIC denotes Science Applications International Corporation.

Table 6-31. Summary of COC Evaluation of Cancer Risk in Sediment (0 to 0.5 foot) for Unrestricted (Residential) Land Use.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	RRA FWCUG[b] (mg/kg)	Ratio of EPC to RRA FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Antimony	8.4	0.96	NA	NA		No	Not carcinogenic
Silver	116	ND	NA	NA		No	Not carcinogenic
Thallium	1.2	ND	NA	NA		No	Not carcinogenic
Benzo(a)pyrene	0.067	---	0.221	0.3		No	Sum of ratios $\leq$ 1
			Cancer Risk Sum of Ratios:	**0.38**			

[a] denotes EPC is the maximum concentration.

[b] denotes FWCUG is excess cancer risk at 10^{-5} for adult as this is lower than the child excess cancer risk values.

c denotes phenanthrene is shown with its maximum concentration. It could not be evaluated due to lack of screening values and toxicity values to develop screening values.

--- denotes no BSV is available for this analyte.

$\leq$ denotes less than or equal to.

BSV denotes background screening value.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

RRA denotes Residential Receptor Adult.

SAIC denotes Science Applications International Corporation

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Table 6-32. Summary of COC Evaluation of Noncancer Effects in Sediment (0 to 0.5 foot) for the National Guard Trainee.

Parameter	EPC[a] (mg/kg)	NGT FWCUG [b] (mg/kg)	Target Organ	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Neurotoxicity Effects							
Thallium	1.2	477	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.0025	100%	No	Sum of ratios by target organ $\leq$ 1
		Neurotoxicity Effects Sum of Ratios:		**0.0025**			
Gastrointestinal Effects							
Silver	116	31,049	Gastrointestinal effects	0.0037	60%	No	Sum of ratios by target organ $\leq$ 1
Thallium	1.2	477	Gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.0025	40%	No	Sum of ratios by target organ $\leq$ 1
		Gastrointestinal Effects Sum of Ratios:		**0.0063**			
Vascular Effects							
Antimony	8.4	1,753	Longevity, blood glucose, and cholesterol	0.0048	100%	No	Sum of ratios by target organ $\leq$ 1
		Vascular Effects Sum of Ratios:		**0.0048**			

Table 6-32. Summary of COC Evaluation of Noncancer Effects in Sediment (0 to 0.5 foot) for the National Guard Trainee (continued).

Parameter	EPC[a] (mg/kg)	NGT FWCUG [b] (mg/kg)	Target Organ	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Renal Effects							
Thallium	1.2	477	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.0025	100%	No	Sum of ratios by target organ $\leq$ 1
			Renal Effects Sum of Ratios:	**0.0025**			
Liver Effects							
Thallium	1.2	477	Temporary hair loss, gastrointestinal effects, central nervous system effects, lungs, heart, liver, and kidneys	0.0025	100%	No	Sum of ratios by target organ $\leq$ 1
			Liver Effects Sum of Ratios:	**0.0025**			
Skin and Eye Effects							
None							
			Skin and Eye Effects Sum of Ratios:	**0.0027**			

Table 6-32. Summary of COC Evaluation of Noncancer Effects in Sediment (0 to 0.5 foot) for the National Guard Trainee (continued).

[a] denotes EPC is the maximum concentration.

[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1.

≤ denotes less than or equal to.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

mg/kg denotes milligrams per kilogram.

NGT denotes National Guard Trainee.

SAIC denotes Science Applications International Corporation.

Table 6-33. Summary of COC Evaluation of Cancer Risk in Sediment (0 to 0.5 foot) for the Commercial Industrial Land Use and the Military Training Land Use.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	NGT FWCUG[b] (mg/kg)	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Antimony	8.4	0.96	NA	NA		No	Not carcinogenic
Silver	116	ND	NA	NA		No	Not carcinogenic
Thallium	1.2	ND	NA	NA		No	Not carcinogenic
Benzo(a)pyrene	0.067	---	4.77	0.02		No	Sum of ratios $\leq$ 1
			Cancer Risk Sum of Ratios:	**0.02**			

[a] denotes EPC is the maximum concentration.

[b] denotes FWCUG is excess cancer risk at 10^{-5}.

[c] denotes phenanthrene is shown with its maximum concentration. It could not be evaluated due to lack of screening values and toxicity values to develop screening values.

--- denotes no BSV is available for this analyte.

$\leq$ denotes less than or equal to.

BSV denotes background screening value.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram.

NA denotes not applicable, no FWCUG for cancer or other risk-screening criteria.

NGT denotes National Guard Trainee.

SAIC denotes Science Applications International Corporation.

NGT FWCUG represents potential criteria for the Industrial Receptor

Table 6-34. Summary of COC Evaluation of Noncancer Effects in Surface Water for Unrestricted (Residential) Land Use.

Parameter	EPC[a] (mg/kg)	RRC FWCUG[b] (mg/kg)	Target Organ	Ratio of EPC to RRC FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Vascular Effects							
Arsenic	6.6	46.3	Hyperpigmentation, keratosis, and possible vascular complications	0.14	100%	No	Sum of ratios by target organ $\leq$ 1
			Vascular Effects Sum of Ratios:	**0.14**			
Skin and Eye Effects							
Arsenic	6.6	46.3	Hyperpigmentation, keratosis, and possible vascular complications	0.14	100%	No	Sum of ratios by target organ $\leq$ 1
			Skin and Eye Effects Sum of Ratios:	**0.14**			

[a] denotes EPC is the maximum concentration.

[b] denotes FWCUG is noncarcinogenic FWCUG at HQ of 1, only child FWCUG is shown as this is lower than adult for noncancer effects.

$\leq$ denotes less than or equal to.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

mg/kg denotes milligrams per kilogram.

RRC denotes Residential Receptor Child.

SAIC denotes Science Applications International Corporation.

Table 6-35. Summary of COC Evaluation of Cancer Risk in Surface Water for Unrestricted (Residential) Land Use.

Parameter	EPC[a] (mg/kg)	BSV (mg/kg)	RRA FWCUG[b] (mg/kg)	Ratio of EPC to RRA FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	6.6	3.2	11	0.60	100%	No	Sum of ratios $\leq$ 1
			Cancer Risk Sum of Ratios:	**0.60**			

[a] denotes EPC is the maximum concentration.

$\leq$ denotes less than or equal to.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

mg/kg denotes milligrams per kilogram.

RRA denotes Residential Receptor Adult.

SAIC denotes Science Applications International Corporation.

Table 6-36. Summary of COC Evaluation of Noncancer Effects in Surface Water for the Commercial Industrial Land Use and Military Training Land Use.

Parameter	EPC[a] (µg/L)	NGT FWCUG [b] (µg/L)	Target Organ	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Vascular Effects							
Arsenic	6.6	670	Hyperpigmentation, keratosis, and possible vascular complications	0.01	100%	No	Sum of ratios by target organ ≤ 1
			Vascular Effects Sum of Ratios:	**0.01**			
Skin and Eye Effects							
Arsenic	6.6	670	Hyperpigmentation, keratosis, and possible vascular complications	0.01	100%	No	Sum of ratios by target organ ≤ 1
			Skin and Eye Effects Sum of Ratios:	**0.01**			

[a] *denotes EPC is the maximum concentration.*

[b] *denotes FWCUG is noncarcinogenic FWCUG at HQ of 1.*

≤ denotes less than or equal to.

µg/L denotes micrograms per liter.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

HQ denotes hazard quotient.

NGT denotes National Guard Trainee.

SAIC denotes Science Applications International Corporation.

Table 6-37. Summary of COC Evaluation for Cancer Risk in Surface Water for the Commercial Industrial Land Use and the Military Training Land Use.

Parameter	EPC[a] (µg/L)	BSV (µg/L)	NGT FWCUG[b] (µg/L)	Ratio of EPC to NGT FWCUG	% Contribution to the Total Sum	COC?	COC Justification
Arsenic	6.6	3.2	42	0.16	100%	No	Sum of ratios $\leq$ 1
	Cancer Risk Sum of Ratios:			**0.16**			

[a] denotes EPC is the maximum concentration.

[b] denotes FWCUG is excess cancer risk at 10^{-5}.

$\leq$ denotes less than or equal to.

µg/L denotes micrograms per liter.

COC denotes chemical of concern.

EPC denotes exposure point concentration.

FWCUG denotes Facility-Wide Cleanup Goal per the Facility-Wide Human Health Cleanup Goals for the Ravenna Army Ammunition Plant, Ravenna, Ohio, Final (SAIC, 2010).

NGT denotes National Guard Trainee.

SAIC denotes Science Applications International Corporation.

Table 6-38. Summary of COCs identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use for each Exposure Media.

Receptor per Land Use and Exposure Point	COPCs Identified[a]		COCs Identified[b]
SURFACE SOIL			
Surface Soil (0 to 1 foot bgs)			
Unrestricted (Residential) Land Use *-Based on MDC*	*Antimony*	*Benzo(a)anthracene*	Arsenic Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene *All carcinogenic*
	Arsenic	*Benzo(a)pyrene*	
	Cadmium	*Benzo(b)fluoranthene*	
	Copper	*Dibenzo(a,h)anthracene*	
	Mercury	*Indeno(1,2,3-cd)pyrene*	
	Silver	*Thallium*	
Surface Soil (0 to 1 foot bgs)			
Commercial Industrial Land Use *-Based on MDC*	*Arsenic*	*Benzo(a)pyrene*	Arsenic Benzo(a)pyrene *All carcinogenic*
	Thallium		
Deep Surface Soil (0 to 1 feet bgs)			
Military Training Land Use *-Based on MDC ISM results for 0 to 1 feet*	*Arsenic*	*Benzo(a)pyrene*	Arsenic Cobalt Benzo(a)pyrene *All carcinogenic based*
	Barium	*Benzo(b)fluoranthene*	
	Cadmium	*Dibenzo(a,h)anthracene*	
	Cobalt		
Deep Surface Soil (1 to 5 feet bgs)			
Military Training Land Use *-Based on site-wide results for 1 to 5 feet and 95% UCL for Discrete samples*	*Arsenic*	*Benzo(a)pyrene*	Arsenic Cobalt Benzo(a)pyrene *All carcinogenic based*
	Barium	*Benzo(b)fluoranthene*	
	Cadmium	*Dibenzo(a,h)anthracene*	
	Cobalt		

Table 6-38. Summary of COCs identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use for each Exposure Media.

Receptor per Land Use and Exposure Point	COPCs Identified[a]		COCs Identified[b]
SUBSURFACE SOIL			
Subsurface Soil (1 to 13 foot bgs)			
Unrestricted (Residential) Land Use (1 to 13 feet bgs) *Based on site-wide results and 95% UCL for Discrete samples*	*Antimony*	*Benzo(a)anthracene*	Arsenic Benzo(a)pyrene *All carcinogenic based*
	Arsenic	*Benzo(a)pyrene*	
	Copper	*Benzo(b)fluoranthene*	
	Thallium	*Dibenzo(a,h)anthracene*	
	Vanadium		
Commercial Industrial Land Use (1 to 13 feet bgs) *-Based on site-wide results and 95% UCL for Discrete samples*	*Arsenic*	*Benzo(a)anthracene*	Arsenic Benzo(a)pyrene Dibenzo(a,h)anthracene *All carcinogenic based*
	Thallium	*Benzo(a)pyrene*	
		Dibenzo(a,h)anthracene	
Subsurface Soil (4 to 7 foot bgs)			
Military Training Land Use *-Based on site-wide results for 5 to 9 feet and 95% UCL for Discrete samples*	*Arsenic*		Arsenic *Carcinogenic based*
Sediment (0 to 0.5 foot bgs)			
Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use	*Antimony*	*Thallium*	None
	Silver	*Benzo(a)pyrene*	
Surface Water			
Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use	*Arsenic*		None

[a] denotes COPCs identified by screening.

[b] denotes COCs identified by screening.

bgs denotes below ground surface. COC denotes chemical of concern.

COPC denotes chemical of potential concern.

7.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

Descriptions in this section and items such as the list of species are based on the 2008 Integrated Natural Resource Management Plan (INRMP) and have not been updated to reflect any changes noted in the 2014 INRMP. However, information presented in this section is still relevant and adequately describes general-current ecological conditions and does not affect the analysis completed in this RI. Ecological receptors that were to be included in the ecological risk assessment were presented in the RVAAP Facility-Wide Ecological Risk Assessment Work Plan (USACE, 2003). These selected receptors have not changed and should be considered with completing an ecological risk assessment. This SLERA evaluates the potential for adverse effects posed to ecological receptors from potential releases at the Sand Creek Site. This SLERA is consistent with the ERA process described in the *EPA Ecological Risk Assessment Guidance for Superfund* (EPA, 1997) and the *Ohio EPA Ecological Risk Assessment Guidance Document* (Ohio EPA, 2008), hereafter referred to as the EPA Guidance and Ohio EPA Guidance, respectively. Other supporting documents used in the preparation of this SLERA include the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003) and the *Risk Assessment Handbook, Volume II Environmental Evaluation* (USACE, 2010).

A SLERA presents a conservative analysis of the potential for ecological risk. The Ohio EPA Guidance describes four levels of ERA: (1) Level I Scoping, (2) Level II Screen, (3) Level III Baseline, and (4) Level IV Field Baseline. This SLERA for the Sand Creek Site includes the equivalent of Ohio EPA's Level I Scoping through Level III Baseline. Following the Level III Baseline, a determination is made whether to move to a Level IV Field Baseline (often referred to as a baseline ERA), which requires additional site-specific exposure and effects information, and often uses less conservative assumptions. A summary of the ecological evaluation and analysis process is presented in tabular form at the end of this section.

7.1 Scope and Objectives

The goal of the SLERA is to evaluate the potential for adverse ecological effects to ecological receptors from SRCs at the Sand Creek Site. This objective is met by characterizing the ecological communities in the vicinity of the site, determining the particular contaminants present, identifying pathways for receptor exposure, and estimating the magnitude of the likelihood of potential adverse effects to identified receptors. The SLERA addresses the potential for adverse effects to the vegetation, wildlife, aquatic life (i.e., sediment-dwelling organisms), threatened and endangered species, and wetlands or other sensitive habitats associated with the site.

The objective of this SLERA is to provide an estimate of the potential for adverse ecological effects associated with contamination resulting from former activities at the Sand Creek Site. The results of the SLERA will contribute to the overall characterization of the site and may be used to determine the need for additional investigations or to develop, evaluate, and select appropriate remedial alternatives. Guidance documents used to perform the SLERA include the general guidelines of the *Tri-Service Procedural Guidelines for Ecological Risk Assessments* (Wentsel et al., 1996), as well as the EPA Guidance (2010a), *EPA Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Bulletin No. 1* (EPA, 1996b), and the Ohio EPA Guidance (2008). The SLERA fits into steps 1 and 2 of the EPA Guidance and Level I through a maximum of Level III evaluation using the Ohio EPA Guidance process.

The SLERA uses site-specific analyte concentration data for surface soil, sediment, and surface water from the Sand Creek Site. Risks to ecological receptors were evaluated by performing a multistep screening process in which, after each step, the detected analytes in the media were either deemed to pose negligible risk and eliminated from further consideration or carried forward to the next step in the screening process to a conclusion of being a chemical of potential ecological concern (COPEC). COPECs are analytes whose concentrations are great enough to pose potential adverse effects to ecological receptors. Following the determination of COPECs, an ecological CSM is developed that describes the selection of receptors, definition of exposure pathways, and selection of assessment and measurement endpoints. Potential impacts were estimated using generic receptors that would be exposed to these media.

7.2 Problem Formulation

The problem formulation step of the SLERA includes descriptions of habitats, biota, threatened and endangered species, selection of EUs, and identification of COPECs.

7.2.1 Ecological Site Description

The Sand Creek Site extends along the embankment of Sand Creek for approximately 1,200 feet, and occupies a total area of approximately 1 acre. The bank slopes from east to west towards the Sand Creek 40 to 60 degrees from horizontal. Prior to the 2003 RA, the site was overgrown with mature trees and ground level vegetation. The RA cleared large areas of vegetation, which were then reseeded with hydroseed and mulched. The RI field activities included areas adjacent to the top of the slopes and along the floodplain at the bottom of the slopes adjacent to the AOC. The total area investigated for the RI consisted of the 1 acre AOC (approximate) and about an additional acre of land adjacent to the AOC.

The Sand Creek Site is primarily within the dry midsuccessional cold-deciduous shrubland alliance, while the area immediately adjacent to the creek is within the *Fraxinus pennsylvanica-Ulmus Americana-Celtis* Temporarily Flooded Forest Alliance (AMEC, 2008). The dry midsuccessional cold-deciduous shrubland alliance is associated with a majority of coverage by shrubs interspersed with relatively few large trees. The dominant species of this alliance include gray dogwood, northern arrowwood, blackberry, hawthorn, and multiflora rose. The Temporarily Flooded Forest Alliance is associated with floodplains near streams and rivers and other temporarily flooded areas. Green ash, American elm, hackberry, and red maple are the dominant species, with black walnut, white ash, swamp white oak, cottonwood, and black willow also present. The vegetation alliances and plant communities at the Sand Creek Site are presented in **Figures 7-1** and **7-2**, respectively (AMEC, 2008).

7.2.1.1 Special Interest Areas and Sensitive Areas

Special Interest Areas include communities that host state-listed species, are representative of historic ecosystems, or are otherwise noteworthy. The *Updated Integrated Natural Resources Management Plan at the Ravenna Training Logistics Site* (AMEC, 2008) was reviewed for information related to Special Interest and Sensitive Areas at the AOC. No Special Interest Areas were identified at the AOC. The AOC has not specifically been surveyed for threatened or endangered species. No federally listed species have been identified on the facility. No sensitive habitats were identified on or near the AOC.

7.2.1.2 Wetlands

Jurisdictional wetlands delineation has not been conducted at the AOC. A planning level survey for wetlands was conducted for the entire facility. According to the planning level survey data, no wetlands were identified on the AOC (AMEC, 2008). Wetlands were identified in the surrounding area to the west, northwest, and south of the Sand Creek Site as shown in **Figure 7-3** (AMEC, 2008)

7.2.1.3 Animal Populations

The plant communities at the former RVAAP provide diverse habitats that support many species of animals. Through casual observations and various studies, the following number of species have been identified at the facility: 35 land mammals, 214 birds, 34 reptiles and amphibians, 46 fish (including 2 hybrids), 4 crayfish, 17 molluscs (clams), 12 aquatic snails, 45 terrestrial snails, 64 damselflies and dragonflies, 64 butterflies, 793 moths, and 800 beetles (AMEC, 2008).

Approximately 25 percent of the site is covered by open shrub land habitat. Common bird species that could be expected to use the forest/riparian habitat adjacent to the creek include the song sparrow (*Melospiza melodia*), gray catbird (*Dumetella carolinensis*), and rufous-sided towhee (*Pipilo erythrophthalmus*). Woodland bird species, such as the wood thrush

(*Hylocichla mustlina*) may also utilize the forested areas at and adjacent to the Sand Creek Site. Other forest and forest-edge birds that may use the site include the red-eyed vireo (*Vireo olivaceous*), yellow-throated vireo (*Vireo flavifrons*), eastern wood-pewee (*Contopus virens*) and Acadian flycatcher (*Empidonax virescens*), in addition to permanent residents typified by the tufted titmouse (*Parus bicolor*), black-capped chickadee (*Parus atricapillus*) , American crow (*Corvus brachyrhynchos*), blue jay (*Cyanocitta cristata*), and red-bellied (*Melanerpes carolinus*) and downy (*Picoides pubescens*) woodpeckers (ODNR, 1997).

Common large mammals include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and woodchuck (*Marmota monax*), while eastern cottontail (*Sylvilagus floridanus*), white-footed mouse (*Peromyscus leucopus*), and short-tailed shrew (*Blarina brevicauda*) are common small mammals (ODNR, 1997).

Sand Creek is an aquatic habitat adjacent to the AOC. A very narrow floodplain that is seasonally inundated occupies the land between the bottom of the embankment and Sand Creek. The floodplain and creek border likely support several species of amphibians, notably salamanders and frogs. Fish are likely present in Sand Creek adjacent to the AOC. Thirty-two and 34 species of fish were identified in the former RVAAP stream habitats during surveys performed in 1999 and 2003, respectively (AMEC, 2008). Fish species that may be found in Sand Creek include black crappie (*Poxomis nigromaculatus*), common shiner (*Luxilus cornutus*), and yellow perch (*Perea flavescens*).

7.2.1.4 Threatened and Endangered Species Information

The relative isolation and protection of habitat at RVAAP has created an important area of refuge for a number of plant and animal species considered rare by the State of Ohio. Since this RI was originally prepared, the INRMP has been updated in 2014 and some of the information in this RI regarding natural resources need to be updated per the 2014 INRMP. The 2014 INRMP identifies one federally-listed species, Northern long-eared bat (*Myotis septentrionalis)* as occurring but not residing on the facility. To date, 77 state-listed species are confirmed to be on the former RVAAP property and are listed in **Table 2-1** (INRMP, 2008). Species information identified in Table 2-1 was based on the 2008 INRMP and will be updated in future documents. However, this data is still applicable for purposes of this RI. The Sand Creek Site has not been specifically surveyed for threatened or endangered species; however, none are known to exist at the AOC.

7.2.1.5 Selection of Exposure Units

From the ecological assessment viewpoint, an EU is the area where ecological receptors potentially are exposed to the site constituents. Although some ecological receptors are likely to gather food, seek shelter, reproduce and move around, spatial boundaries of the ecological EU are the same as the spatial boundaries of aggregates defined for historical use, nature and

extent of contamination, fate and transport, and the HHRA. Although some ecological receptors are likely to gather food, seek shelter, reproduce, and move around, spatial boundaries of the ecological EUs are the same as the spatial boundaries of aggregates defined for nature and extent, fate and transport, and the HHRA. These proposed EUs for Sand Creek are as follows:

- Terrestrial EU—Soil at Sand Creek Site
- Sediment EU—Sediment from the narrow floodplain between Sand Creek and the ridge
- Surface water EU—Surface water in Sand Creek

7.2.2 Selection of COPECs

The available data sets for use in the SLERA consist of the confirmation soil, sediment, and surface water samples collected after the RA was performed in 2003, the two surface water samples collected as part of the 2003 FWBWQS, and the surface soil, sediment, and subsurface soil samples collected for this RI. This section provides a discussion on the media samples that were selected and the rationale as to why they were chosen for evaluation of ecological risks at the Sand Creek Site. A list of the media samples used for the SLERA is presented in **Table 7-1**.

It was determined that only the 0- to 1-foot sampling interval for surface soil will be evaluated for the SLERA because most ecological exposure occurs within the top 1 foot of soil and is assumed to represent the zone of maximum exposure for most ecological receptors. In addition, as a historical former disposal site, it is expected that much of the native soil has been reworked, removed, or used as cover material during dumping activities, which would likely decrease the attractiveness to burrowing receptors.

The confirmation soil samples from the 2003 RA showed elevated concentrations (i.e., greater than the BSVs) of heavy metals in the northern third of the site with a few widely scattered hits of other contaminants (heavy metals, SVOCs, explosives and propellants) over the remainder of the site. The confirmation sediment samples collected from the neighboring floodplain and Sand Creek reported arsenic levels above its BSV. Additionally, low levels of propellants and/or explosives were detected in the full suite sediment and surface water samples (MKM, 2004). These results guided and informed the sampling effort for the current RI.

Surface and subsurface soil samples were collected as part of the RI field activities. Surface samples were collected from 0 to 1 foot using ISM. Subsurface samples were collected from various intervals (1 to 5 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet) using a modified

ISM approach. Although the discrete confirmation soil samples from the 2003 RA were available, the ISM data collected for the RI were considered to be the most relevant for estimating ecological exposure for the SLERA because they are the most recently collected data and therefore, provide the best representation of current site conditions. Additionally, the ISM approach provides a better estimate of average concentrations than discrete samples. Based on this evaluation for the surface soil media, only the ISM samples collected for the RI were used in the SLERA.

For sediment, 12 discrete confirmation samples collected as part of the 2003 RA are available as are the 2 ISM sampling units collected during the RI field effort. The ISM samples were collected along the length of the bank adjacent to the affected soil units and are considered to represent the most relevant data for evaluating ecological risk for the same reasons as described for surface soil. Therefore, the ISM sediment samples collected for the RI were considered to be more applicable for inclusion in the SLERA.

For surface water, data are available from the three samples collected as part of the 2003 RA and the two samples collected during the 2003 FWBWQS. All five surface water samples were evaluated for this SLERA for the purpose of supporting the decision to not collect surface water samples as part of the RI sampling event and to further confirm the results of the 2003 FWBWQS that indicated that surface water at the former RVAAP has not been impacted from historical activities at the facility.

From the chemical results of samples described above, a COPEC selection process was performed to develop a subset of SRCs. These chemicals are also present at sufficient frequencies, concentrations, and spatial areas to pose a potential risk to ecological receptors. COPECs were identified by using methods described for Level II Screening in the Ohio EPA Guidance (2008). Identification of COPECs entails a multistep process that begins with the detected SRCs that are identified in the site characterization process, then proceeds to a data evaluation, media evaluation, and media screening as part of the Level II Screen. This selection process is described in more detail in the following sections.

7.2.2.1 Data Organization

Chemical analytical data as well as all previous and ongoing investigations were reviewed and evaluated for quality, usefulness, and uncertainty. Data identified as being of acceptable quality for use in the SLERA were summarized in a manner that presents the pertinent information to be applied in the SLERA. All data used in the SLERA were validated, and no data was identified as being rejected.

The data for each chemical were sorted by medium. Chemicals not detected at least once in a medium were not included in the SLERA. Available background data for each medium were provided in the FWCUG Report (SAIC, 2010).

7.2.2.2 Data Evaluation

The data evaluation of SRCs normally entails two components: (1) a frequency of detection analysis and (2) an evaluation of common laboratory contaminants. The purpose of the frequency of detection analysis is to eliminate from further consideration any SRCs detected in 5 percent or less of the samples for a given medium, excluding SRCs present in multiple media or deemed to be persistent, bioaccumulative, and toxic (PBT). However, for this site, no frequency-of-detection screening was performed for soil, surface water, or sediment because fewer than 20 samples were available for these data sets. Also, frequency of detection is not an appropriate criterion for ISM samples.

Common laboratory contaminants include acetone, 2-butanone (methyl ethyl ketone), carbon disulfide, methylene chloride, toluene, and phthalate esters. If blanks contained detectable concentrations of these contaminants, then the sample results were considered positive results in accordance with the QSM 4.1 (DOD, 2009). Laboratory contaminants are typically identified (and rejected) using data qualifiers. The analytical data included qualifiers from the analytical laboratory QC or from the data validation process that reflect the level of confidence in the data.

7.2.2.3 Media Evaluation

The media evaluation was performed after the frequency of detection and common laboratory contaminant evaluation, using the SRCs that were not eliminated during those two steps. The purpose of the media evaluation is to determine whether SRCs have impacted media associated with the site. The evaluation methods were media specific and included comparison against BSVs for all media. The MDCs of SRCs in soil, sediment, and surface water were compared to selected BSVs and eliminated from further consideration in the Level II Screen if the MDCs were less than BSVs and the SRCs were not PBT compounds. If the MDCs of SRCs exceeded BSVs, and/or the SRCs were PBT compounds, the SRCs were carried forward to the media-screening step.

7.2.2.4 COPEC Selection Criteria

The criteria used to identify COPECs in the SLERA are described in the following sections:

Comparison to ESVs

The MDCs of chemicals detected in various media were compared with ecological screening values (ESVs) for ecological endpoints following recommendations obtained from the Ohio EPA Guidance (2008). Chemicals that exceed the ESVs, or for which no ESVs are available,

were retained as COPECs. The following ESV hierarchy was used for the ecological evaluation:

SOIL

For soils, the MDC of each COPEC was compared to soil screening values. The hierarchy of sources of soil screening values, in order of preference, was as follows:

- Ecological Soil Screening Levels (EcoSSLs) (EPA, 2010) online updates from http://www.epa.gov/ecotox/ecossl/
- ESLs, EPA Region 5, August 2003
- Oak Ridge National Laboratory (ORNL): Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, 1997. *Preliminary Remediation Goals for Ecological Endpoints*, ES/ER/TM-162/R2
- Los Alamos National Laboratory (LANL): EcoRisk Database, Release 2.3, September, 2010.
- Talmage et al., 1999. *Nitroaromatic Munitions Compounds: Environmental Effects and Screening Values, Rev. Environ. Contamin. Toxicol.*, 161: 1–156

SEDIMENT

For sediment, the MDC of each COPEC was compared to sediment screening values. The hierarchy of sources of sediment screening values, in order of preference, was as follows:

- MacDonald et al., 2000. *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems, Arch. Environ. Contam. Toxicol. 39: 20–31, Threshold Effect Concentration (TEC)*
- ESLs (EPA, 2003)
- ORNL (Efroymson et al., 1997a)
- LANL, 2010
- Talmage et al., 1999.

SURFACE WATER

For surface water, the MDCs of COPECs are to be compared to surface water screening values. The hierarchy for surface water screening values, in order of preference, was as follows:

- Ohio Administrative Code (OAC) 3745-1, *Ohio River Basin Aquatic Life Criteria, OMZA*, March 6, 2011. (Based on total recoverable metals and assuming a hardness

value of 100 mg/L for hardness dependent criteria, iron and nitrate/nitrite criteria are based on protection of agricultural use.)

- ESLs (EPA, 2003)
- ORNL (Efroymson et al., 1997b)
- LANL, 2010
- Talmage et al., 1999
- ORNL, 1987

The ESVs used for the SLERA are presented in **Appendix G**.

Essential Nutrients
Evaluating essential nutrients is a special form of risk-based screening applied to certain ubiquitous elements that are generally considered to be required nutrients. Essential nutrients such as calcium, iron, magnesium, potassium, and sodium are usually eliminated as COPECs because they are generally considered to be innocuous in environmental media. Other essential nutrients, including chloride, iodine, and phosphorus, may be eliminated as COPECs, if their presence in a particular medium is unlikely to cause adverse effects to biological health.

PBT Pollutants
The PBT compounds listed in the Ohio EPA Guidance, including chemicals whose log octanol-water partition coefficient (K_{ow}) values are greater than or equal to 3, are retained as COPECs. However, if the chemical's ESV is based on an endpoint that is protective of bioaccumulation effects, the chemical may be eliminated as a COPEC if its MDC is below its ESV (Ohio EPA, 2008). Although they typically have log K_{ow} values greater than 3, PAHs, including carbazole, a PAH heterocycle, exhibit little tendency to biomagnify in food chains, despite their high lipid solubility, possibly due to their tendency to be rapidly metabolized by most organisms (Eisler, 1987; EPA, 2010). Low molecular weight PAHs (i.e., anthracene and phenanthrene) are subject to chemical degradation and biodegradation. The hydrophobic, higher molecular weight PAHs (i.e., benzo[a]pyrene) show a high affinity for binding to dissolved humic materials and tend to have rapid biotransformation rates, which may lessen or negate bioaccumulation and food chain transfer for these types of compounds (Eisler, 1987). For these reasons, PAHs are not considered PBT chemicals.

7.2.2.5 Summary of COPEC Selection

The results of the COPEC screening are presented in **Tables 7-2** through **7-4** for surface soil, sediment, and surface water, respectively. The tables present the following information for each medium:

- SRC (as identified in Section 4.0)

- Range of detected concentrations
- Range of detection limits
- Mean concentration (for media with more than one sample)
- BSV
- ESV
- HQ
- Determination as to whether the chemical is a PBT compound (soil and sediment only)
- Determination as to whether the chemical is a COPEC

The HQ is calculated as the detected concentration divided by the ESV. An HQ greater than 1 indicates that the concentration in the medium exceeds the conservative ESV, and may indicate that a potential ecological threat exists. Chemicals with HQs less than 1 are considered to be of low concern, and are not carried forward as COPECs, unless the chemical is a PBT pollutant, and its screening value is not protective of food chain effects.

A description and summary of the COPECs identified in each medium are presented in the following sections:

Soil COPEC Selection

A total of 54 chemicals were identified as SRCs in the RI surface soil data set following the data screening process in Section 4.0 and were further evaluated in the SLERA. The SRCs in surface soil consisted of 15 metals, 1 general chemistry parameter, 3 explosives compounds, 6 pesticides, and 29 SVOCs. One metal, 1 general chemistry parameter, 2 explosives, and 13 SVOCs were eliminated because they were not PBT compounds, and their MDCs were lower than their ESVs. Three additional pesticide PBT compounds were eliminated during the toxicity screen because they were detected at concentrations less than ESVs that are protective of food chain effects. Following the screen, 14 inorganic chemicals, 1 propellant compound, 3 pesticides, and 16 SVOCs were identified as COPECs (**Table 7-2**). Two pesticides and eight SVOCs were selected as COPECs solely because they are PBT pollutants (i.e., their detected concentrations did not exceed their ESVs). The one propellant compound (nitroguanidine) was selected as a COPEC because it lacked an ESV.

Table 7-5 at the end of this section presents the distribution of COPEC concentrations by analytical unit (i.e., metals, SVOCs, propellants, and pesticides). All soil sampling units had at least one chemical that failed the BSV (metals only) and/or toxicity screening criteria.

Sediment COPEC Selection

A total of 42 chemicals were identified as SRCs in the RI sediment data set following the data screening process in Section 4.0 and were further evaluated in the SLERA. The SRCs in sediment consisted of 11 metals, 1 general chemistry parameter, 1 explosive compound, 12 pesticides/PCBs, and 15 SVOCs. Two metals and 13 SVOCs were eliminated because they were not PBT compounds, and their MDCs were lower than their ESVs. Following the toxicity screen, 8 inorganic chemicals, 1 general chemistry parameter, 1 explosives compound, 14 pesticides/PCBs, and 4 SVOCs were identified as COPECs (**Table 7-3**). Eleven chemicals were selected as COPECs solely because they are PBT pollutants (i.e., their detected concentrations did not exceed their ESVs). The sediment sample from sampling unit SCsd-070 (SCsd-070M-0001-SD), collected along the floodplain along the northern portion of the AOC, contained 16 COPECs that exceeded screening criteria (9 metals, 6 pesticides/PCBs, and 1 SVOC). Sediment sample SCsd-071M-0001-SD from sampling unit SCsd-071, collected along the floodplain at the southern portion of the AOC, had only three COPECs (all metals).

Surface Water COPEC Selection

A total of 11 chemicals were identified as SRCs in the surface water data sets from the 2003 RA and the 2003 FWBWQS following the data screening process in Section 4.0 and were further evaluated in the SLERA. The SRCs in surface water consisted of 11 metals, 2 SVOCs, and 2 nutrient parameters. All of the metals and SVOC SRCs were screened out and no COPECs were identified because they were detected at concentrations lower than their ESVs (**Table 7-4**). The detected nitrate/nitrite and phosphate results were collected as water quality parameters during the 2003 FWBWQS. Nitrate and phosphate are nutrients that may cause algal blooms at elevated concentrations, which can be problematic for water bodies, particularly lentic systems. However, they are typically not evaluated as part of a SLERA and are removed from further consideration for ecological risks.

COPEC Selection Conclusions

The Ohio EPA Guidance states, "For a site to present a potential for hazard, it must exhibit the following three conditions: (a) contain COPECs in media at detectable and biologically significant concentrations, (b) provide exposure pathways linking COPECs to ecological receptors, and (c) have endpoint species that either utilize the site, are not observed to utilize the site, but habitat is such that the endpoints species should be present, are present nearby, or can potentially come into contact with site-related COPECs." This Level II Screen has shown that these three conditions are met at media of concern (surface soil and sediment) at the Sand Creek Site.

The Level II Screen identifies site-specific receptors, relevant and complete exposure pathways, and other pertinent information (Ohio EPA, 2008). These components represent preliminary information for a Level III Baseline. The following section presents the ecological

CSM, including selection of site-specific ecological receptor species, relevant and complete exposure pathways, and candidate ecological assessment endpoints and measures.

7.2.3 Ecological Conceptual Site Model

The ecological CSM depicts and describes the known and expected relationships among the stressors, pathways, and assessment endpoints that are considered in the risk assessment, along with a rationale for their inclusion. Two ecological CSMs are presented for this Level II Screen. One ecological CSM is associated with the media screening of the Level II Screen (**Figure 7-4**). The other ecological CSM (**Figure 7-5**) represents a preliminary CSM for the Level III Baseline. The ecological CSMs for the Sand Creek Site were developed using the available site-specific information and professional judgment. The contamination mechanism, source media, transport mechanisms, exposure media, exposure routes, and ecological receptors for the ecological CSMs are described below.

7.2.3.1 Contamination Source

The contamination source includes releases from historic dumping that occurred at the Sand Creek Site. Section 1.3 of this RI report describes the types of historical operations that took place at the site.

7.2.3.2 Source Medium

The source medium at the Sand Creek Site is soil. For the purposes of the SLERA, surface soil is defined as 0 to 1 foot bgs. Contaminants released from historic dumping operations were deposited directly into the surrounding soil.

7.2.3.3 Transport Mechanisms

Transport mechanisms at the site include volatilization into the air, biota uptake, erosion to surface water and sediment, and leaching to groundwater. Biota uptake is a transport mechanism because some of the identified SRCs are known to accumulate in biota, which may act as a vehicle to spatially disperse contaminants, as well as represent a secondary exposure medium for upper trophic level receptors that prey on the biota. The deposition of eroded soils containing SRCs into surface water and sediment is also a valid transport mechanism for both ecological CSMs.

7.2.3.4 Exposure Media

Sufficient time has elapsed for contaminants in the source medium to have migrated to potential exposure media, resulting in possible exposure of plants and animals that come in contact with these media. Potential exposure media include air, surface soil, food chain, surface water, and sediment. Subsurface soil includes soil at depths that ecological receptors typically do not come into contact with, and is not being evaluated at the AOC. Groundwater is not considered an exposure medium because ecological receptors are unlikely to contact

groundwater. If groundwater daylights into surface water as a seep or spring, it is evaluated as surface water media. Soil, sediment, surface water, and biota comprising prey items for higher trophic level receptors are the four principal exposure media for the Sand Creek Site.

7.2.3.5 Exposure Routes

Exposure routes are functions of the characteristics of the media in which the sources occur, and reflect how both the released chemicals and receptors interact with those media. For example, chemicals in surface water may be dissolved or suspended as particulates and be highly mobile, whereas those same constituents in soil may be much more stationary. The ecology of the receptors is important because it dictates their home range, whether the organism is mobile or immobile, local or migratory, burrowing or aboveground, plant eating, animal eating, or omnivorous.

For the Level II Screen CSM (**Figure 7-4**), specific exposure routes were not identified because the screen is not receptor specific and only focuses on comparison of MDCs of chemicals in the exposure media against published ecological toxicological benchmark concentrations derived for those media. However, the Level III Baseline ecological CSM (**Figure 7-5**) identifies specific exposure routes and indicates whether the exposure routes from the exposure media to the ecological receptors are major or minor. Major exposure routes are evaluated quantitatively, whereas minor routes are evaluated qualitatively. The Level III Baseline ecological CSM (**Figure 7-5**) shows major exposure routes of soil, surface water, and sediment to ecological receptors and an incomplete exposure route of groundwater. Ecological receptors are assumed not to come into direct contact with groundwater.

The major exposure routes for chemical toxicity from surface soil include ingestion (for terrestrial invertebrates, voles, shrews, robins, foxes, and hawks) and direct contact (for terrestrial plants and invertebrates). The ingestion exposure routes for voles, shrews, robins, foxes, and hawks include soil, as well as plant and/or animal food (i.e., food chain), that was exposed to the surface soil. Minor exposure routes for surface soil include direct contact and inhalation of fugitive dust. The major exposure routes for surface water include ingestion (as drinking water) and direct contact (for aquatic biota and benthic invertebrates). Minor exposure pathways for surface water and sediment include direct contact and inhalation (for muskrats, ducks, mink, and herons). The major exposure routes for sediment include ingestion (for aquatic biota, muskrats, ducks, mink, and herons) and direct contact (for aquatic biota and benthic invertebrates). The ingestion exposure routes for aquatic biota (including vertebrate mammals and birds) include sediment and surface water (as applicable) as well as plant and/or animal food (food chain) that were exposed to the sediment or surface water.

Exposure to groundwater is an incomplete pathway for all terrestrial and aquatic ecological receptors because receptors typically do not come into direct contact with groundwater. If the

groundwater outcrops via seeps or springs into wetlands or ditches, it becomes part of the surface water and would be evaluated in the surface water pathway.

7.2.4 Ecological Receptors

For the Level II Screen, specific ecological receptors were not identified, but terrestrial and aquatic biotas are considered as a whole. However, for the Level III Baseline evaluation, terrestrial, semiaquatic, and aquatic ecological receptors are identified as part of the ecological CSM (**Figure 7-5**). The terrestrial receptors include plants, terrestrial invertebrates (earthworms), voles, shrews, robins, foxes, and hawks. The aquatic receptors include benthic invertebrates and aquatic biota. Aquatic herbivore receptors are represented by the muskrat and the mallard duck. Semiaquatic carnivores include mink and herons. These receptors are discussed in more detail in Section 7.2.4.1.

7.2.4.1 Selection of Site-Specific Ecological Receptor Species

The selection of ecological receptors for the site-specific analysis screen was based on plant and animal species that are likely to occur in the terrestrial and aquatic habitats at the site. Three criteria were used to identify the site-specific receptors:

- **Ecological Relevance**—The receptor has or represents a role in an important function such as energy fixation (i.e., plants), nutrient cycling (i.e., earthworms), and population regulation (i.e., hawks). Receptor species were chosen to include representatives of all applicable trophic levels identified by the ecological CSM for the site. These species were selected to be predictive of assessment endpoints (including protected species/species of special concern and recreational species).
- **Susceptibility**—The receptor is known to be sensitive to the chemicals detected at the site, and given their food and habitat preferences, their exposure are expected to be high. The species have a likely potential for exposure based upon their residency status, home range size, sedentary nature of the organism, habitat compatibility, exposure to contaminated media, exposure route, and/or exposure mechanism compatibility. Ecological receptor species were also selected based on the availability of toxicological effects and exposure information.
- **Management Goals**— The receptor represents a valued component of the AOC's ecological significance. Furthermore, as a significant natural resource, its presence should be managed in a manner that is compatible with the military mission at the former RVAAP (AMEC, 2008).

At the Sand Creek Site, the following types of ecological receptors are likely to be present: terrestrial plants, terrestrial invertebrates, meadow voles (*Microtus pennsylvanicus*), short-tailed shrews (*Blarina brevicauda*), American robins (*Turdus migratoris*), red foxes (*Vulpes*

vulpes), red-tailed hawks (*Buteo jamaicensis*), sediment-dwelling biota, aquatic biota, muskrats (*Ondatra zibenthicus*), mallard ducks (*Anas platyrhynchos*), mink (*Mustella vison*), and great blue herons (*Ardea herodias*). Each of these receptors is described in the following sections for terrestrial exposures and for aquatic and semiaquatic exposures:

7.2.4.2 Terrestrial Exposure Classes and Receptors

Terrestrial exposures, receptors, and justification for their relevance at the Sand Creek Site are presented below:

TERRESTRIAL VEGETATION EXPOSURE TO SOIL

Terrestrial vegetation exposure to soil is applicable to the Sand Creek Site. Terrestrial plants have ecological relevance because they represent the base of the food web and are the primary producers that turn energy from the sun into organic material (plants) that provides food for many animals. There is sufficient habitat present for them at the site. In addition, plants are important in providing shelter and nesting materials to many animals, thus, plants are a major component of habitat. Plants provide natural cover and stability to soil and stream banks, thereby reducing soil erosion.

Terrestrial plants are susceptible to toxicity from chemicals. Plants have roots that are in direct contact with surface soil, which provides them with direct exposure to contaminants in the soil. They also can have exposure to contaminants via direct contact on the leaves. There are published toxicity benchmarks for plants (Efroymson et al., 1997b), and there are regulatory statutes for plants because of their importance in erosion control.

TERRESTRIAL INVERTEBRATE EXPOSURE TO SOIL

Terrestrial invertebrate exposure to soil is applicable to soils for the Sand Creek Site. Earthworms represent the receptor for the terrestrial invertebrate class, and there is sufficient habitat present for them on site. Earthworms have ecological relevance because they are important for decomposition of detritus and for energy and nutrient cycling in soil (Efroymson et al., 1997c). Earthworms are probably the most important of the terrestrial invertebrates for promoting soil fertility due to the volume of soil that they process.

Earthworms are susceptible to exposure to and toxicity from COPECs in soil. Earthworms are nearly always in contact with soil and ingest soil, which results in constant exposure. Earthworms are sensitive to various chemicals. Toxicity benchmarks are available for earthworms (Efroymson et al., 1997b). Although management goals for earthworms are not immediately obvious, the role of earthworms in soil fertility and as a prey item for other organisms is significant. Thus, there is sufficient justification to warrant earthworms as a candidate receptor for the Sand Creek Site.

Mammalian Herbivore Exposure to Soil

Mammalian herbivore exposure to soil is applicable to the Sand Creek Site. Cottontail rabbits and meadow voles represent mammalian herbivore receptors, and there is suitable habitat present for them at the site. Both species have ecological relevance by consuming vegetation, which helps in the regulation of plant populations and in the dispersion of some plant seeds. Small herbivorous mammals such as cottontail rabbits and voles are prey items for top terrestrial predators.

Both cottontail rabbits and meadow voles are susceptible to exposure to and toxicity from COPECs in soil and vegetation. Herbivorous mammals are exposed primarily through ingestion of plant material and incidental ingestion of contaminated surface soil containing chemicals. Exposures by inhalation of COPECs in air or on suspended particulates, as well as exposures by direct contact with soil, were assumed to be negligible. Dietary toxicity benchmarks are available for many COPECs for mammals (Sample et al., 1996), and there are management goals for rabbits because they are an upland small game species protected under Ohio hunting regulations. There are no regulatory statutes for meadow voles at the AOC. Meadow voles have smaller home ranges than rabbits, which makes them potentially more susceptible to localized contamination. Therefore, they are a more conservative selection as a representative mammalian herbivore than rabbits, and are selected as candidate receptors for the Sand Creek Site.

Insectivorous Mammal and Bird Exposure to Soil

Insectivorous mammal and bird exposure to soil is applicable to the Sand Creek Site. Short-tailed shrews and American robins represent the receptors for the insectivorous mammal and bird terrestrial exposure class, respectively. There is sufficient, suitable habitat present at the site for these receptors. Both species have ecological relevance because they help to control aboveground invertebrate community size by consuming large numbers of invertebrates. Shrews and robins are a prey item for terrestrial top predators.

Both short-tailed shrews and American robins are susceptible to exposure to and toxicity from COPECs in soil, as well as contaminants in vegetation and terrestrial invertebrates. Insectivorous mammals such as short-tailed shrews and birds such as American robins are primarily exposed by ingestion of contaminated prey (i.e., earthworms, insect larvae, and slugs), as well as ingestion of soil. In addition, shrews ingest a small amount of leafy vegetation, and the robin's diet consists of 50 percent each of seeds and fruit. Dietary toxicity benchmarks are available for mammals and birds (Sample et al., 1996). Both species are recommended as receptors because there can be different toxicological sensitivity between mammals and birds exposed to the same contaminants. There are regulatory statutes for robins because they are federally protected under the *Migratory Bird Treaty Act of 1993*, as amended, and are consistent with the former Camp Ravenna's policies and management goals (AMEC,

2008). There are no specific regulatory statutes for shrews at the MRS. Based on the regulatory statutes for robins, plus the susceptibility to contamination and ecological relevance for both species, there is sufficient justification to warrant shrews and robins as candidate receptors for the Sand Creek Site.

TERRESTRIAL TOP PREDATORS

Exposure of terrestrial top predators is applicable to the Sand Creek Site. Red foxes and red-tailed hawks represent the mammal and bird receptors for the terrestrial top predator exposure class, and there is a limited amount of suitable habitat available for them at the site. Both species have ecological relevance; as representatives of the top of the food chain for the site terrestrial EUs, they control populations of prey animals such as small mammals and birds.

Both red foxes and red-tailed hawks are susceptible to exposure to and toxicity from COPECs in soil, vegetation, and/or animal prey. Terrestrial top predators feed on small mammals and birds that may accumulate constituents in their tissues following exposure at the site. There is a potential difference in toxicological sensitivity between mammals and birds exposed to the same COPECs so it is prudent to examine a species from each taxon (Mammalia and Aves, respectively). Red foxes are primarily carnivorous but consume some plant material. The red-tailed hawk consumes only animal prey. The fox may incidentally consume soil. There are regulatory statutes for both species. Laws (Ohio trapping season regulations for foxes, and federal protection of raptors under the *Migratory Bird Treaty Act of 1993*, as amended) and the former RVAAP's policies and management goals also protect these species (AMEC, 2008). In addition, both species are susceptible to contamination and have ecological relevance as top predators in the terrestrial ecosystem. Thus, there is sufficient justification to warrant these two species as candidate receptors for the Sand Creek Site.

7.2.4.3 Aquatic and Semiaquatic Exposure Classes and Receptors

The aquatic and semiaquatic exposures, receptors, and justification for their relevance at the Sand Creek Site are presented below:

EXPOSURE OF AQUATIC BIOTA TO WATER

Exposure of aquatic biota to water is applicable to the Sand Creek Site. Aquatic biota (i.e., aquatic plants, invertebrates, and fish) represent the ecological receptors for the aquatic biota exposure class, and aquatic habitat is available at this site. Aquatic biotas have ecological relevance because they represent the range of living organisms in the aquatic ecosystem and they provide food for various predators.

Aquatic biotas are susceptible to exposure to and toxicity from COPECs in surface water. The exposure concentration for aquatic biota is assumed to be equal to the measured environmental concentration because the biotas have constant contact with water and the aquatic toxicity benchmarks that are used are expected to protect aquatic life from all exposure pathways,

including ingestion of surface water as well as contaminated plants and animals. Toxicity benchmarks are available for aquatic biota, but the OWQS, Chapter 3745-1 of the OAC (Ohio EPA, 2011), must also be met.

There are regulatory statutes for aquatic biota in laws that specify Ohio water quality standards to support designated uses (i.e., survival and propagation of aquatic life) for waters of the state. In addition, aquatic biotas are susceptible to contamination by virtue of continual exposure in water, and they have ecological relevance within the aquatic and terrestrial ecosystems. Thus, there is sufficient justification to warrant aquatic biota as a candidate receptor for the Sand Creek Site.

EXPOSURE OF SEDIMENT-DWELLING BIOTA TO SEDIMENT

Sediment-dwelling biota exposure to sediment is applicable to the site-specific analysis. Benthic invertebrates such as aquatic insect larvae like caddisflies (*Trichoptera*), mayflies (*Ephemeroptera*), and midges (*Chironomidae*), as well as noninsects such as crayfish (*Decapoda*), snails (*Gastropoda*), and clams and bivalves (*Pelycypoda*), represent the receptors for the sediment-dwelling biota aquatic exposure class. These biota have ecological relevance because they provide food for many aquatic species and also for some terrestrial mammals and birds such as raccoons, mallards, and herons.

Benthic invertebrates are susceptible to exposure to and toxicity from, COPECs in sediment. These biotas have direct contact with sediment and sediment pore water. Toxicity benchmarks are available for benthic invertebrates.

There are regulatory statutes for sediment-dwelling biota because the condition of these biological communities is linked to assessment of Ohio water quality use attainment in streams. These biota are susceptible to contamination by virtue of continual exposure in sediment, and they have ecological relevance as a major food source for aquatic biota. Thus, there is sufficient justification to warrant sediment-dwelling biota as a candidate receptor for the Level III Baseline.

HERBIVORE EXPOSURE TO WATER, SEDIMENT, AND THE AQUATIC FOOD WEB

Aquatic herbivores like muskrats and mallard ducks are exposed to water and sediment. Therefore, these exposures are applicable to the Sand Creek Site. There is also suitable habitat for them at the AOC. Muskrats ingest aquatic vegetation. Mallard ducks are surface-feeding ducks that obtain much of their food by dabbling in shallow water and filtering through soft mud with their bills. Their food consists mostly of seeds of aquatic plants as well as aquatic invertebrates (EPA, 1993). Animal matter accounts for the majority of the diet for breeding female ducks during the spring and summer, but decreases to less than 10 percent of the diet during the winter. Mallards have ecological relevance as important components of the aquatic

food web. As aquatic herbivores, muskrats and mallards help maintain the size and composition of the aquatic vegetation community.

Muskrats and mallards are susceptible to exposure to and toxicity from COPECs in surface water and aquatic vegetation. The potential for exposure to contaminants is high because they consume aquatic and sediment-dwelling plants that can accumulate high concentrations of some chemicals from water. In addition, these species can have further exposure via ingestion of contaminants in surface water that they use for a drinking water source and incidentally ingested sediment. Since there is a potential difference in the toxicological sensitivity of mammals and birds exposed to the same COPECs, one mammal and one bird were examined for exposure to water, sediment, and the aquatic food chain. Dietary toxicity benchmarks for many inorganic and some organic substances are available for mammals and birds.

There are regulatory statutes for muskrats and mallards. For example, there are Ohio trapping season regulations for muskrats, and mallards are federally protected under the *Migratory Bird Treaty Act of 1993*, as amended, and are consistent with the former RVAAP's policies and management goals (AMEC, 2008). Mallard ducks are also federally protected as a game species under the *Migratory Bird Hunting and Conservation Stamp Act of 1934*, as amended. Both species are susceptible to COPECs, especially via ingestion exposure, and they have ecological relevance. Thus, there is sufficient justification to warrant these receptors for the Sand Creek Site.

SEMIAQUATIC CARNIVORES

Exposure of predators to aquatic biota is applicable to the Sand Creek Site because PBT chemicals are present at the AOC. There is also suitable habitat for these receptors at the site. Exposure evaluation for piscivores (fish-eating predators) is required per the Ohio EPA Guidance (2008) when a PBT compound or a COPEC with no screening benchmark is found in surface water or sediment. Mink and great blue herons are semiaquatic carnivores selected to represent mammalian and bird receptors for the fish-eating predator exposure class. These semiaquatic carnivores feed predominantly in and along the riparian zone along the banks of streams. Both species have ecological relevance because they are important components of the aquatic food web representing the top predators. As top predators, they help limit the population size for some aquatic and some sediment-dwelling biota communities.

Both species are susceptible to exposure to and toxicity from COPECs in surface water, aquatic biota, and sediment-dwelling biota. The potential for exposure to COPECs is high for these two species because they consume fish, which can accumulate high concentrations of some chemicals from water. In addition, both species can have further exposure via ingestion of COPECs in surface water that is used for a drinking water source. Dietary toxicity benchmarks are available for mammals and birds. There can be differences in toxicological sensitivity

between mammals and birds exposed to the same COPEC, so both species are appropriate for consideration.

There are regulatory statutes for both species because regulations protect both species and are consistent with the former RVAAP's policies and management goals (AMEC, 2008). For example, mink are regulated by Ohio trapping regulations because they are fur-bearing mammals. Great blue herons are federally protected under the *Migratory Bird Treaty Act* of 1993, as amended. Both species are susceptible to contamination, especially via ingestion exposure routes, and they have ecological relevance as predators. Thus, there is sufficient justification to warrant evaluating these two receptors as candidate receptors for the Sand Creek Site.

7.2.4.4 Relevant and Complete Exposure Pathways

Relevant and complete exposure pathways for the ecological receptors at the Sand Creek Site were described in Section 7.2.3. As previously discussed, there are relevant and complete exposure pathways for various ecological receptors including terrestrial vegetation and invertebrates; aquatic and sediment-dwelling biota; and terrestrial and aquatic herbivores, insectivores, and carnivores. Thus, these types of receptors could be exposed to COPECs in abiotic media at the Sand Creek Site.

7.2.5 Ecological Endpoint (Assessment and Measurement) Identification

The protection of ecological resources, such as habitats and species of plants and animals, is a primary motivation for conducting SLERAs. Key aspects of ecological protection are presented as general management goals. These are general goals established by legislation or agency policy that are based on societal concern for the protection of certain environmental resources. For example, environmental protection is mandated by a variety of legislation and government agency policies (i.e., CERCLA and the *National Environmental Policy Act*). Other legislation includes the *ESA 16 U.S.C. 1531–1544* (1993, as amended) and the *Migratory Bird Treaty Act of 1993*. To evaluate whether a general management goal has been met, assessment endpoints, measures of effects, and decision rules were formulated. The general management goals, assessment endpoints, measures of effects, and decision rules are discussed below:

There are two general management goals for the Sand Creek Site. However, the assessment endpoints differ between the general screen and the site-specific analysis screen. The general management goals for the SLERA are as follows:

- **General Management Goal 1:** Protect terrestrial plant and animal populations from adverse effects due to the release or potential release of chemical substances associated with past site activities.

- **General Management Goal 2:** Protect aquatic plant and animal populations and communities from adverse effects due to the release or potential release of chemical substances associated with past site activities.

Ecological assessment endpoints are selected to determine whether these general management goals are met at the unit. An ecological assessment endpoint is a characteristic of an ecological component that may be affected by exposure to a stressor (i.e., COPEC). Assessment endpoints are "explicit expressions of the actual environmental value that is to be protected" (EPA, 1992). Assessment endpoints often reflect environmental values that are protected by law, provide critical resources, or provide an ecological function that would be significantly impaired if the resource was altered. Unlike the HHRA process, which focuses on individual receptors, the SLERA focuses on populations or groups of interbreeding nonhuman, nondomesticated receptors. Accordingly, assessment endpoints generally refer to characteristics of populations and communities. In the SLERA process, risks to individuals are assessed only if they are protected under the ESA or other species-specific legislation, or if the species is a candidate for listing as a threatened or endangered species.

The Ohio EPA Guidance (2008) was used to select assessment endpoints since an assessment endpoints list is not available. For the Level II Screen evaluation, the assessment endpoints are any potential adverse effects on ecological receptors, where receptors are defined as any plant or animal population, communities, habitats, and sensitive environments. Although the assessment endpoints for the Level II Screen are associated with general management goals 1 and 2, specific receptors are not identified with the assessment endpoints.

Table 7-6 shows the general management goals for terrestrial and aquatic resources, associated assessment endpoints, measures of effect, and decision rules by assessment endpoint number. Furthermore, the table provides definitions of assessment endpoints 1, 2, 3, and 4 (terrestrial receptors) and 5, 6, 7, and 8 (aquatic receptors). As stated, the assessment endpoint table includes a column describing the conditions for making a decision depending on whether the HQ is less than or more than 1. If the HQ is greater than 1, the scientific management decision point (SMDP) options from Ohio EPA Guidance (2008) are provided (i.e., no further action, risk management, monitoring, remediation, or further investigation).

For the Level III Baseline evaluation, the assessment endpoints are more specific and stated in terms of types of specific ecological receptors associated with each of the two general management goals. Assessment endpoints 1, 2, 3, and 4 entail the growth, survival, and reproduction of terrestrial receptors such as vegetation and terrestrial invertebrates, herbivorous mammals, worm-eating/insectivorous mammals and birds, and carnivorous top predator mammals and birds, respectively. Assessment endpoints 1 through 4 are associated with General Management Goal 1, protection of terrestrial populations and communities.

Assessment endpoint 5 deals with the growth, survival, and reproduction of sediment-dwelling biota, which is associated with General Management Goal 2, protection of aquatic populations and communities. Assessment endpoints 6, 7, and 8 are also associated with General Management Goal 2, and deal with the growth, survival, and reproduction of aquatic biota, aquatic herbivores, and semiaquatic carnivores, respectively.

The assessment endpoints are evaluated through the use of measurement endpoints. The EPA defines measurement endpoints as ecological characteristics used to quantify and predict change in the assessment endpoints. They consist of measures of receptor and population characteristics, measures of exposure, and measures of effect. For example, measures of receptor characteristics include parameters such as home range, food intake rate, and dietary composition. Measures of exposure include attributes of the environment such as contaminant concentrations in soil, sediment, surface water, and biota. The measurement endpoints of effect for the Level II Screen evaluation consist of the comparison of the MDCs of each contaminant in each medium to ESV benchmarks for SRCs in soil and sediment, and OWQS (Ohio EPA, 2011) for surface water.

Measurement endpoints for the Level III Baseline evaluation include the comparison of predicted doses of chemicals in various receptor animals such as voles, shrews, American robins, and aquatic biota to Toxicity Reference Values (TRVs).

In the Level II Screen, MDCs in soil or sediment at each EU were compared to default soil or sediment screening values that are expected not to cause harm to ecological populations. The MDCs in surface water were compared to Ohio WQC. The Level II Screen used the Ohio EPA Guidance (2008) for selecting screening values for soil and sediment, and the OWQS (Ohio EPA, 2011) for surface water.

The COPECs that were retained after the Level II Screen are potentially subject to a Level III Baseline analysis with exposures that are more representative of the exposures expected for the representative receptors. The Level III Baseline analysis includes evaluation of exposure of a variety of receptors to the reasonable maximum exposure (RME) concentrations of COPECs at each EU, using default dietary and uptake factors. The representative ecological receptors may not all be present at each EU. However, all representative receptors are evaluated at this step.

For the Level III Baseline evaluation, the decision rules for COPECs came from Ohio EPA Guidance (2008) for chemicals. Briefly, for COPECs, the first decision rule is based on the ratio (or HQ) of the dose to a given receptor species (i.e., a vole, representing herbivorous mammals) associated with a chemical's concentration in the environment (numerator) to the ecological effects or TRV (denominator) of the same chemical. A ratio of 1 or smaller means

that ecological risk is negligible while a ratio of greater than 1 means that ecological risk from that individual chemical is possible and that additional investigation should follow to confirm or refute this prediction. The second decision rule is that if "no other observed significant adverse effects on the health or viability of the local individuals or populations of species are identified" and the HI does not exceed 1, "the site is highly unlikely to present significant risks to endpoint species" (Ohio EPA, 2008). There are three potential outcomes for the Level III Baseline evaluation: (1) no significant risks to endpoint species so no further analysis is needed, (2) conduct field baseline assessment to quantify adverse effects to populations of representative species that were shown to be potentially impacted based on hazard calculations in the Level III Baseline evaluation, or (3) remedial action taken without further study.

7.2.6 Level II Screen Weight of Evidence Discussion

Prior to making the determination as to whether a Level III Baseline is warranted, it is appropriate to evaluate various lines of evidence that might suggest whether or not additional ecological investigation is needed at this AOC. Due to the highly conservative nature of the Level II Screen, the identification of COPECs does not necessarily indicate that the potential for adverse effects is realistic at this site. Therefore, although any chemical with an HQ greater than 1 must be identified as a COPEC (Ohio EPA, 2008), HQs less than 10 represent a low potential for environmental effects, HQs from 10 up to but less than 100 represent a significant potential that effects could result from greater exposure, and HQs greater than 100 represent the greatest potential for expected effects (Wentsel et al., 1996). It should be noted that the Ohio EPA considers HQs greater than 1 to be potentially significant. It should also be noted that HQs are not measures of risk, are not population-based statistics, and are not linearly scaled statistics. Therefore, an HQ above 1, even exceedingly so, does not definitively indicate that there is even one individual expressing the toxicological effect associated with a given chemical to which it was exposed (Tannenbaum, 2005; Bartell, 1996). Therefore, the findings of the Level II Screen are discussed in additional detail in this section to support final recommendations for this stage of the SLERA process.

7.2.6.1 Surface Soil Weight of Evidence Discussion

As presented in Section 7.2.2.5, a total of 34 COPECs was identified in surface soil. Ten of these, however, were detected at concentrations below their conservative ESVs, and were only selected as COPECs because they were identified as PBT chemicals. One chemical (nitroguanidine) was selected as a COPEC because no ESV was identified. All surface soil ISM sampling units had at least one COPEC present that exceeded its screening criteria. Some sampling units were obviously more greatly impacted than others, however. **Table 7-7** presents the concentrations of all COPECs by surface soil ISM sampling unit, and **Table 7-8** presents the HQs associated with each COPEC in the individual sampling units.

For metals, the only inorganic chemical that exceeded an HQ of 100 was mercury, which was detected at elevated concentrations in multiple ISM sampling units. Several other metals had HQs greater than 10 (but less than 100), including antimony, cadmium, copper, lead, and silver. Because antimony, cadmium, copper, lead and silver are not identified as PBT chemicals, food chain effects are not considered to be significant, and proceeding to a Level III Baseline evaluation for these chemicals is not considered necessary. For these metals, localized impacts to ecological receptors cannot be ruled out where elevated concentrations are present. However, due to the minimal area of the combined ISM sampling units that make up the EU for the AOC as a whole (2.6 acres), it is unlikely that populations of receptors (which are the endpoints of concern for the ERA) would be affected. Nonmotile (i.e., plants) or small range (i.e., soil invertebrates, small mammals, etc.) could potentially be affected on a local scale, but population compensatory mechanisms as well as avoidance behavior that many organisms exhibit in the presence of contamination would likely result in few, if any, population-level impacts. The one propellant compound, nitroguanidine, could not be evaluated because no ESV was identified. The compound was detected in one out of two samples at a concentration marginally exceeding its reporting limit (**Table 7-7**). Propellant compounds typically are not bioaccumulative, and this chemical was not identified as a PBT compound. Therefore, although the presence of this chemical represents a small uncertainty in this SLERA, nitroguanidine is unlikely to pose a significant threat to ecological receptors.

Three pesticides were identified as COPECs, two of which (alpha-chlordane and lindane) were only selected as COPECs because they are PBT chemicals. Heptachlor was the only pesticide with an HQ above 1 for one sample (**Table 7-8**), and the HQ does not exceed unity when rounded. Although pesticides were used at the former RVAAP, pest control was consistent with standard and legal application procedures at the time. Due to their relatively low concentrations, and the lack of an obvious site-related source such as a spill, these chemicals are considered to be of low significance to ecological receptors.

Sixteen SVOCs were selected as COPECs. Eight of these SVOCs (1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, dibenzofuran, di-n-butyl phthalate, and pentachlorophenol) were only selected as COPECs because they are considered PBT compounds. The HQs for these chemicals ranged from 0.0008 to 0.25. The presence of these chemicals at these low concentrations suggests that their potential to result in adverse ecological effects is minimal. Six PAHs consisting of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and pyrene as well as bis(2-ethylhexyl)phthalate were detected at several ISM sampling units, resulting in HQs that were all below 5 (**Table 7-8**). PAHs are anthropogenic compounds that are commonly found in the environment due to their widespread generation from the incomplete combustion of fossil fuels. Although PAHs may bioaccumulate in lower trophic

level organisms, they are readily metabolized by higher order organisms and are not considered PBT compounds in this SLERA.

Bis(2-ethylhexyl)phthalate is a common laboratory contaminant, and its presence in a single sample resulting in an HQ that marginally exceeds 1 is not considered a significant threat to ecological receptors. Therefore, bis(2-ethylhexyl)phthalate is not considered to be COPECs that require further evaluation for ecological purposes.

The final SVOC COPEC, carbazole, is a heterocycle, which is a PAH in which one of the carbons within the aromatic structure is substituted by a nitrogen atom. Carbazole occurs as a natural constituent of creosote and coal tar (Agency for Toxic Substances and Disease Registry, 2002), and is often collocated with PAHs in the environment. Carbazole was detected in 9 of the 18 ISM sampling units at concentrations ranging from 0.034 to 0.61 mg/kg (**Table 7-7**). Unlike the PAHs, carbazole had very high HQs (maximum HQ of 7,600) in many ISM sampling units (**Table 7-8**) owing to its very low ESV of 0.00008 mg/kg, which is approximately five orders of magnitude lower than PAHs such as benzo(a)pyrene (ESV of 1.1 mg/kg). Given the structural similarity of carbazole to PAHs, the appropriateness of using such a conservative ESV is highly questionable, particularly in light of the fact that soil toxicity studies have shown carbazole exhibits similar toxic responses as PAHs in soil invertebrates (Wassenberg et al., 2005; Sverdrup et al., 2001, 2002a, and 2002b). Therefore, the presence of carbazole represents an uncertainty at the site, but further investigation of this chemical in soil for ecological purposes alone is not recommended.

7.2.6.2 Sediment Weight of Evidence Discussion

As presented in Section 7.2.2.5, 29 COPECs were identified in sediment. Eleven of these, however, were detected at concentrations below their conservative ESVs, and were only selected as COPECs because they were identified as PBT chemicals. One chemical (nitroguanidine) was selected as a COPEC because no ESV was identified. Sediment sample SCsd-070M-0001-SD contained 16 COPECs that exceeded screening criteria (8 metals, 1 explosive compound, 6 pesticides/PCBs, and 1 SVOC), while sediment sample SCsd-071M-0001-SD had only three COPECs (all metals) based on concentrations above the screening criteria. **Table 7-9** presents the concentrations of all COPECs by sediment sampling unit, and **Table 7-10** presents the HQs associated with each COPEC in the individual ISM sampling units.

Antimony at sampling unit SCsd-070 and thallium at both sediment ISM sampling units had HQs greater than 10 (but less than 100). Because silver, antimony, and thallium are not identified as PBT chemicals, food chain effects are not considered to be significant, and proceeding to a Level III Baseline evaluation is not considered necessary. Several other non-PBT metals had HQs below 5, and are not considered to be significant.

The MDC for silver was detected over 200 times greater than its ESV in sediment sample SCsd-070M-0001-SD. The MDC for silver also resulted in an HQ greater than 100 and indicates a potential for adverse effects. Silver was not detected in the other sediment sample (SCsd-071M-0001-SD), but was detected at elevated concentrations in soil, particularly surface soil samples from ISM sampling units SCss-060 through SCss-064 which are upgradient of sediment sampling unit SCsd-070. Localized impacts to ecological receptors cannot be ruled out where elevated concentrations, such as the silver concentration at sampling unit SCsd-070, are present; however, due to the small size of the sampling units (and the AOC as a whole), it is unlikely that populations of receptors (which are the endpoints of concern for the ERA) would be affected. Nonmotile (i.e., hydric-adapted vegetation) or small range (i.e., benthic invertebrates, small mammals, etc.) could potentially be affected on a local scale, but population compensatory mechanisms as well as avoidance behavior that many organisms exhibit in the presence of contamination would likely result in few, if any, population-level impacts. The single propellant compound, nitroguanidine, could not be evaluated because no ESV was identified. The compound was detected in both sediment samples at a MDC of 1.2 mg/kg (**Table 7-9**). Propellant compounds typically are not bioaccumulative, and this chemical was not identified as a PBT compound. Therefore, although the presence of this chemical represents a small uncertainty in this SLERA, nitroguanidine is unlikely to pose a significant threat to ecological receptors.

Two PCBs and 12 pesticides were identified as COPECs in sediment, 8 of which were only selected as COPECs because they are PBT chemicals. For those chemicals that exceed screening values, all HQs were below 5 and are not considered to be significant (**Table 7-10**). Pesticides were likely routinely used at the former RVAAP for pest control consistent with standard and legal application procedures at the time. Due to their relatively low concentrations, and the lack of an obvious site-related source, PCBs, and pesticides are considered to be of low significance to ecological receptors.

Four SVOCs were selected as COPECs, three of which (1,2-dichlorobenzene, 1,4-dichlorobenzene, and di-n-butyl phthalate) were only selected as COPECs because they are considered PBT compounds. The HQs for these chemicals ranged from 0.1 to 0.3. The HQ for the one SVOC selected as a COPEC because it exceeded its ESV (2-methylnapthalene) was below 5 and is not considered to be significant (**Table 7-10**).

7.2.7 Level II Screen Recommendations

Most of the COPECs detected in surface soil at the Sand Creek Site were detected at concentrations that are unlikely to be ecologically significant. Elevated concentrations of several COPECs (primarily metals and SVOCs) were detected in soil. Exposure to some of these COPECs may result in localized impacts to ecological receptors, but for all COPECs except mercury, no population-level impacts are expected due to the relatively low

concentrations and/or because the small spatial area where elevated concentrations were detected are unlikely to result in exposure to multiple organisms. Mercury, however, was detected at elevated concentrations in several surface soil ISM sampling units. Mercury is a potentially bioaccumulative metal, and its presence over a relatively large percentage of the AOC may result in exposure to higher order receptors through direct as well as indirect (i.e., food chain) pathways. Therefore, with the exception of mercury, no further investigation of COPECs in surface soil (0 to 1 foot) at the AOC is recommended. A Level III Baseline is recommended for mercury in soil to estimate ecological hazards to specific target receptors.

Several chemicals identified as COPECs in sediment overlapped the list of COPECs for soil, but most chemicals were detected at concentrations that are unlikely to be ecologically significant. Some metals, particularly silver (and to a lesser extent antimony and thallium), had elevated HQs, which indicate a potential for adverse effects. Because of the numerous conservative assumptions typical of ERAs, and several resulting uncertainties associated with HQ calculation, HQs only provide order-of-magnitude estimates of the potential for adverse effects, not exact measurements of actual effects on receptor organisms. Additionally, the COPECs in sediment are not PBT chemicals so food chain effects are considered unlikely, and any impacts are expected to be localized. Population-level effects due to exposure to contaminated sediment are not considered likely. Therefore, no further investigation is recommended for any of the COPECs detected in sediment at the AOC.

7.3 Level III Baseline Evaluation

The objective of a Level III Baseline evaluation is to estimate hazards to representative endpoint species using a deterministic risk assessment approach (Ohio EPA, 2008). This evaluation is performed in accordance with the ecological CSM presented during the Level II Screen step (Section 7.2.3), modified based on recommendations from the Level II Screen. According to the recommendations from the Level II Screen, the scope of the Level III Baseline evaluation is limited to only evaluating mercury food chain effects in soil. A revised Level III Baseline ecological CSM reflecting this scope is presented in **Figure 7-6**.

7.3.1 Exposure Assessment

An estimate of the nature, extent, and magnitude of potential exposure of assessment receptors to COPECs that are present at or migrating from the site is presented in this section, considering both current and reasonably plausible future use of the site. Exposure characterization is critical in further evaluating the risk of chemicals identified as COPECs during the screening process (Section 7.2.2). The exposure assessment has been conducted by linking the magnitude (concentration) and distribution (locations) of the contaminants detected in the media sampled during the investigation, evaluating pathways by which chemicals may

be transported through the environment, and determining the points at which organisms found in the study area may contact contaminants.

7.3.2 Exposure Analysis

An exposure analysis was performed that combines the spatial and temporal distribution of the ecological receptors with those of the COPECs to evaluate exposure. The exposure analysis focuses on the bioavailable chemicals and the means by which the ecological receptors are exposed (i.e., exposure pathways). The focus of the analysis is dependent on the assessment receptors being evaluated as well as the assessment and measurement endpoints.

Exposure pathways consist of four primary components: (1) source and mechanism of contaminant release, (2) transport medium, (3) potential receptors, and (4) exposure route. A chemical may also be transferred between several intermediate media before reaching the potential receptor. All of these components are described in the ecological CSM (Section 7.2.3). If any of these components is not complete, then contaminants in the affected media do not constitute an environmental risk at the site. The major fate and transport properties associated with typical site contaminants are described in subsequent sections. These properties directly affect a contaminant's behavior in each of the exposure pathway components.

Ecological routes of exposure for biota may be direct (bioconcentration) or through the food web via the consumption of contaminated organisms (biomagnification). Direct exposure routes include dermal contact, absorption, inhalation, and ingestion. Examples of direct exposure include animals incidentally ingesting contaminated soil or sediment (i.e., during burrowing or dust-bathing activities), animals ingesting surface water, plants absorbing contaminants by uptake from contaminated sediment or soil, and the dermal contact of aquatic organisms with contaminated surface water or sediment. Given the scarcity of available data for wildlife dermal and inhalation exposure pathways, potential risk from these pathways is not estimated in this SLERA. In addition, these pathways are generally considered to be incidental for most species, with the possible exceptions of burrowing animals and dust-bathing birds.

Food web exposure can occur when terrestrial or aquatic fauna consume contaminated biota. Examples of food web exposure include animals at higher trophic levels consuming plants or animals that bioaccumulate contaminants.

Bioavailability is an important contaminant characteristic that influences the degree of chemical-receptor interaction. The bioavailability of a chemical refers to the degree to which a receptor is able to absorb a chemical from the environmental medium. A chemical’s bioavailability is a function of several physical and chemical factors such as grain size, organic

carbon content, water hardness, and pH. Unless site-specific data are available, bioavailability is conservatively assumed to be 100 percent.

Daily doses of COPECs for vertebrate receptors were calculated using standard exposure algorithms. These algorithms incorporate species-specific natural history parameters (i.e., feeding rates, water ingestion rates, dietary composition, etc.) and also use site-specific area use factors (AUFs), as follows:

$$Total\ Daily\ Dose = \left(\frac{\left(\left[Soil_j * IR_{soil} \right] + \left[Water_j * IR_{water} \right] + \left[\sum_{i=1}^{N} B_{ji} * P_i * IR_{food} \right] \right)}{Body\ Weight} \right) * AUF \quad \text{Eq. 7.1}$$

where:

$Soil_j$	=	Concentration of COPEC "j" in soil
$Water_j$	=	Concentration of COPEC "j" in surface water
B_{ji}	=	Concentration of COPEC "j" in food type "i"
IR_{soil}	=	Soil ingestion rate
IR_{water}	=	Surface water ingestion rate
IR_{food}	=	Food ingestion rate
P_i	=	Proportion of food type$_i$ in receptor diet
AUF	=	Area Use Factor (equal to area of EU/home range of receptor
Body Weight	=	Body weight of receptor

If sediment was a medium of concern, sediment could be evaluated by replacing soil in Equation 7.1 for aquatic or semiaquatic receptors. Because soil is the only medium of concern for this AOC, the exposure equation for terrestrial organisms is as follows:

$$Total\ average\ daily\ dose = ADD_P + ADD_A + ADD_S \times AUF \times TUF$$

where:

ADD_P	=	Average daily dose by ingestion of plant matter (mg/kg body wt/d)
ADD_A	=	Average daily dose by ingestion of animal matter (mg/kg body wt/d)
ADD_S	=	Average daily dose by ingestion of soil (mg/kg body wt/d)
AUF	=	Area Use Factor (unitless)
TUF	=	Temporal Use Factor (unitless)

Feeding and drinking rates for site receptors have been established for the former RVAAP and are described in the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003). To estimate dose associated with ingested food items, concentrations of COPECs in the vegetation or prey in the species' diet is estimated using bioaccumulation factors (BAFs)

(sometimes referred to as bioconcentration factors [BCFs]). BAFs are based on regression models or scalar variables that reflect the potential for the COPECs to be present in food items at concentrations different from (usually greater than) the ambient environment. Differences in concentration are due to chemical-specific properties of the COPEC that affect its tendency to bioaccumulate in tissue, balanced by the innate ability of the species to regulate body burden levels of the chemical via metabolic and excretory processes.

Selection of appropriate BAFs is a critical component to food chain modeling. General approaches for BAF selection have been discussed in Sample and Suter (1994), EPA (1999a), U.S. Army Environmental Command (USAEC) (2005), and the Ohio EPA Guidance (2008) . An approach that is consistent with these sources was followed in the selection of BAFs for the former RVAAP. The general hierarchy for selection of BAFs based on types of sources is as follows:

- Use of regression equations derived from paired field- or laboratory-based measurements.
- Ratio-derived BAFs developed based on paired data of tissue concentrations compared to media concentrations where the BAF is equal to the tissue concentration divided by the concentration in the abiotic medium.
- Modeled equilibrium partitioning-derived BAFs based on physical or chemical characteristics.
- Assumptions based on values common to chemical class.

Both the USAEC (2005) and the EPA (1999a) support the use of ratio BAFs in preference to equilibrium partitioning-based BAFs, which are typically calculated based on factors such as log K_{ow} values, fraction of organic carbon in soil, or percent of lipids in invertebrates.
Other general recommendations provided in the Ohio EPA Guidance (2008) were also followed, including the following:

- For selection of ratio-based BAFs, median values are selected over maximum or other high-end BAFs.
- BAFs for PAH accumulation into mammalian prey are assumed to equal 0 due to the high metabolic breakdown of PAHs in mammals.

Regression equations used to calculate prey tissue concentrations of a specific chemical typically take the following general equation form:

$$\text{Ln}\,(C_{food}) = \text{slope value} \times \ln\,(C_{abiotic\_media}) + \text{intercept value} \qquad \text{Eq. 7.2}$$

where:

C_{food} = Concentration of chemical in food type
$C_{abiotic\_media}$ = Concentration of chemical in abiotic media

Ratio BAFs can be generally presented as follows:

$$C_{food} = BAF \times (C_{abiotic\_media}) \qquad \text{Eq. 7.3}$$

where:

C_{food}	=	Concentration of chemical in food type
$C_{abiotic\_media}$	=	Concentration of chemical in abiotic media
BAF	=	Bioaccumulation Factor

BAFs calculated based on equilibrium partitioning typically use a physical constant of a chemical to generate a BAF. A generalized form for this calculation would be as follows:

$$\text{Log (BAF)} = \text{slope value} \times \text{Log } (K_{ow}) + \text{intercept value} \qquad \text{Eq. 7.4}$$

where:

Log (BAF) = Log of the BAF for chemical in food type
K_{ow} = Octanol-water partition coefficient

BAFs calculated based on equilibrium partitioning are applied in the same fashion as ratio-based BAFs to generate a tissue concentration value. K_{ow} values needed for BAFs based on equilibrium partitioning are obtained using the K_{ow} WIN application in EPA's EPI Suite software (http://www.epa.gov/oppt/exposure/pubs/episuite.htm).

Finally, where ratio-based BAFs are missing and where no equilibrium partitioning method has been developed for calculating BAFs, other methods, such as using BAFs for chemicals in the same class as surrogates, may be presented for establishing ratio-based BAFs. The hierarchies used to select BAFs specific to the various types of biota are presented below:

Soil-to-plants BAFs are also used to evaluate sediment-to-plant uptake at the former RVAAP. Soil-to-plants BAFs are selected using the following specific hierarchy of sources:

- EcoSSLs (EPA, 2010) selected regressions
- Efroymson, R.A., B.E. Sample, and G.W. Suter, 2001. *Uptake of Inorganic Chemicals From Soil by Plant Leaves: Regressions of Field Data, Environ. Toxicol. Chem.* 20: 2561–2571
- EcoSSLs (EPA, 2010) recommended nonregression BAFs
- International Atomic Energy Agency (IAEA) (1994) BAFs

- Baes, C.E., R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*, ORNL-5786, September

Soil-to-invertebrates BAFs are selected using the following hierarchy of sources:

- EcoSSLs (EPA, 2010) selected regressions
- Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, and Ashwood, 1998a. *Development and Validation of Bioaccumulation Models for Earthworms*, ES/ER/TM-220 regressions
- Sample et al. (1998) median BAFs
- Equilibrium BAF calculation method in EPA (2010a) based on Jager, T., 1998. "Mechanistic Approach for Estimating Bioconcentration of Organic Chemicals in Earthworms," *Environ. Toxicol. Chem.*, 17: 2080–2090

Soil-to-mammals BAFs are selected using the following hierarchy or sources:

- EcoSSLs (EPA, 2010) or Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, 1998, *Development and Validation of Bioaccumulation Models for Small Mammals*, ES/ER/TM-219 selected regressions
- EcoSSLs (EPA, 2010) referenced BAFs (Note: per EPA [2010], a BAF of zero is used for all PAHs, trinitrotoluene, and RDX.)
- Sample et al. (1998b) median BAFs
- IAEA (1994) BAFs
- Baes et al. (1984) BAFs (these values were often updated in the newer IAEA [1994] publication)
- EPA (1999b) *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA530-D-99-001A, November (maximum calculated BAFs/BCFs for feeding guilds)

The BAFs used for mercury are presented in **Table 7-11**.

7.3.2.1 Terrestrial Ecological Receptor Species

The exposed ecological receptors for the Level III Baseline were identified in the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003) based on three criteria, including their ecological relevance, susceptibility to the contaminants likely to be found at the AOC, and consistency with RVAAP management goals, including protection of threatened

and endangered species. Based on these criteria, the following terrestrial receptors were selected for evaluation, representing specific taxonomic and foraging guilds likely to be found at the site:

- Vegetation
  - Variety of grasses, forbs, and trees
- Soil-dwelling invertebrates
  - Earthworms
- Mammalian herbivores
  - Meadow vole
- Worm-eating and/or insectivorous mammals and birds
  - Short-tailed shrew
  - American robin
- Terrestrial top predators
  - Red-tailed hawk
  - Barn owl (a threatened and endangered species)
  - Red fox

These receptors are likely to be present at the facility and were selected consistent with Ohio EPA Guidance (2008). Evaluation of these receptors addresses the assessment endpoints presented in Level II Screen evaluation (Section 7.2.3). For the Level III Baseline, plants and invertebrates are not quantitatively assessed, as the protection of soil plants and invertebrates was already addressed by the comparisons to ESVs in the Level II Screen evaluation . Justification for selection of ecological receptors and their associated exposure parameters are presented in the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003) and are summarized in **Table 7-12**.

7.3.2.2 Exposure Characterization Summary

The estimated chemical intakes for each exposed receptor group under each exposure pathway and scenario are presented in the ecological risk assessment tables in **Appendix H**. These intake estimates are combined with the COPEC toxicity values, discussed in the following section, to derive estimates and characterize potential ecological risk.

7.3.3 Toxicity Assessment

The toxicity assessment primarily describes the development of TRVs. TRVs provide a reference point for the comparison of toxicological effects upon exposure to a contaminant and are compared against calculated receptor doses. TRVs are not used for evaluating plants or invertebrates, which are evaluated in terms of potential hazards at a community scale rather than a species scale.

7.3.3.1 Development of Toxicity Reference Values

TRVs focusing on the growth, survival, and reproduction of species and/or populations have been developed for the Sand Creek Site SLERA. Empirical data are available for the specific receptor-endpoint combinations in some instances. The No Observed Adverse Effect Level (NOAEL) is a dose of each COPEC that produced no known adverse effects in the test species. The NOAEL was judged to be an appropriate toxicological endpoint since it would provide the greatest degree of protection to the receptor species. In addition, the Lowest Observed Adverse Effect Level (LOAEL) was used as a point of comparison for risk management decisions. The LOAEL is the lowest concentration in a laboratory test setting that is associated with an effect, and is considered to be a more realistic (although still conservative) endpoint. In instances where data are unavailable for a site-associated COPEC, toxicological information for surrogate chemicals or groups of chemical was used. Safety factors were used to adjust for these differences and extrapolate risks to the site's receptors at the NOAEL and/or LOAEL endpoint. This process is described in the following paragraphs.

Because the measurement endpoint ranges from the NOAEL to the LOAEL, preference is given to chronic studies noting concentrations at which no adverse effects were observed and those for which the lowest concentrations associated with adverse effects were observed. Where data are unavailable for the exposure of a receptor to a COPEC, data for a surrogate chemical or group of chemicals may be considered.

TRVs are developed separately for birds and mammals; it is inappropriate to apply TRVs across classes (i.e., a TRV for a bird species may not be used to estimate hazard for a mammal species). In instances where TRVs for multiple avian or mammalian species are supported, the TRV for the most similar species to the measurement receptor based on feeding strategy and physiological attributes were used. For example, a mammalian TRV for mercury based on both mink and mouse test species data are available. The mink TRV was used in the food chain model to evaluate the terrestrial mammalian carnivore (i.e., the red fox), while the mouse TRV was used for the short-tailed shrew and meadow vole due to closer taxonomic similarity and foraging patterns.

TRVs represent NOAELs and LOAELs with the safety factors presented in Wentsel et al. (1996), applied to toxicity information that was derived from studies other than no effects or

lowest effects studies (**Figure 7-7**). Because NOAELs and LOAELs for the selected wildlife receptor species are based on data from test species that are usually different from the species of concern, the previous ERA often applied a mathematical adjustment to the TRVs using a power function of the ratio of species body weights (i.e., Sample et al., 1996). This practice is often referred to as allometric scaling. Alternately, uncertainty factors have also been used to adjust the TRVs when the toxicity values were based on a different species from the evaluated receptor to account for the potential differences in species' chemical sensitivities. However, in recent years, these practices have been discouraged by most scientific and regulatory groups. Recent reviews of these practices (Ohio EPA, 2008; Allard et al., 2009) have concluded that the use of allometric scaling of TRVs does not reflect a sound application of toxicological or ecological risk practices because supporting data for this practice are limited, and the ratio relationships used for the mathematical conversions were developed based on acute (rather than chronic) toxicity data. Allard et al. (2009) also concluded that uncertainty factors based on an arbitrary multiplier should not be used without a scientific basis for their application. Therefore, the use of toxicity data without adjustments as reported in the literature is regarded as the most technically sound approach and is adopted for this SLERA. The TRVs used for the Level III Baseline are summarized in **Tables 7-13** and **7-14** for mammals and birds, respectively.

7.3.3.2 Risk Characterization

The risk characterization phase integrates information on exposure, exposure-effects relationships, and defined or presumed target populations. The result is a determination of the likelihood, severity, and characteristics of adverse effects to environmental stressors present at a site. Because potential adverse effects to terrestrial and aquatic plants and invertebrates have been qualitatively assessed during the Level II Screen (Section 7.2.2), the Level III Baseline risk characterization focuses on potential impacts to assessment receptors.

For the semi-quantitative predictive assessment, TRVs and average daily doses (ADDs) were calculated and used to generate food chain HQs (Wentsel et al., 1996). HQs are calculated by summing intake doses across all exposure pathways for each chemical for a given receptor to generate an ADD and dividing by the TRV. HQs for those chemicals that have a similar mode of toxicological action are typically summed to account for cumulative effects.

7.3.3.3 Hazard Estimation for Terrestrial Wildlife

The hazard estimation was performed through a series of quantitative HQ calculations that compare receptor-specific exposure doses with TRVs. The same HQ guidelines for assessing the risk posed from contaminants described in Section 7.2.6.

The HQs for mercury are based on both NOAEL and LOAEL values that were calculated for all six representative receptor species: the meadow vole, short-tailed shrew, American robin,

red-tailed hawk, barn owl, and red fox. Only the more conservative NOAEL-based HQs were calculated for the barn owl receptor because it represents a threatened species. The MDC and average concentration of all the sampling units were used as EPCs, and HQs were also calculated for each sampling unit individually to determine where potential hazards occur. Two results tables were created; **Table 7-15** and **Table 7-16**. The first table (**Table 7-15**) assumed that the receptors used the site 100 percent of the time, and an AUF adjustment was not performed. The American robin was the only receptor that had an HQ that exceeded 1. Both the NOAEL- and LOAEL-based HQs exceeded 1 for ISM sampling units SCss-057, -058, -059, -060, and -061, and NOAEL-based HQs exceeded 1 for sampling units SCss-062 and -063. For the second table (**Table 7-16**), an adjusted AUF was used to calculate the HQs based on the size of each of the sampling units and the sum of the area of all the sampling units that constitute the EU (2.6 acres) was used in the adjusted AUFs for the MDC and average concentrations. The adjusted AUFs were calculated by dividing the EU area by the home range of each of the receptors. Using this approach, no individual ISM sampling unit had an HQ greater than 1, although the site as a whole exceeded 1 for the robin for both the NOAEL- and LOAEL-based HQs, using both the maximum and average concentrations. The adjusted AUF used to calculate the HQs for the maximum and average concentrations for the robin in **Table 7-16** was 4.2 (i.e., the EU area [2.6 acres] divided by the robin home range [0.618 acres]).

7.3.4 Uncertainty Analysis

Several factors contribute to the overall variability and uncertainty inherent in ERAs. Variability is due primarily to measurement error and natural variability of chemical concentrations in environmental media. Laboratory media analyses, sampling design/methods, and receptor study design are the major sources of this kind of error. Uncertainty, on the other hand, is associated primarily with deficiency or irrelevancy of effects, exposure, or habitat data to actual ecological conditions at the site. Species physiology, feeding patterns, and nesting behavior are poorly predictable. Therefore, all toxicity information derived from toxicity testing, field studies, or observation have uncertainties associated with them. Laboratory studies conducted to obtain site-specific, measured information often suffer from poor relevance to the actual exposure and uptake conditions on site (i.e., bioavailability, exposure, assimilation, etc.) are generally greater under laboratory conditions as compared to field conditions. Calculating an estimated value based on a large number of assumptions is often the only alternative to the accurate, albeit costly, methods of direct field or laboratory observation, measurement, and/or testing. Finally, habitat- or site-specific species may be misidentified if, for example, the observational assessment results are based on only one or even two brief site reconnaissance surveys.

The uncertainty analysis describes many of the major assumptions made for the SLERA. When discernible, the direction of bias caused by each assumption (i.e., whether the uncertainty

results in an overestimate or underestimate of risk) is provided as well. Where possible, a description of recommendations for minimizing the identified uncertainties is also presented if the SLERA progresses to higher level assessment phases. The most important uncertainties associated with this SLERA are discussed in the following paragraphs.

7.3.4.1 Assumptions of Bioavailability

The assumption that COPECs are 100 percent bioavailable likely overestimates the potential for adverse effects. The duration that has lapsed since the contaminant release affects bioavailability as the contaminant becomes sequestered or transformed within the environmental media. Sequestration, transformation, and bioavailability are influenced by medium characteristics including pH, temperature, and organic carbon content.

7.3.4.2 Use of Laboratory-Derived or Empirically Estimated Partitioning and Transfer Factors

The use of laboratory-derived or empirically estimated partitioning and transfer factors to predict COPEC concentrations in plants, invertebrates, and prey species, likely overestimates potential risks. As discussed previously, the incorporation of COPECs into the food chain is influenced by the characteristics of the exposure medium, which likely differs from that used in the laboratory to derive partitioning and transfer factors.

7.3.4.3 Use of Laboratory-Derived Toxicity Reference Values

The use of laboratory-derived TRVs may overestimate or underestimate the potential for adverse effects. The method of administration of the contaminant in the laboratory is typically different than that experienced in the wild by the receptors. Also, laboratories typically use "naïve" organisms in their toxicity testing, which are likely to be much more sensitive to toxicants than organisms living in the wild or at the site, which have likely developed resistances or have otherwise adapted to ambient concentrations of chemicals in their environment.

7.3.4.4 Use of the HQ Method to Estimate Risks to Populations or Communities

The calculation of HQs also introduces uncertainty. The following limitations associated with HQs (Tannenbaum et al., 2003) are noted:

- HQs are not measures of risk.
- HQs are not population based.
- HQs are not linearly scaled.
- HQs are often produced that are unrealistically high and toxicologically impossible (i.e., estimated HQs greater than 1,000, although HQs generated for the Sand Creek

Site SLERA do not appear to fall into this category, with the possible exception of carbazole).

- Trace soil concentrations of inorganic chemicals (including concentrations well below BSVs) can lead to HQ threshold exceedances.

Therefore, HQs greater than 1 do not mean that adverse ecological effects are occurring or may occur in the future.

7.3.4.5 Sampling and Analytical Limitations

It is not possible to completely characterize the nature and extent of contamination on any site. Uncertainties arise from limits on the number of locations that can be sampled. The sampling protocol used at the Sand Creek Site, however, was designed to optimize efficiency of the sampling effort and reduce uncertainty by providing coverage of the affected area using an ISM sampling approach that is designed to provide a more realistic estimate of the average concentrations of chemicals at the site.

7.3.4.6 Identifying BSV Chemicals

Metals are judged to be present at concentrations comparable to background if the MDC does not exceed the BSV. The comparison of "average" concentrations as represented by ISM sampling results to a BSV that is based on discrete background samples may be inappropriate because the distributions of data produced by the two methods are typically different (USACE, 2009). The direction of bias is unknown. However, because the BSVs are intended to be conservative representatives of BSVs, comparing an ISM result to the BSV should typically provide the information necessary to make a sound decision as to whether the chemical is present at concentrations greater than BSVs.

7.3.5 Level III Baseline Conclusions and Recommendations

Mercury in soil was the only COPEC recommended to be evaluated under the Level III Baseline evaluation following the Level II Screen (Section 7.2.7). Food chain modeling was used to estimate ecological hazards to six avian and mammalian representative species to address assessment endpoints designed to be protective of terrestrial receptors (the protection of plants and terrestrial invertebrates were assessment endpoints that were previously addressed during the Level II Screen, which evaluates direct toxicity). ADDs of mercury were calculated for the six receptor species and compared to TRVs to calculate an HQ. Only the robin had an HQ greater than 1, which indicates that potential hazards may exist to omnivorous birds foraging at the site. The robin HQ calculated for the entire Sand Creek Site using the average concentration of the sampling units was 1.8 using the LOAEL TRV. The HQs calculated for the individual sampling units exceeded 1 at surface soil ISM sampling units SCss-057 through SCss-061 (both NOAEL and LOAEL HQs) and sampling units SCss-062

and SCss-063 (NOAEL HQs only). When AUFs were incorporated into the calculation, however, none of the individual sampling units had HQs greater than 1.

It is important to state that the finding of HQs greater than 1 does not necessarily indicate that adverse impacts are occurring. The food chain model has several conservative assumptions deliberately incorporated into its calculations to reduce the likelihood of producing a finding that no risk exists, when in fact a risk might be present (i.e., a "Type II" error). However, the potential for adverse effects associated with exposure to mercury must take the conservative nature of these factors into account. For example, the food chain model assumes that mercury is 100 percent bioavailable. In reality, when a chemical is released to the environment, it reacts with other compounds and is affected by ambient conditions that often reduce the chemical's ability to be absorbed by and/or retained in an organism. For example, metals released to terrestrial systems often sorb to soil, reducing their bioavailability. Furthermore, the toxicity studies upon which TRVs are based are highly conservative. These studies typically use naive (i.e., laboratory) organisms comprised of a single genetic strain that have no inherent resistance to chemical insults. Nonlaboratory organisms have both a more diverse genetic makeup and exposure history to ambient levels of chemicals (both natural and anthropogenic in origin) that favor the development of resistances to chemical exposure in nature. Furthermore, the life history characteristics of the affected receptor(s) must be considered. Like most insectivorous birds, the robin is a transient (or seasonal) migrant. Some individuals migrate south to warmer climates during the winter, and individuals that remain during the colder months are nomadic, moving from area to area based on food supplies. Therefore, the assumption that the robin spends 100 percent of its time at the Sand Creek Site over the course of a year is highly conservative. A final point of emphasis is that the endpoint of concern for a non-threatened or endangered species, such as the robin, is protection of the population (see **Table 7-6**). The Sand Creek Site is only approximately 1 acre in size, while the home range for an individual robin is approximately 0.9 acres. Therefore, it is highly unlikely that sufficient exposure would occur to multiple individuals (i.e., a local population of robins) within this 1-acre area such that adverse population effects would occur.

Because the site as a whole had HQs less than 1 for all the receptors evaluated using the LOAEL derived TRV and considering AUFs, no additional evaluations or investigations from an ecological perspective are warranted at this AOC. The only HQ greater than 1 was for mercury for the robin and it was based on very conservative exposure parameters. Considering the EPC, localized impacts to omnivorous birds associated with exposure to mercury are not likely at the AOC. Because the conservative assumptions of the food chain model, adverse effects to insectivorous birds as a result of exposure to mercury in soil are not considered likely. Although the HQ was greater than 1 for the robin, which indicates that potential hazards could exist to omnivorous birds foraging exclusively at the site. It is important to state that the

finding of HQs greater than 1 does not necessarily indicate that adverse impacts are occurring. Additionally, the size of the entire AOC would only support one breeding pair of the American robin. The AOC is not large enough to support very many birds, especially as foraging habitat. Therefore, no further evaluation from an ecological risk perspective is warranted.

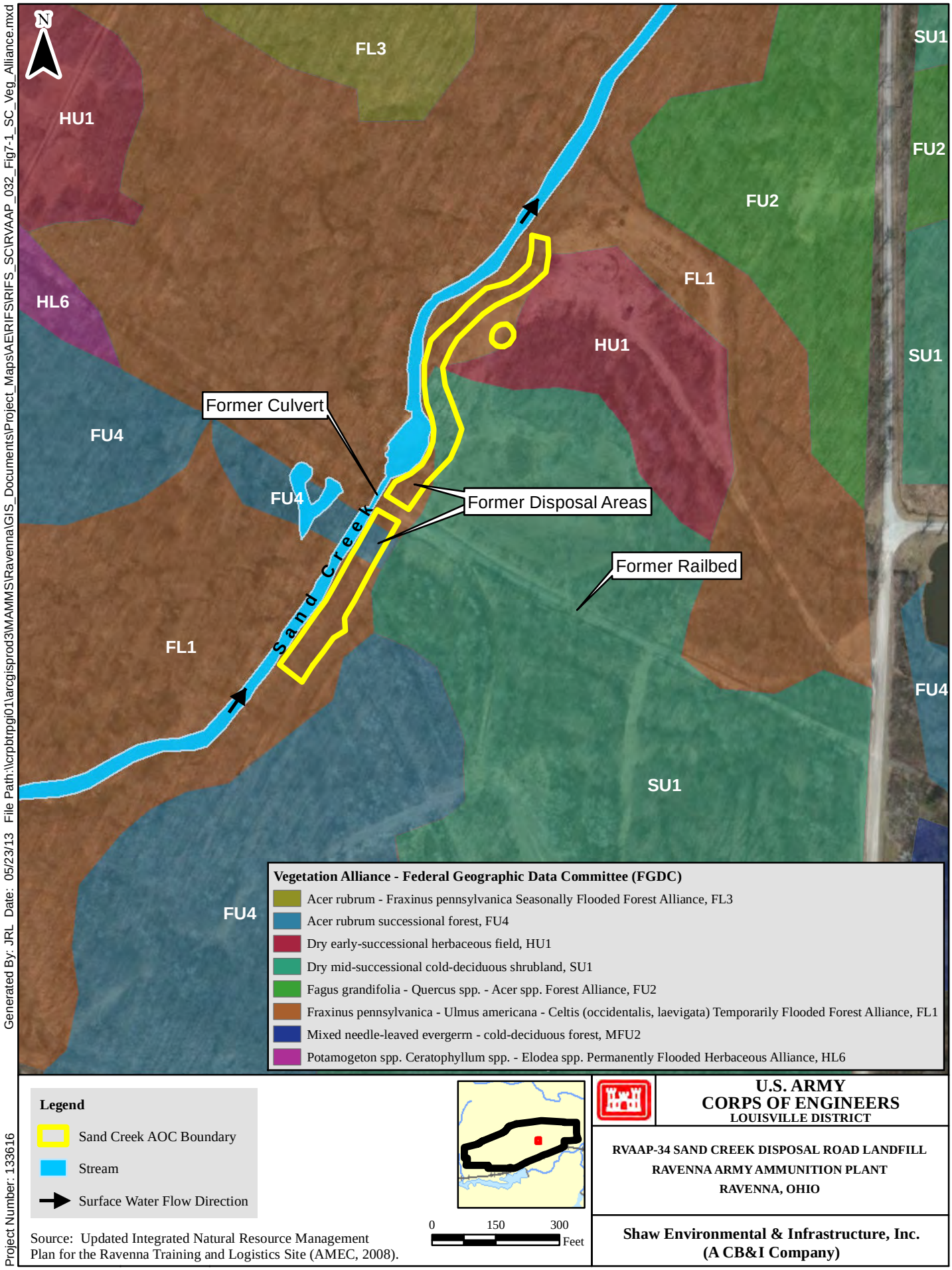


Figure 7-1 Vegetation Alliance Map

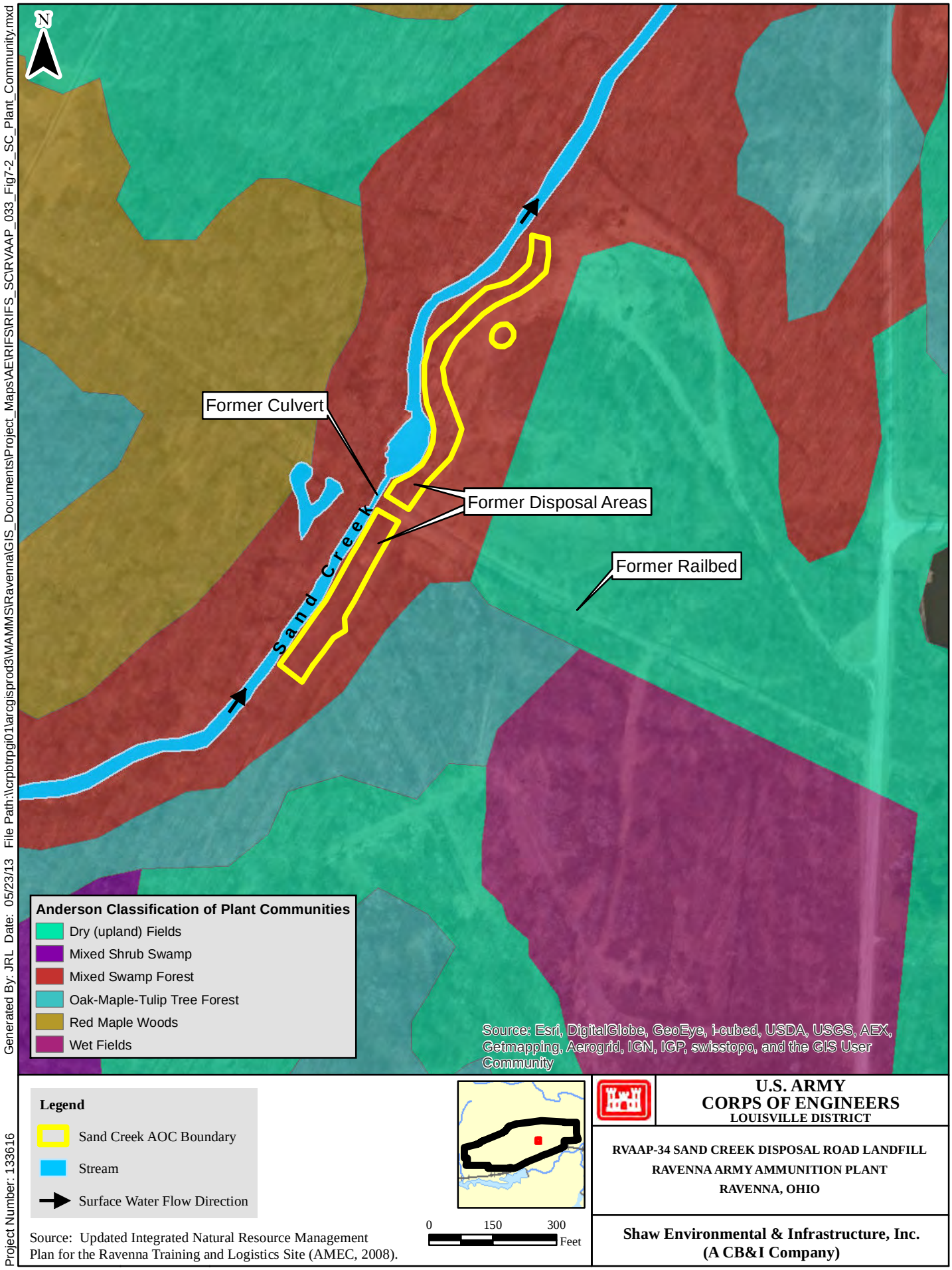


Figure 7-2 Plant Community Map

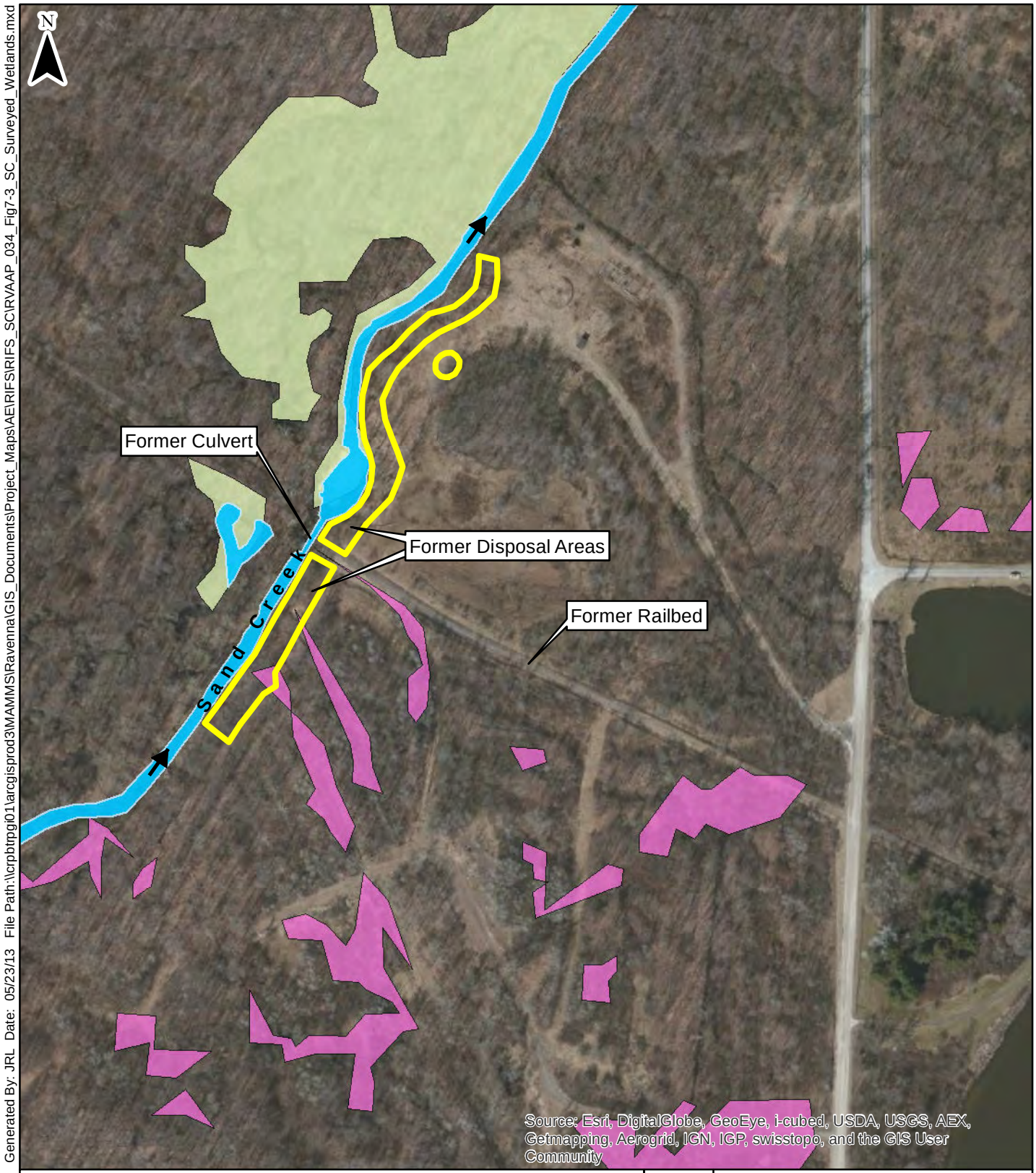


Figure 7-3 Surveyed Wetlands Map

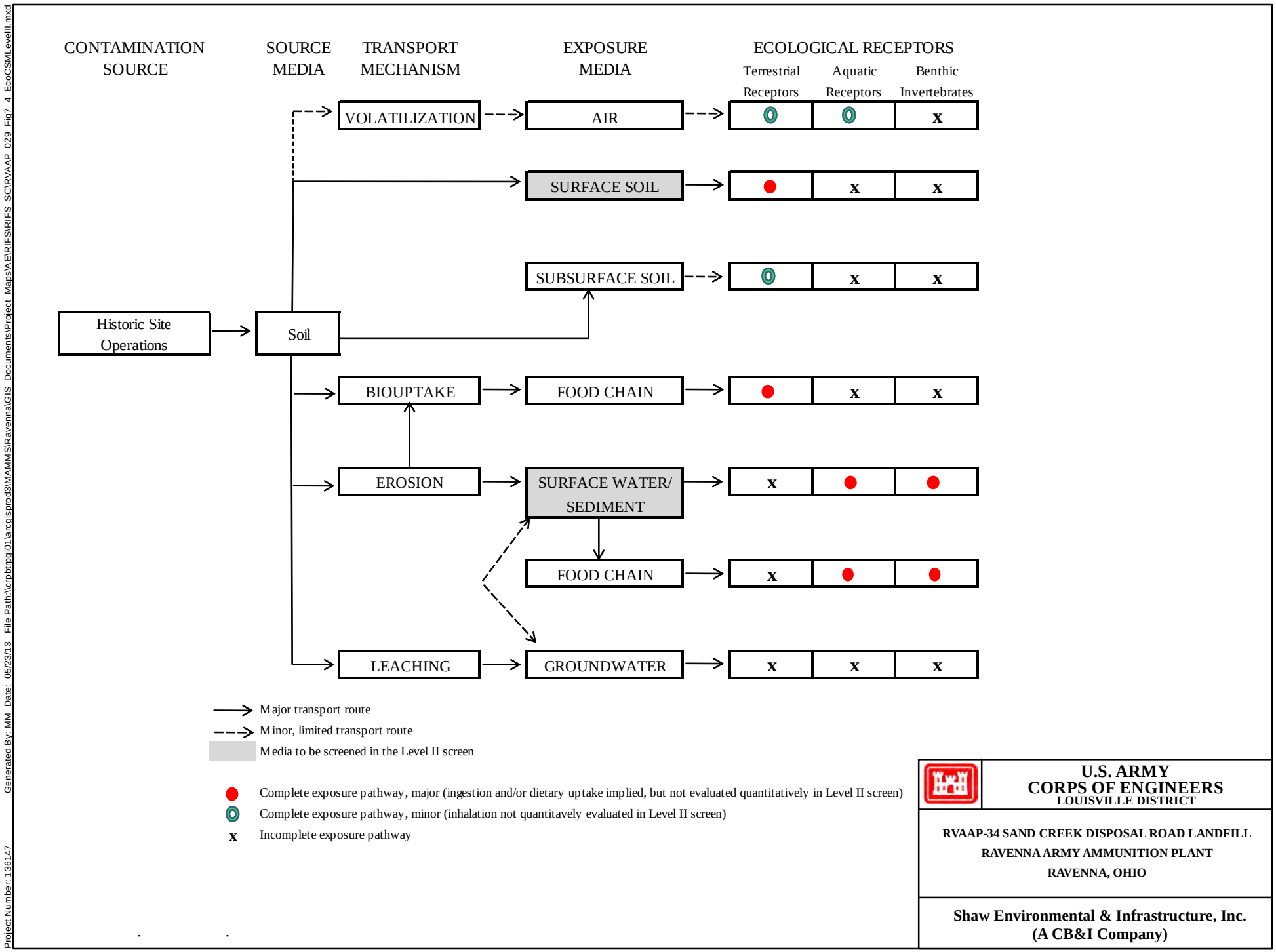


Figure 7-4 Ecological Conceptual Site Model for Level II Screen

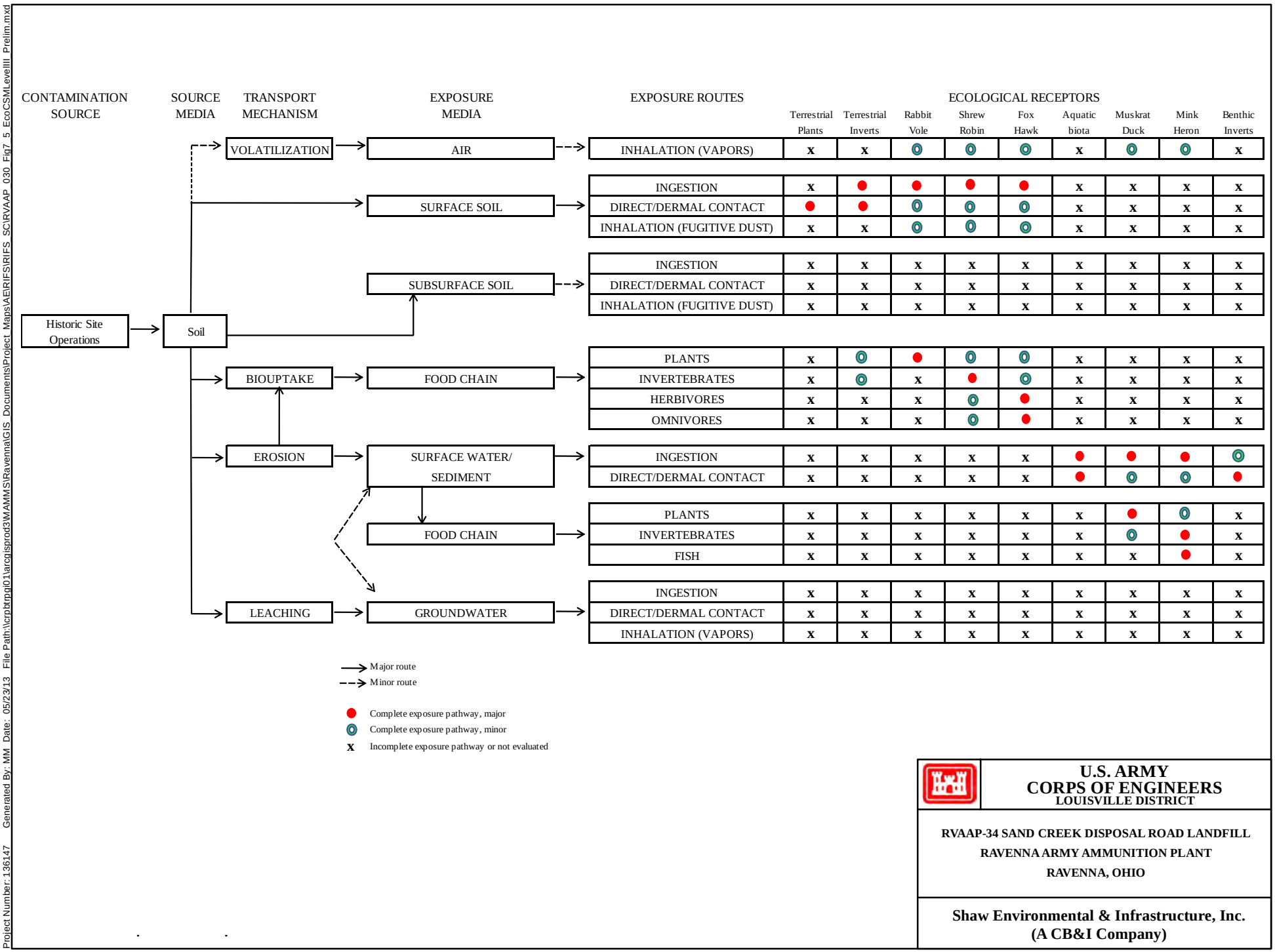
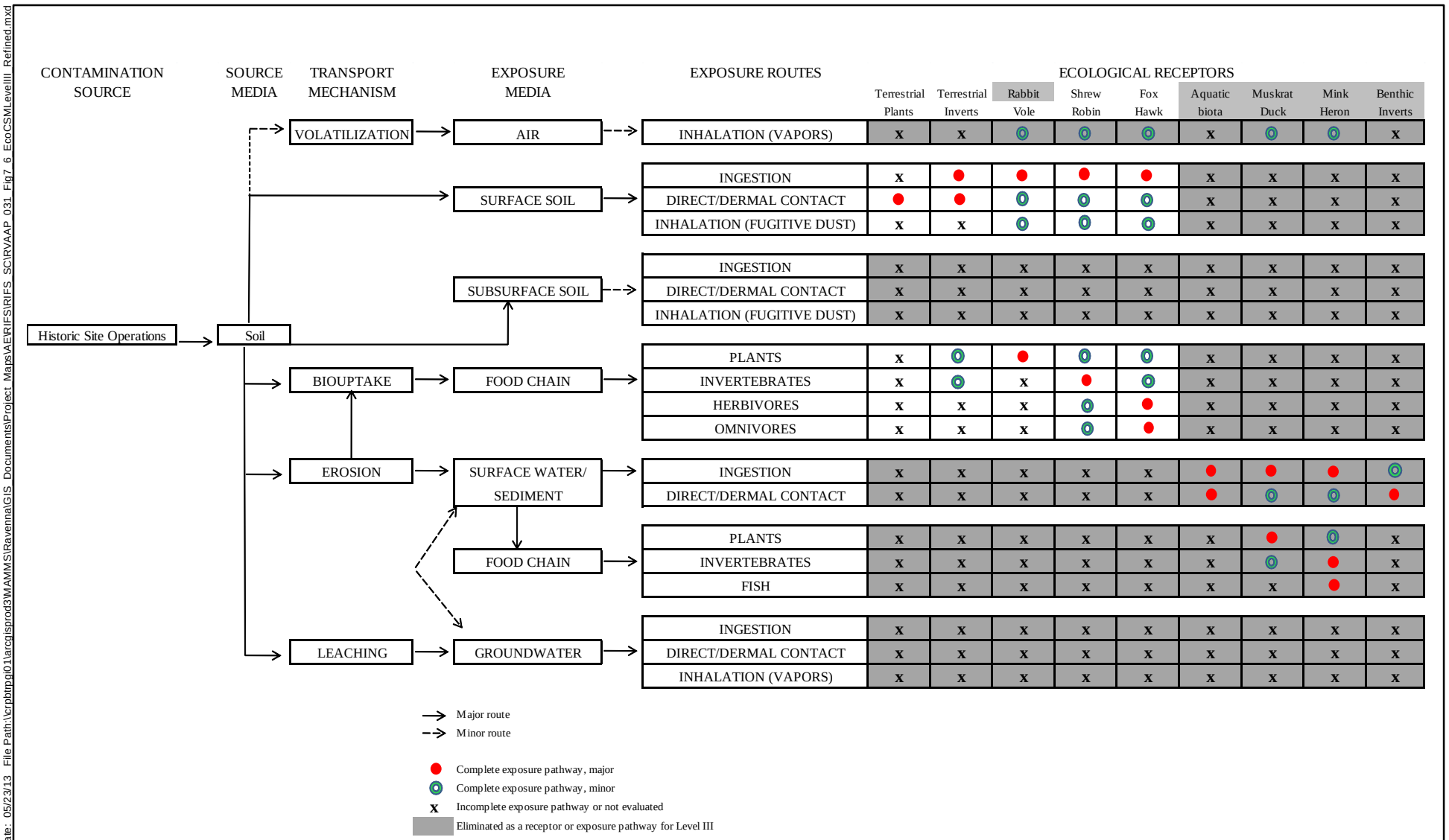


Figure 7-5 Preliminary Ecological Conceptual Site Model for Level III Baseline



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U.S. ARMY
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LOUISVILLE DISTRICT

RVAAP-34 SAND CREEK DISPOSAL ROAD LANDFILL
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Shaw Environmental & Infrastructure, Inc.
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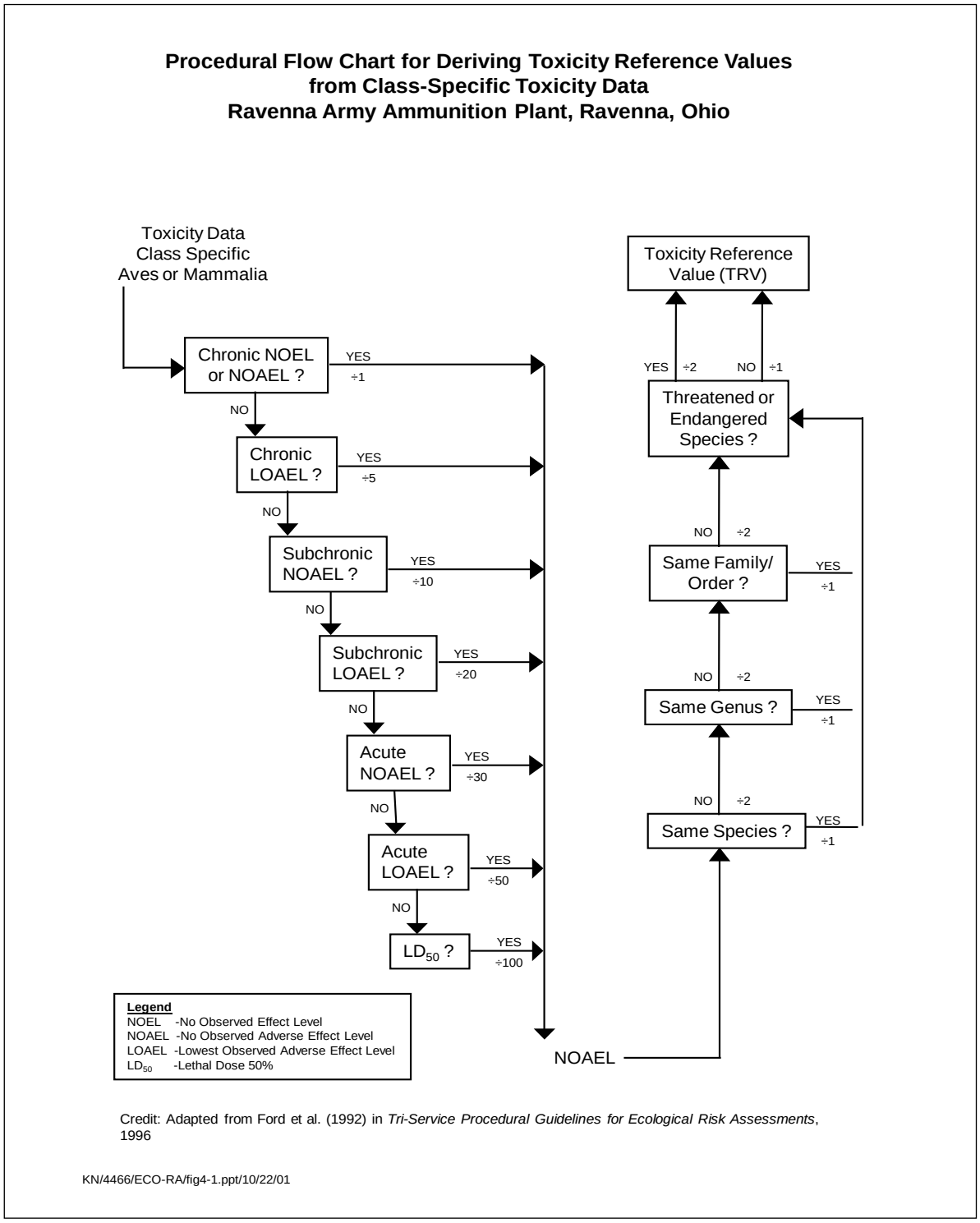
Figure 7-6 Refined Ecological Conceptual Site Model for Level III Baseline

Figure 7-7
Procedural Flow Chart for Deriving Toxicity Reference Values from Class-Specific Toxicity Data



Credit: Adapted from Ford et al. (1992) in *Tri-Service Procedural Guidelines for Ecological Risk Assessments*, 1996

KN/4466/ECO-RA/fig4-1.ppt/10/22/01

Table 7-1. Ecological Risk Assessment Data Set for Surface Soils, Sediment, and Surface Water.

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
Surface Soil Samples Used in the Ecological Risk Assessment					
SCss-057	SCss-057D-0001-SO	9/24/10	0	1	VOCs
SCss-057	SCss-057M-0001-SO	9/24/10	0	1	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCss-058	SCss-058M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-059	SCss-059M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-060	SCss-060M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-061	SCss-061M-0001-SO	9/23/10	0	1	Explosives, Metals, SVOCs
SCss-062	SCss-062M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-063	SCss-063M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs
SCss-064	SCss-064M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-065	SCss-065M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs
SCss-066	SCss-066M-0001-SO	9/22/10	0	1	Explosives, Metals, SVOCs, Hex. Chrome
SCss-067	SCss-067M-0001-SO	9/21/10	0	1	Explosives, Metals, SVOCs
SCss-068	SCss-068D-0001-SO	9/21/10	0	1	VOCs
SCss-068	SCss-068M-0001-SO	9/21/10	0	1	Explosives, Metals, SVOCs
SCss-069	SCss-069M-0001-SO	9/24/10	0	1	Explosives, Metals, SVOCs
SCss-072	SCss-072M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-073	SCss-073M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-074	SCss-074M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs

Table 7-1. Ecological Risk Assessment Data Set for Surface Soils, Sediment, and Surface Water (continued).

Sample Location	Sample Number	Sample Date	Depth of Sample (feet bgs)		Analyses
SCss-075	SCss-075M-0001-SO	11/9/10	0	1	Explosives, Metals, SVOCs
SCss-076	SCss-076M-0001-SO	11/9/10	0	1	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
Sediment Samples Used in the Ecological Risk Evaluation					
SCsd-070	SCsd-070M-0001-SD	9/28/10	0	0.5	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
SCsd-071	SCsd-071D-0001-SD	9/28/10	0	0.5	VOCs
SCsd-071	SCsd-071M-0001-SD	9/28/10	0	0.5	Exp/Prop, Metals, Pesticides, PCBs, SVOCs, Total Cyanide, Hex. Chrome
Surface Water Samples Used in the Ecological Risk Evaluation					
S-7	FSW-SW-011-0000	6/24//03	NA	NA	Explosives, Metals, PCBs, Pesticides, SVOCs, Total Cyanide, Ammonia, Phosphorus, Nitrate
S-7	FSW-SW-051-0000	9/17/03	NA	NA	Explosives, Metals, SVOCs
SCsw-001	SCsw-001-0001-SW	9/18/03	NA	NA	Exp/Prop, Field Tests[a], Gen Chem[b], Metals, PCB, Pesticides, SVOCs, VOCs
SCsw-002	SCsw-002-0001-SW	9/18/03	NA	NA	Field Tests[a], Gen Chem[b], Metals
SCsw-003	SCsw-003-0001-SW	9/18/03	NA	NA	Field Tests[a], Gen Chem[b], Metals

[a] denotes field tests for surface water included conductivity, pH, oxygen, temperature, and turbidity.

[b] denotes general chemistry included analysis for asbestos.

bgs denotes below ground surface.

Exp denotes explosives.

Gen. Chem. denotes general chemistry.

Hex. Chrome denotes hexavalent chromium.

NA denotes not applicable.

PCB denotes polychlorinated biphenyl.

Prop denotes propellants.

SVOC denotes semivolatile organic compound.

VOC denotes volatile organic compound.

Table 7-2. Summary of Screening Results for COPECs in Surface Soil (0 to 1 foot).

Site-Related Chemical	Range of Values, mg/kg						BSV [a] (mg/kg)	ESV [a] (mg/kg)	Below ESV?	HQ	PBT?[a]	COPEC?[c]
	Detected Concentrations				Reporting Limits							
	Min	VQ	Max	VQ	Min	Max						
General Chemistry												
Cyanide, Total	0.3	J	0.39	J	0.39	0.39	---	1.33	Yes	0.3	No	No (b)
Inorganics												
Antimony	0.75		17.1		0.28	5.5	0.96	0.27	No	63	No	Yes
Arsenic	4.5		36.6		0.46	9.1	15.4	18	No	2.0	No	Yes
Barium	1.5		764		0.028	0.55	88.4	330	No	2.3	No	Yes
Beryllium	0.41		1.1		0.024	0.24	0.88	21	Yes	0.05	No	No (b)
Cadmium	0.057		12.9		0.021	0.43	0	0.36	No	36	No	Yes
Chromium	0.26		188		0.064	1.3	17.4	26	No	7.2	No	Yes
Cobalt	6.7		19.7		0.05	1	10.4	13	No	1.5	No	Yes
Copper	0.49		726		0.2	4.1	17.7	28	No	26	No	Yes
Lead	0.88		405		0.14	2.8	26.1	11	No	37	No	Yes
Mercury	0.026		24.6		0.008	0.85	0.036	0.00051	No	48,235	Yes	Yes
Nickel	0.083	J	48.2		0.062	1.2	21.1	38	No	1.3	No	Yes
Selenium	0.13		3.1		0.43	8.5	1.4	0.52	No	6.0	No	Yes
Silver	0.095	J	256		0.057	60	0	4.2	No	61	No	Yes
Thallium	0.14	J	3.2	J	0.28	2.8	0	1	No	3.2	No	Yes
Zinc	0.96		373		0.12	2.4	61.8	46	No	8.1	No	Yes
Explosives and Propellants												
2,4,6-Trinitrotoluene	0.26	J	3.9		0.43	0.44	---	6.4	Yes	0.6	No	No (b)
2-Amino-4,6-Dinitrotoluene	0.26	J	0.26	J	0.43	0.44	---	2.1	Yes	0.1	No	No (b)
Nitroguanidine	0.64		0.64		0.16	0.25	---	NA	Yes	NA	No	Yes
Pesticides												
4,4'-DDD	0.0014	J	0.0023	J	0.0024	0.0024	---	0.021	Yes	0.11	Yes	No (d)
4,4'-DDT	0.0015	J	0.0017	J	0.0024	0.0024	---	0.021	Yes	0.08	Yes	No (d)
alpha-Chlordane	0.0015	J	0.0015	J	0.0024	0.0041	---	0.224	Yes	0.01	Yes	Yes
Heptachlor	0.001	J	0.0081	J	0.0024	0.0024	---	0.00598	No	1.4	Yes	Yes

Table 7-2. Summary of Screening Results for COPECs in Surface Soil (0 to 1 foot) (continued).

Site-Related Chemical	Range of Values, mg/kg						BSV [a] (mg/kg)	ESV [a] (mg/kg)	Below ESV?	HQ	PBT?[a]	COPEC?[c]
	Detected Concentrations				Reporting Limits							
	Min	VQ	Max	VQ	Min	Max						
Lindane	0.0013	J	0.0013	J	0.0024	0.0024	---	0.005	Yes	0.26	Yes	Yes
Methoxychlor	0.0016	J	0.0016	J	0.0024	0.0024	---	0.0199	Yes	0.08	Yes	No (d)
Semivolatile Organic Compounds												
1,2,4-Trichlorobenzene	0.027	J	0.027	J	0.41	0.43	---	20	Yes	0.001	Yes	Yes
1,2-Dichlorobenzene	0.028	J	0.11	J	0.41	0.43	---	2.96	Yes	0.04	Yes	Yes
1,3-Dichlorobenzene	0.031	J	0.031	J	0.41	0.43	---	37.7	Yes	0.0008	Yes	Yes
1,4-Dichlorobenzene	0.022	J	0.27	J	0.41	0.43	---	20	Yes	0.01	Yes	Yes
2-Methylnaphthalene	0.045	J	0.53		0.41	0.43	---	3.24	Yes	0.2	Yes	Yes
Acenaphthene	0.029	J	0.44		0.41	0.43	---	29	Yes	0.02	No	No (b)
Acenaphthylene	0.029	J	0.16	J	0.41	0.43	---	29	Yes	0.006	No	No (b)
Anthracene	0.026	J	1.1		0.41	0.43	---	29	Yes	0.04	No	No (b)
Benzo(a)anthracene	0.027	J	2.6		0.41	0.43	---	1.1	No	2.4	No	Yes
Benzo(a)pyrene	0.026	J	2.4		0.41	0.43	---	1.1	No	2.2	No	Yes
Benzo(b)fluoranthene	0.039	J	4.8		0.41	0.43	---	1.1	No	4.4	No	Yes
Benzo(g,h,i)perylene	0.031	J	0.69		0.41	0.43	---	1.1	Yes	0.6	No	No (b)
Benzo(k)fluoranthene	0.027	J	1.4		0.41	0.43	---	1.1	No	1.3	No	Yes
Benzoic Acid	0.39	J	0.57	J	0.99	2.1	---	1	Yes	0.6	No	No (b)
Bis(2-Ethylhexyl)phthalate	0.1	J	1.7		1	1.1	---	0.925	No	1.8	Yes	Yes
Carbazole	0.034	J	0.61		0.41	0.43	---	0.00008	No	7,625	No	Yes
Chrysene	0.049	J	2.7		0.41	0.43	---	1.1	No	2.5	No	Yes
Dibenzo(a,h)anthracene	0.055	J	0.28	J	0.41	0.43	---	1.1	Yes	0.25	No	No (b)
Dibenzofuran	0.027	J	0.33	J	0.41	0.43	---	6.1	Yes	0.05	Yes	Yes
Diethyl Phthalate	0.069	J	0.14	J	0.41	0.43	---	100	Yes	0.001	No	No (b)
Di-n-Butyl Phthalate	0.082	J	0.47		0.41	0.43	---	200	Yes	0.002	Yes	Yes
Fluoranthene	0.04	J	4.3		0.41	0.43	---	29	Yes	0.15	No	No (b)
Fluorene	0.031	J	0.47		0.41	0.43	---	29	Yes	0.02	No	No (b)
Indeno(1,2,3-cd)pyrene	0.025	J	0.81		0.41	0.43	---	1.1	Yes	0.7	No	No (b)

Table 7-2. Summary of Screening Results for COPECs in Surface Soil (0 to 1 foot) (continued).

Site-Related Chemical	Range of Values, mg/kg						BSV [a] (mg/kg)	ESV [a] (mg/kg)	Below ESV?	HQ	PBT?[a]	COPEC?[c]
	Detected Concentrations				Reporting Limits							
	Min	VQ	Max	VQ	Min	Max						
Isophorone	0.051	J	0.2	J	0.41	0.43	---	139	Yes	0.001	No	No (b)
Naphthalene	0.028	J	0.33	J	0.41	0.43	---	29	Yes	0.01	No	No (b)
Pentachlorophenol	0.4	J	0.52	J	1	1.1	---	2.1	Yes	0.2	Yes	Yes
Phenanthrene	0.026	J	3.4		0.41	0.43	---	29	Yes	0.1	No	No (b)
Pyrene	0.035	J	4		0.41	0.43	---	1.1	No	3.6	No	Yes

*[a] denotes see **Appendix G**.*
[b] denotes chemicals with MDCs lower than the BSV are not considered to be site related (background values are for inorganics only).
[c] denotes selection of COPECs.
Yes denotes COPEC exceeds the ESV and BSV or is a PBT pollutant.
No(a) denotes COPEC is not a PBT pollutant or site related (MDC is less than BSV).
No(b) denotes COPEC is not a PBT pollutant or site related (MDC is less than ESV).
No(c) denotes COPEC is an essential nutrient.
No (d) denotes even though the chemical is bioaccumulative, the ESV is protective of food chain effects.
--- denotes no BSV is available.
BSV denotes background screening value.
COPEC denotes chemical of potential ecological concern.
ESV denotes ecological screening value.
J denotes reported result is an estimated value.
HQ denotes hazard quotient
MDC denotes maximum detected concentration.
mg/kg denotes milligrams per kilogram.
NA denotes not applicable.
PBT denotes persistent, bioaccumulative, and toxic.
VQ denotes validation qualifier.

Table 7-3. Summary of Screening Results for COPECs in Sediment (0 to 0.5 foot).

Site-Related Chemical	Range of Values, mg/kg						BSV [a] (mg/kg)	ESV [a] (mg/kg)	Below ESV?	HQ	PBT?[a]	COPEC?[c]
	Detected Concentrations				Reporting Limits							
	Min	VQ	Max	VQ	Min	Max						
General Chemistry												
Cyanide, Total	0.32	J	0.36	J	0.39	0.39	---	0.1	No	3.6	No	Yes
Inorganics												
Antimony	0.45	J	8.4		1.4	1.4	0	0.36	No	23	No	Yes
Barium	75.7		231		0.14	0.14	123	48	No	4.8	No	Yes
Beryllium	0.41		0.47		0.061	0.061	0.38	73	Yes	0.006	No	No (b)
Cadmium	0.19		2.7		0.11	0.11	0	0.99	No	2.7	No	Yes
Chromium	40.9		107		0.32	0.32	18.1	43.4	No	2.5	No	Yes
Copper	16.6		53.7		1	1	27.6	31.6	No	1.7	Yes	Yes
Lead	7.2		104		0.71	0.71	27.4	35.8	No	2.9	No	Yes
Mercury	0.049		0.3		0.008	0.0081	0.059	0.18	No	1.7	No	Yes
Nickel	20		21.1		0.31	0.31	17.7	22.7	Yes	0.9	No	No (b)
Silver	116		116		0.29	57	0	0.5	No	232	No	Yes
Thallium	1.1		1.2		0.71	0.71	0.89	0.044	No	27	No	Yes
Explosives and Propellants												
Nitroguanidine	0.69		1.2		0.16	0.16	---	NA	Yes	NA	No	Yes
Polychlorinated Biphenyls												
Arochlor 1254	0.15		0.15		0.051	0.051	---	0.0598	No	2.5	Yes	Yes
Arochlor 1262	0.094		0.094		0.051	0.051	---	0.0598	No	1.6	Yes	Yes
Pesticides												
4,4'-DDD	0.00061	J	0.0034		0.0024	0.0024	---	0.00488	Yes	0.7	Yes	Yes
4,4'-DDE	0.0043		0.0043		0.004	0.0041	---	0.00316	No	1.4	Yes	Yes
4,4'-DDT	0.00091	J	0.0068		0.0024	0.0024	---	0.00416	No	1.6	Yes	Yes
alpha-Chlordane	0.0023	J	0.0023	J	0.004	0.0041	---	0.00324	Yes	0.7	Yes	Yes
beta-BHC	0.0012	J	0.0012	J	0.004	0.0041	---	0.006	Yes	0.2	Yes	Yes

Table 7-3. Summary of Screening Results for COPECs in Sediment (0 to 0.5 foot) (continued).

Site-Related Chemical	Range of Values, mg/kg						BSV [a] (mg/kg)	ESV [a] (mg/kg)	Below ESV?	HQ	PBT?[a]	COPEC?[c]
	Detected Concentrations				Reporting Limits							
	Min	VQ	Max	VQ	Min	Max						
delta-BHC	0.0017	J	0.0017	J	0.0024	0.0024	---	7.15	Yes	0.0002	Yes	Yes
Dieldrin	0.0046		0.0046		0.0024	0.0024	---	0.0019	No	2.4	Yes	Yes
Endosulfan Sulfate	0.0055		0.0055		0.004	0.0041	---	34.6	Yes	0.0002	Yes	Yes
Endrin Aldehyde	0.0063		0.0063		0.004	0.0041	---	0.48	Yes	0.01	Yes	Yes
gamma-Chlordane	0.0078		0.0078		0.004	0.0041	---	0.00324	No	2.4	Yes	Yes
Heptachlor	0.002	J	0.0057		0.0024	0.0024	---	0.6	Yes	0.01	Yes	Yes
Methoxychlor	0.0016	J	0.0021	J	0.0024	0.0024	---	0.0136	Yes	0.2	Yes	Yes
Semivolatile Organic Compounds												
1,2-Dichlorobenzene	0.044	J	0.044	J	0.4	0.41	---	0.294	Yes	0.1	Yes	Yes
1,4-Dichlorobenzene	0.04	J	0.04	J	0.4	0.41	---	0.318	Yes	0.1	Yes	Yes
2-Methylnaphthalene	0.043	J	0.043	J	0.4	0.41	---	0.0202	No	2.1	Yes	Yes
Benzo(a)anthracene	0.057	J	0.057	J	0.4	0.41	---	0.108	Yes	0.5	No	No (b)
Benzo(a)pyrene	0.067	J	0.067	J	0.4	0.41	---	0.15	Yes	0.4	No	No (b)
Benzo(b)fluoranthene	0.046	J	0.11	J	0.4	0.41	---	10.4	Yes	0.01	No	No (b)
Benzo(g,h,i)perylene	0.026	J	0.026	J	0.4	0.41	---	0.17	Yes	0.2	No	No (b)
Benzo(k)fluoranthene	0.047	J	0.047	J	0.4	0.41	---	0.24	Yes	0.2	No	No (b)
Chrysene	0.027	J	0.07	J	0.4	0.41	---	0.166	Yes	0.4	No	No (b)
Di-n-Butyl Phthalate	0.11	J	0.3	J	0.4	0.41	---	1.114	Yes	0.3	Yes	Yes
Fluoranthene	0.047	J	0.089	J	0.4	0.41	---	0.423	Yes	0.2	No	No (b)
Indeno(1,2,3-cd)pyrene	0.026	J	0.026	J	0.4	0.41	---	0.2	Yes	0.1	No	No (b)
Naphthalene	0.029	J	0.029	J	0.4	0.41	---	0.176	Yes	0.2	No	No (b)
Phenanthrene	0.027	J	0.053	J	0.4	0.41	---	0.204	Yes	0.3	No	No (b)
Pyrene	0.04	J	0.089	J	0.4	0.41	---	0.195	Yes	0.5	No	No (b)

Table 7-3. Summary of Screening Results for COPECs in Sediment (0 to 0.5 foot) (continued).

*[a] denotes see **Appendix G.***
[b] denotes chemicals with MDCs lower than the BSV are not considered to be site related (background values are for inorganics only).
[c] denotes selection of COPECs.
Yes denotes COPEC exceeds the ESV and BSV or is a PBT pollutant.
No(a) denotes COPEC is not a PBT pollutant or site related (MDC is less than BSV).
No(b) denotes COPEC is not a PBT pollutant or site related (MDC is less than ESV).
No(c) denotes COPEC is an essential nutrient.
--- denotes no BSV available.
BSV denotes background screening value.
COPEC denotes chemical of potential ecological concern.
ESV denotes ecological screening value.
J denotes reported result is an estimated value.
HQ denotes hazard quotient
MDC denotes maximum detected concentration.
mg/kg denotes milligrams per kilogram.
NA denotes not applicable.
PBT denotes persistent, bioaccumulative, and toxic.
VQ denotes validation qualifier.

Table 7-4. Summary of Screening Results of COPECs in Surface Water.

Site-Related Chemical	Range of Values, µg/L						BSV [a] (µg/L)	ESV [a] (µg/L)	Below ESV?	COPEC?[c]
	Detected Concentrations				Reporting Limits					
	Min	VQ	Max	VQ	Min	Max				
Inorganics										
Antimony	2.9		2.9		1.9	6	0	190	Yes	No(b)
Arsenic	2.2		6.6		2	4.9	3.2	150	Yes	No(b)
Chromium	0.66		1.4		10		0	11	Yes	No(b)
Cobalt	0.4		0.4		1.6	5	0	24	Yes	No(b)
Lead	2.9		2.9		2	8	0	6.4	Yes	No(b)
Silver	1.1		1.1		2.5	5	0	1.3	Yes	No(b)
Vanadium	0.5		0.5		0.5	5	0	44	Yes	No(b)
Semivolatile Organic Compounds										
Bis(2-Ethylhexyl)phthalate	2.1		2.1		4.9	12	NA	8.4	Yes	No(b)
Di-n-Butyl Phthalate	3.85		3.85		4.9	11	NA	9.7	Yes	No(b)
Nutrients										
Phosphorus	430		430		NA		---	NA	NA	No
Nitrate/Nitrite	130		130		NA		---	NA	Yes	No

*[a] denotes see **Appendix G**.*

[b] denotes chemicals with MDCs lower than the BSV are not considered to be site related (background values are for inorganics only).

[c] denotes selection of COPECs.

Yes denotes COPEC is site related and exceeds its BSV.

No(a) denotes COPEC is not a PBT pollutant or site related (MDC is less than BSV).

No(b) denotes COPEC is not a PBT pollutant or site related (MDC is less than ESV).

No(c) denotes COPEC is an essential nutrient.

µg/L denotes micrograms per liter.

BSV denotes background screening value.

COPEC denotes chemical of potential ecological concern.

ESV denotes ecological screening value.

J denotes reported result is an estimated value.

MDC denotes maximum detected concentration.

NA denotes not applicable.

PBT denotes persistent, bioaccumulative, and toxic.

VQ denotes validation qualifier.

Table 7-5. COPEC Distribution by Sampling Unit in Surface Soil.

Sample Location	Number of COPECs that Fail Screening Criteria			
	Metals	Propellant	Pesticides	SVOCs
SCss-057	4	1	1	0
SCss-058	7	0	0	2
SCss-059	3	0	0	6
SCss-060	10	0	0	7
SCss-061	11	0	0	3
SCss-062	11	0	0	1
SCss-063	10	0	0	1
SCss-064	8	0	0	0
SCss-065	3	0	0	1
SCss-066	4	0	0	0
SCss-067	1	0	0	0
SCss-068	1	0	0	0
SCss-069	2	0	0	0
SCss-072	2	0	0	1
SCss-073	7	0	0	1
SCss-074	9	0	0	1
SCss-075	4	0	0	0
SCss-076	4	0	0	0

Screening criteria include the BSV and the ESV screening steps.

BSV denotes background screening value.

COPEC denotes chemical of potential ecological concern.

ESV denotes ecological screening value.

SVOC denotes semivolatile organic compound.

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Table 7-6. General Management Goals, Ecological Assessment Endpoints, Measures of Effect, and Decision Rules during Level II Screening.

General Management Goals	Assessment Endpoint	Measures of Effect	Decision Rule
General Management Goal 1: The protection of terrestrial populations, communities, and ecosystems	**Assessment Endpoint 1:** Growth, survival, and reproduction of plant and soil invertebrate communities and tissue concentrations of contaminants low enough such that higher trophic levels that consume them are not at risk. Receptors: plants and earthworms.	**Measures of Effect 1:** Plant and earthworm soil toxicity benchmarks and measured RME concentrations of constituents in soil.	**Decision Rule for Assessment Endpoint 1:** If HQs, defined as the ratios of COPEC RME concentrations in surface soil to soil toxicity benchmarks for adverse effects on plants and soil invertebrates, are less than or equal to 1, then Assessment Endpoint 1 has been met and plants and soil-dwelling invertebrates are not at risk. If the HQs are >1, an SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological resources, monitoring of the environment, remediation of any site usage–related COPECs and applicable media, or further investigation such as a Level III and Level IV Field Baseline.
	Assessment Endpoint 2: Growth, survival, and reproduction of herbivorous mammal populations and low enough concentrations of contaminants in their tissues so that higher trophic level animals that consume them are not at risk. Receptor: meadow vole.	**Measures of Effect 2:** Estimates of receptor home range area, body weights, feeding rates, and dietary composition based on published measurements of endpoint species or similar species; modeled COPEC concentrations in food chain based on measured concentrations in physical media; chronic dietary NOAELs applicable to wildlife receptors based on measured responses of similar species in laboratory studies.	**Decision Rule for Assessment Endpoint 2:** If HQs, based on ratios of estimated exposure concentrations predicted from COPEC RME concentrations in surface soil to dietary limits corresponding to NOAEL TRV benchmarks for adverse effects on herbivorous mammals are less than or equal to 1, Assessment Endpoint 2 is met, and the receptors are not at risk. If the HQs are >1, an SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological resources, monitoring of the environment, remediation of any site usage–related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.
	Assessment Endpoint 3: Growth, survival, and reproduction of worm-eating and insectivorous mammal and bird populations and low enough concentrations of contaminants in their tissue so that predators that consume them are not at risk. Receptors: shrews and robins.	**Measures of Effect 3:** Estimates of receptor home range area, body weights, feeding rates, and dietary composition based on published measurements of endpoint species or similar species; modeled COPEC concentrations in food chain based on measured concentrations in physical media; chronic dietary NOAELs applicable to wildlife receptors based on measured responses of similar species in laboratory studies.	**Decision Rule for Assessment Endpoint 3:** If HQs based on ratios of estimated exposure concentrations predicted from COPEC RME concentrations in surface soil to dietary limits corresponding to NOAEL TRV benchmarks for adverse effects on worm-eating and insectivorous mammals and birds is less than or equal to 1, then Assessment Endpoint 3 is met, and these receptors are not at risk. If the HQs are >1, a SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological resources, monitoring of the environment, remediation of any site usage–related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.
	Assessment Endpoint 4: Growth, survival, and reproduction of carnivorous mammal and bird populations. Receptor: red-tailed hawk and red fox.	**Measures of Effect 4:** Estimates of receptor home range area, body weights, feeding rates, and dietary composition based on published measurements of endpoint species or similar species; modeled COPEC concentrations in food chain based on measured concentrations in physical media; chronic dietary NOAELs applicable to wildlife receptors based on measured responses of similar species in laboratory studies.	**Decision Rule for Assessment Endpoint 4:** If HQs based on ratios of estimated exposure concentrations predicted from COPEC RME concentrations in surface soil to dietary limits corresponding to NOAEL TRV benchmarks for adverse effects on carnivorous mammals and birds are less than or equal to 1, then Assessment Endpoint 4 is met, and the receptors are not at risk. If the HQs are >1, a SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological resources, monitoring of the environment, remediation of any site usage–related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.

Table 7-6. General Management Goals, Ecological Assessment Endpoints, Measures of Effect, and Decision Rules during Level II Screening (continued).

General Management Goals	Assessment Endpoint	Measures of Effect	Decision Rule
General Management Goal 2: The protection of aquatic populations, communities, and ecosystems	**Assessment Endpoint 5:** Survival, reproduction, and diversity of benthic invertebrate communities, as well as low enough concentrations of contaminants in their tissues so that higher trophic level animals that consume them are not at risk. Receptor: benthic invertebrates.	**Measures of Effect 5:** Measured concentration of contaminants in sediment and sediment toxicity thresholds, i.e., consensus-based TECs, EPA Region 5 ESLs, and Ohio EPA sediment reference values.	**Decision Rule for Assessment Endpoint 5:** If HQs based on ratios of COPEC RME concentrations in sediment-to-sediment toxicity benchmarks are less than or equal to1, then Assessment Endpoint 5 is met and sediment-dwelling organisms are not at risk. If the HQs are > 1, a SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological resources, monitoring of the environment, remediation of any site usage–related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.
	Assessment Endpoint 6: Growth, survival, and reproduction of aquatic biota (including fish, plants, invertebrates). Receptor: aquatic biota.	**Measures of Effect 6:** Measured concentrations of contaminants in surface water and Ohio EPA Chemical-Specific Water Quality Criteria.	**Decision Rule for Assessment Endpoint 6:** If HQs based on ratios of COPEC RME concentrations in surface water to aquatic biota toxicity benchmarks are less than or equal to 1, then Assessment Endpoint 6 is met and the receptors are not at risk. If the HQs are > 1, a SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological resources, monitoring of the environment, remediation of any site usage–related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.
	Assessment Endpoint 7: Growth, survival, and reproduction of aquatic herbivores that ingest aquatic plants, surface water, and sediment. Receptors: muskrats and mallards.	**Measures of Effect 7:** Estimates of receptor home range area, body weights, feeding rates, and dietary composition based on published measurements of endpoint species or similar species; modeled COPEC concentrations in food chain based on measured concentrations in physical media; chronic dietary NOAELs applicable to wildlife receptors based on measured responses of similar species in laboratory studies.	**Decision Rule 7:** If HQs based on ratios of COPEC RME concentrations in surface water and sediment to dietary limits corresponding to NOAEL TRV benchmarks for adverse effects on aquatic herbivorous mammals and birds are less than or equal to 1, then Assessment Endpoint 7 is met and the receptors are not at risk. If the HQs are > 1, a SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological receptors, monitoring of the environment, remediation of any site usage–related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.
	Assessment Endpoint 8: Growth, survival, and reproduction of riparian carnivorous mammal and bird communities that feed on aquatic organisms. Receptors: mink and herons.	**Measures of Effect 8:** Estimates of receptor home range area, body weights, feeding rates, and dietary composition based on published measurements of endpoint species or similar species; modeled COPEC concentrations in food chain based on measured concentrations in physical media; chronic dietary NOAELs applicable to wildlife receptors based on measured responses of similar species in laboratory studies.	**Decision Rule 8:** If HQs based on ratios of estimated exposure concentrations predicted from COPEC RME concentrations in surface water to dietary limits corresponding to NOAEL TRV benchmarks for adverse effects on riparian carnivores is less than or equal to 1, then Assessment Endpoint 8 has been met and these receptor populations are not at risk. If the HQs are > 1, a SMDP is reached, at which point it will be necessary to decide what is needed: no further action, risk management of ecological receptors, monitoring of the environment, remediation of any site usage related COPECs in applicable media, or further investigation such as a Level III and Level IV Field Baseline.

COPEC denotes chemical of potential ecological concern.
ESL denotes ecological screening value.
HQ denotes Hazard Quotient.
NOAEL denotes no observed adverse effect level.
RME denotes reasonable maximum exposure.
SMDP denotes Scientific Management Decision point.
TEC denotes Threshold Effect Concentration.
TRV denotes Toxicity Reference Value.

Table 7-7. Summary of COPECs in Surface Soil Sampling Units.

		Sample Location:		SCss-057M		SCss-058M		SCss-059M		SCss-060M		SCss-061M		SCss-062M	
		Sample Number:		SCss-057M-0001-SO		SCss-058M-0001-SO		SCss-059M-0001-SO		SCss-060M-0001-SO		SCss-061M-0001-SO		SCss-062M-0001-SO	
		Sample Date:		24-Sep-10		23-Sep-10		23-Sep-10		23-Sep-10		23-Sep-10		22-Sep-10	
		Depth (feet bgs):		0–1		0–1		0–1		0–1		0–1		0–1	
COPEC	**Background**	**ESV**	**Units**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**
Inorganics															
Antimony	0.96	0.27	mg/kg			**3.1**				***1.5***		***17.1***		***3.7***	
Arsenic	15.4	18	mg/kg									***21.2***		***36.6***	
Barium	88.4	330	mg/kg			*127*				*163*		***764***		*226*	
Cadmium	0	0.36	mg/kg	***0.41***	**J**	***1.9***				***3.6***		***12.9***		***2.3***	
Chromium	17.4	26	mg/kg	***174***		***143***		***30.9***		***33.5***		***77.6***		***106***	
Cobalt	10.4	13	mg/kg	***13.2***				*12.2*							
Copper	17.7	28	mg/kg	*25.3*		***33.7***		*17.8*		***42.8***		***188***		***63.7***	
Lead	26.1	11	mg/kg	**12.1**	**J**	***139***				***134***		***405***		***141***	
Mercury	0.036	0.00051	mg/kg	***15.1***		***11.1***		***24.6***		***8.8***		***2.7***		***0.5***	
Nickel	21.1	38	mg/kg			*21.7*		*26.4*				*30.7*		*37.6*	
Selenium	1.4	0.52	mg/kg			**0.83**	**J**			**0.63**				***3.1***	
Silver	0	4.2	mg/kg	***12.9***		*3.8*				***47.9***	**J**	***256***		***145***	
Thallium	0	1	mg/kg	***3.2***	**J**	***1.7***		***1.8***		***1.7***		***2.4***		***1.4***	
Zinc	61.8	46	mg/kg	***94***		***269***		**59.9**		***234***		***373***		***111***	
Propellants															
Nitroguanidine	---	NA		*0.64*		NS		NS		NS		NS		NS	
Pesticides															
alpha-Chlordane [a]	---	0.224	mg/kg			NS		NS		NS		NS		NS	
Heptachlor	---	0.00598	mg/kg	**0.0081**	**J**	NS		NS		NS		NS		NS	
Lindane [a]	---	0.005	mg/kg			NS		NS		NS		NS		NS	

Table 7-7. Summary of COPECs in Surface Soil Sampling Units (continued).

		Sample Location:		SCss-057M		SCss-058M		SCss-059M		SCss-060M		SCss-061M		SCss-062M	
		Sample Number:		SCss-057M-0001-SO		SCss-058M-0001-SO		SCss-059M-0001-SO		SCss-060M-0001-SO		SCss-061M-0001-SO		SCss-062M-0001-SO	
		Sample Date:		24-Sep-10		23-Sep-10		23-Sep-10		23-Sep-10		23-Sep-10		22-Sep-10	
		Depth (feet bgs):		0–1		0–1		0–1		0–1		0–1		0–1	
COPEC	Background	ESV	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
Semivolatile Organic Compounds															
1,2,4-Trichlorobenzene [a]	---	20	mg/kg												
1,2-Dichlorobenzene [a]	---	2.96	mg/kg												
1,3-Dichlorobenzene [a]	---	37.7	mg/kg												
1,4-Dichlorobenzene [a]	---	20	mg/kg												
2-Methylnaphthalene [a]	---	3.24	mg/kg												
Benzo(a)anthracene	---	1.1	mg/kg					**1.8**		**2.6**					
Benzo(a)pyrene	---	1.1	mg/kg					**1.5**		**2.4**					
Benzo(b)fluoranthene	---	1.1	mg/kg					**2.3**		**4.8**		**1.7**			
Benzo(k)fluoranthene	---	1.1	mg/kg							**1.4**					
Bis(2-Ethylhexyl)phthalate	---	0.925	mg/kg												
Carbazole	---	0.00008	mg/kg			**0.078**	**J**	**0.61**		**0.59**		**0.12**	**J**	**0.045**	**J**
Chrysene	---	1.1	mg/kg					**1.6**		**2.7**					
Dibenzofuran [a]	---	6.1	mg/kg												
Di-n-Butyl Phthalate [a]	---	200	mg/kg												
Pentachlorophenol [a]	---	2.1	mg/kg												
Pyrene	---	1.1	mg/kg			**1.3**		**3**		**4**		**1.5**			

Table 7-7. Summary of COPECs in Surface Soil Sampling Units (continued).

				Sample Location:	SCss-063M		SCss-064M		SCss-065M		SCss-066M		SCss-067M		SCss-068M	
				Sample Number:	SCss-063M-0001-SO		SCss-064M-0001-SO		SCss-065M-0001-SO		SCss-066M-0001-SO		SCss-067M-0001-SO		SCss-068M-0001-SO	
				Sample Date:	22-Sep-10		22-Sep-10		22-Sep-10		22-Sep-10		21-Sep-10		21-Sep-10	
				Depth (feet bgs):	0–1		0–1		0–1		0–1		0–1		0–1	
COPEC	**Background**	**ESV**	**Units**		**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**
Inorganics																
Antimony	0.96	0.27	mg/kg		*2.8*		0.75									
Arsenic	15.4	18	mg/kg		*16.2*											
Barium	88.4	330	mg/kg		*180*		*128*									
Cadmium	0	0.36	mg/kg		*2.8*		*0.69*		*0.12*		*0.41*		*0.071*		*0.057*	
Chromium	17.4	26	mg/kg		*39.9*		*187*		*30.8*		*38.6*		*24.7*		*24.2*	
Cobalt	10.4	13	mg/kg													
Copper	17.7	28	mg/kg		*95.5*		*726*		*21.4*							
Lead	26.1	11	mg/kg		*109*		*131*		*37*		*37.1*		*35.5*		*29.8*	
Mercury	0.036	0.00051	mg/kg		*0.55*		*0.078*		0.029		*0.07*		0.026		0.031	
Nickel	21.1	38	mg/kg		*27.6*		*48.2*		*22*		*25.6*		*21.3*			
Selenium	1.4	0.52	mg/kg		*1.9*		0.48									
Silver	0	4.2	mg/kg		*120*		*0.95*		*1.3*							
Thallium	0	1	mg/kg		*2.7*		*1.1*		*0.76*		*0.72*		*0.97*		*0.62*	
Zinc	61.8	46	mg/kg		*303*		*235*		*68.8*		61.6		49.7		48.2	
Propellants																
Nitroguanidine	---	NA			NS		NS		NS		NS		NS		NS	
Pesticides																
alpha-Chlordane [a]	---	0.224	mg/kg		NS		NS		NS		NS		NS		NS	
Heptachlor	---	0.00598	mg/kg		NS		NS		NS		NS		NS		NS	
Lindane [a]	---	0.005	mg/kg		NS		NS		NS		NS		NS		NS	
Semivolatile Organic Compounds																
1,2,4-Trichlorobenzene [a]	---	20	mg/kg													
1,2-Dichlorobenzene [a]	---	2.96	mg/kg													
1,3-Dichlorobenzene [a]	---	37.7	mg/kg													

Table 7-7. Summary of COPECs in Surface Soil Sampling Units (continued).

		Sample Location:		SCss-063M		SCss-064M		SCss-065M		SCss-066M		SCss-067M		SCss-068M	
		Sample Number:		SCss-063M-0001-SO		SCss-064M-0001-SO		SCss-065M-0001-SO		SCss-066M-0001-SO		SCss-067M-0001-SO		SCss-068M-0001-SO	
		Sample Date:		22-Sep-10		22-Sep-10		22-Sep-10		22-Sep-10		21-Sep-10		21-Sep-10	
		Depth (feet bgs):		0–1		0–1		0–1		0–1		0–1		0–1	
COPEC	Background	ESV	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
1,4-Dichlorobenzene [a]	---	20	mg/kg												
2-Methylnaphthalene [a]	---	3.24	mg/kg												
Benzo(a)anthracene	---	1.1	mg/kg												
Benzo(a)pyrene	---	1.1	mg/kg												
Benzo(b)fluoranthene	---	1.1	mg/kg												
Benzo(k)fluoranthene	---	1.1	mg/kg												
Bis(2-Ethylhexyl)phthalate	---	0.925	mg/kg												
Carbazole	---	0.00008	mg/kg	**0.1**	**J**			**0.034**							
Chrysene	---	1.1	mg/kg												
Dibenzofuran [a]	---	6.1	mg/kg												
Di-n-Butyl Phthalate [a]	---	200	mg/kg												
Pentachlorophenol [a]	---	2.1	mg/kg												
Pyrene	---	1.1	mg/kg												

Table 7-7. Summary of COPECs in Surface Soil Sampling Units (continued)

				Sample Location:	SCss-069M		SCss-072M		SCss-073M		SCss-074M		SCss-075M		SCss-076M	
				Sample Number:	SCss-069M-0001-SO		SCss-072M-0001-SO		SCss-073M-0001-SO		SCss-074M-0001-SO		SCss-075M-0001-SO		SCss-076M-0001-SO	
				Sample Date:	24-Sep-10		9-Nov-10		9-Nov-10		9-Nov-10		9-Nov-10		9-Nov-10	
				Depth (feet bgs):	0–1		0–1		0–1		0–1		0–1		0–1	
COPEC	**Background**	**ESV**	**Units**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**	**Result**	**VQ**
Inorganics															
Antimony	0.96	0.27	mg/kg			**0.89**		***2.9***		***1.4***		***1.3***		***3.1***	
Arsenic	15.4	18	mg/kg					***21.8***		***18.3***		12.4		10.3	
Barium	88.4	330	mg/kg					*94.3*		*96.1*					
Cadmium	0	0.36	mg/kg			*0.3*		***0.63***		***1.6***		***0.85***		***0.65***	
Chromium	17.4	26	mg/kg			***32***		***130***		***88.4***		***81***		***188***	
Cobalt	10.4	13	mg/kg					*10.8*		***19.7***					
Copper	17.7	28	mg/kg					*24.3*		***67***					
Lead	26.1	11	mg/kg					***50.3***		***140***		**13.2**		**18.2**	
Mercury	0.036	0.00051	mg/kg	***0.061***		***0.063***		***0.27***		***0.13***		***0.054***		***0.049***	
Nickel	21.1	38	mg/kg			*21.7*		*32.7*		*25.9*		*21.8*		*25.3*	
Selenium	1.4	0.52	mg/kg			***1.6***		***2.4***		**0.98**		**1.4**		***2.2***	
Silver	0	4.2	mg/kg	*0.52*		*2.7*		*2*		*0.69*		*0.095*		*0.11*	
Thallium	0	1	mg/kg	***1.1***						*0.23*	J	*0.14*	J	*0.73*	
Zinc	61.8	46	mg/kg			**54.4**		***86.1***		***147***		**50.1**		**46.9**	
Propellants															
Nitroguanidine	---	NA		NS		NS		NS		NS		NS		NS	
Pesticides															
alpha-Chlordane [a]	---	0.224	mg/kg	NS		NS		NS		NS		NS			
Heptachlor	---	0.00598	mg/kg	NS		NS		NS		NS		NS			
Lindane [a]	---	0.005	mg/kg	NS		NS		NS		NS		NS			
Semivolatile Organic Compounds															
1,2,4-Trichlorobenzene [a]	---	20	mg/kg												
1,2-Dichlorobenzene [a]	---	2.96	mg/kg												
1,3-Dichlorobenzene [a]	---	37.7	mg/kg												

Table 7-7. Summary of COPECs in Surface Soil Sampling Units (continued).

		Sample Location:		SCss-069M		SCss-072M		SCss-073M		SCss-074M		SCss-075M		SCss-076M	
		Sample Number:		SCss-069M-0001-SO		SCss-072M-0001-SO		SCss-073M-0001-SO		SCss-074M-0001-SO		SCss-075M-0001-SO		SCss-076M-0001-SO	
		Sample Date:		24-Sep-10		9-Nov-10		9-Nov-10		9-Nov-10		9-Nov-10		9-Nov-10	
		Depth (feet bgs):		0–1		0–1		0–1		0–1		0–1		0–1	
COPEC	Background	ESV	Units	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
1,4-Dichlorobenzene [a]		20	mg/kg												
2-Methylnaphthalene [a]	---	3.24	mg/kg												
Benzo(a)anthracene	---	1.1	mg/kg												
Benzo(a)pyrene	---	1.1	mg/kg												
Benzo(b)fluoranthene	---	1.1	mg/kg												
Benzo(k)fluoranthene	---	1.1	mg/kg												
Bis(2-Ethylhexyl)phthalate	---	0.925	mg/kg			**1.7**									
Carbazole	---	0.00008	mg/kg					**0.058**	**J**	**0.057**	**J**				
Chrysene	---	1.1	mg/kg												
Dibenzofuran [a]	---	6.1	mg/kg												
Di-n-Butyl Phthalate [a]	---	200	mg/kg												
Pentachlorophenol [a]	---	2.1	mg/kg												
Pyrene	---	1.1	mg/kg												

Detects in bold exceed ESV; detects in italic exceed BSV or indicate that a BSV isn't available.

[a] denotes MDC is below ESV; COPEC is retained for bioaccumulative effects.

--- denotes BSV is not available.

bgs denotes below ground surface.

COPEC denotes chemical of potential ecological concern.

ESV denotes ecological screening value.

J denotes reported result is an estimated value.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

ND denotes not detected.

NS denotes not sampled.

VQ denotes validation qualifier.

Table 7-8. Hazard Quotients for COPECs in Surface Soil Sampling Units.

Sample Location:	SCss-057M	SCss-058M	SCss-059M	SCss-060M	SCss-061M	SCss-062M	SCss-063M	SCss-064M	SCss-065M
Sample Number:	SCss-057M-0001-SO	SCss-058M-0001-SO	SCss-059M-0001-SO	SCss-060M-0001-SO	SCss-061M-0001-SO	SCss-062M-0001-SO	SCss-063M-0001-SO	SCss-064M-0001-SO	SCss-065M-0001-SO
Sample Date:	24-Sep-10	23-Sep-10	23-Sep-10	23-Sep-10	23-Sep-10	22-Sep-10	22-Sep-10	22-Sep-10	22-Sep-10
Depth (feet bgs):	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1	0–1
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Inorganics									
Antimony				5.6	**63.3**	**13.7**	10.4		
Arsenic					1.2	2.0			
Barium					2.3				
Cadmium	1.1	5.3		10.0	**35.8**	6.4	7.8	1.9	
Chromium	6.7	5.5	1.2	1.3	3.0	4.1	1.5	7.2	1.2
Cobalt	1.0								
Copper		1.2		1.5	6.7	2.3	3.4	**25.9**	
Lead		**12.6**		**12.2**	**36.8**	**12.8**	9.9	**11.9**	3.4
Mercury	**29,608**	**21,765**	**48,235**	**17,255**	**5,294**	**980**	**1,078**	**153**	
Nickel								1.3	
Selenium						6.0	3.7		
Silver	3.1			**11.4**	**61.0**	**34.5**	**28.6**		
Thallium	3.2	1.7	1.8	1.7	2.4	1.4	2.7	1.1	
Zinc	2.0	5.8	1.3	5.1	8.1	2.4	6.6	5.1	1.5
Propellants									
Nitroguanidine									
Pesticides									
alpha-Chlordane [a]									
Heptachlor	1.4								
Lindane [a]									

Table 7-8. Hazard Quotients for COPECs in Surface Soil Sampling Units (continued).

Sample Location:	SCss-057M	SCss-058M	SCss-059M	SCss-060M	SCss-061M	SCss-062M	SCss-063M	SCss-064M	SCss-065M
Sample Number:	**SCss-057M-0001-SO**	**SCss-058M-0001-SO**	**SCss-059M-0001-SO**	**SCss-060M-0001-SO**	**SCss-061M-0001-SO**	**SCss-062M-0001-SO**	**SCss-063M-0001-SO**	**SCss-064M-0001-SO**	**SCss-065M-0001-SO**
Sample Date:	**24-Sep-10**	**23-Sep-10**	**23-Sep-10**	**23-Sep-10**	**23-Sep-10**	**22-Sep-10**	**22-Sep-10**	**22-Sep-10**	**22-Sep-10**
Depth (feet bgs):	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**
COPEC	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene [a]									
1,2-Dichlorobenzene [a]									
1,3-Dichlorobenzene [a]									
1,4-Dichlorobenzene [a]									
2-Methylnaphthalene [a]									
Benzo(a)anthracene			1.6	2.4					
Benzo(a)pyrene			1.4	2.2					
Benzo(b)fluoranthene			2.1	4.4	1.5				
Benzo(k)fluoranthene				1.3					
Carbazole		**975**	**7,625**	**7,375**	**1,500**	**563**	**1,250**		**425**
Chrysene			1.5	2.5					
Dibenzofuran [a]									
Di-n-Butyl Phthalate [a]									
Pentachlorophenol [a]									
Pyrene		1.2	2.7	3.6	1.4				

Table 7-8. Hazard Quotients for COPECs in Surface Soil Sampling Units (continued).

Sample Location:	SCss-066M	SCss-067M	SCss-068M	SCss-069M	SCss-072M	SCss-073M	SCss-074M	SCss-075M	SCss-076M
Sample Number:	**SCss-066M-0001-SO**	**SCss-067M-0001-SO**	**SCss-068M-0001-SO**	**SCss-069M-0001-SO**	**SCss-072M-0001-SO**	**SCss-073M-0001-SO**	**SCss-074M-0001-SO**	**SCss-075M-0001-SO**	**SCss-076M-0001-SO**
Sample Date:	**22-Sep-10**	**21-Sep-10**	**21-Sep-10**	**24-Sep-10**	**9-Nov-10**	**9-Nov-10**	**9-Nov-10**	**9-Nov-10**	**9-Nov-10**
Depth (feet bgs):	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**
COPEC	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**
Inorganics									
Antimony						**10.7**	5.2	4.8	**11.5**
Arsenic						1.2	1.0		
Barium									
Cadmium	1.1					1.8	4.4	2.4	1.8
Chromium	1.5				12	5.0	3.4	3.1	7.2
Cobalt							1.5		
Copper							2.4		
Lead	3.4	3.2	2.7			4.6	**12.7**		
Mercury	**137**			**120**	**124**	**529**	**255**	**106**	**96**
Nickel									
Selenium					3.1	4.6			4.2
Silver									
Thallium				1.1					
Zinc						1.9	3.2		
Propellants									
Nitroguanidine									
Pesticides									
alpha-Chlordane [a]									
Heptachlor									
Lindane [a]									
Semivolatile Organic Compounds									
1,2,4-Trichlorobenzene [a]									
1,2-Dichlorobenzene [a]									
1,3-Dichlorobenzene [a]									

Table 7-8. Hazard Quotients for COPECs in Surface Soil Sampling Units (continued).

Sample Location:	SCss-066M	SCss-067M	SCss-068M	SCss-069M	SCss-072M	SCss-073M	SCss-074M	SCss-075M	SCss-076M
Sample Number:	**SCss-066M-0001-SO**	**SCss-067M-0001-SO**	**SCss-068M-0001-SO**	**SCss-069M-0001-SO**	**SCss-072M-0001-SO**	**SCss-073M-0001-SO**	**SCss-074M-0001-SO**	**SCss-075M-0001-SO**	**SCss-076M-0001-SO**
Sample Date:	**22-Sep-10**	**21-Sep-10**	**21-Sep-10**	**24-Sep-10**	**9-Nov-10**	**9-Nov-10**	**9-Nov-10**	**9-Nov-10**	**9-Nov-10**
Depth (feet bgs):	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**	**0–1**
COPEC	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**	**HQ**
1,4-Dichlorobenzene [a]									
2-Methylnaphthalene [a]									
Benzo(a)anthracene									
Benzo(a)pyrene									
Benzo(b)fluoranthene									
Benzo(k)fluoranthene									
Bis(2-Ethylhexyl)phthalate						1.8			
Carbazole	**425**						**725**	**713**	
Chrysene									
Dibenzofuran [a]									
Di-n-Butyl Phthalate [a]									
Pentachlorophenol [a]									
Pyrene									

Only results that exceeded BSVs and ESVs are present.
Cells in bold exceed an HQ of 10.
Shaded cells exceed an HQ of 100.
[a] denotes MDC is below ESV; COPEC is retained for bioaccumulative effects.
bgs denotes below ground surface.
BSV denotes background screening value.
COPEC denotes chemical of potential ecological concern.
ESV denotes ecological screening value.
HQ denotes hazard quotient.
MDC denotes maximum detected concentration.

Table 7-9. Summary of COPECs in Sediment Sampling Units.

		Sample Location:		SCsd-070M		SCsd-071M	
		Sample Number:		SCsd-070M-0001-SD		SCsd-071M-0001-SD	
		Sample Date:		28-Sep-10		28-Sep-10	
		Depth (feet bgs):		0–0.5		0–0.5	
COPEC	**BSV**	**ESV**	**Units**	**Result**	**VQ**	**Result**	**VQ**
Inorganics							
Antimony	0	0.36	mg/kg	***8.4***		***0.45***	***J***
Barium	123	48	mg/kg	***231***		**75.7**	
Cadmium	0	0.99	mg/kg	***2.7***		*0.19*	
Chromium	18.1	43.4	mg/kg	*40.9*		***107***	
Copper	27.6	31.6	mg/kg	***53.7***			
Lead	27.4	35.8	mg/kg	***104***			
Mercury	0.059	0.18	mg/kg	***0.3***			
Nickel	17.7	22.7	mg/kg	*21.1*		*20*	
Selenium	1.7	0.9	mg/kg	**1.4**	**J**		
Silver	0	0.5	mg/kg	***116***			
Thallium	0.89	0.044	mg/kg	***1.2***		***1.1***	
Propellants							
Nitroguanidine		NA	mg/kg	**0.69**		**1.2**	

Table 7-9. Summary of COPECs in Sediment Sampling Units (continued).

		Sample Location:		SCsd-070M		SCsd-071M	
		Sample Number:		SCsd-070M-0001-SD		SCsd-071M-0001-SD	
		Sample Date:		28-Sep-10		28-Sep-10	
		Depth (feet bgs):		0–0.5		0–0.5	
COPEC	**BSV**	**ESV**	**Units**	**Result**	**VQ**	**Result**	**VQ**
Polychlorinated Biphenyls							
Arochlor 1254		0.0598	mg/kg	**0.15**			
Arochlor 1262		0.0598	mg/kg	**0.094**			
Pesticides							
4,4'-DDD [a]		0.00488	mg/kg				
4,4'-DDE		0.00316	mg/kg	**0.0043**			
4,4'-DDT		0.00416	mg/kg	**0.0068**			
alpha-Chlordane [a]		0.00324	mg/kg				
beta-BHC [a]		0.006	mg/kg				
delta-BHC [a]		7.15	mg/kg				
Dieldrin		0.0019	mg/kg	**0.0046**			
Endosulfan Sulfate [a]		34.6	mg/kg				
Endrin Aldehyde [a]		0.48	mg/kg				
gamma-Chlordane		0.00324	mg/kg	**0.0078**			
Heptachlor [a]		0.6	mg/kg				
Methoxychlor [a]		0.0136	mg/kg				

Table 7-9. Summary of COPECs in Sediment Sampling Units (continued).

		Sample Location:		SCsd-070M		SCsd-071M	
		Sample Number:		SCsd-070M-0001-SD		SCsd-071M-0001-SD	
		Sample Date:		28-Sep-10		28-Sep-10	
		Depth (feet bgs):		0–0.5		0–0.5	
COPEC	**BSV**	**ESV**	**Units**	**Result**	**VQ**	**Result**	**VQ**
Semivolatile Organic Compounds							
1,2-Dichlorobenzene [a]		0.294	mg/kg				
1,4-Dichlorobenzene [a]		0.318	mg/kg				
2-Methylnaphthalene		0.0202	mg/kg	**0.043**			
Di-n-Butyl Phthalate [a]		1.114	mg/kg				

Detects in bold exceed ESV.

Detects in italic exceed BSV or indicate that a BSV isn't available (applicable to metals only).

[a] denotes MDC is below ESV; COPEC is retained for bioaccumulative effects.

bgs denotes below ground surface.

BSV denotes background screening value.

COPEC denotes chemical of potential ecological concern.

ESV denotes ecological screening value.

J denotes reported result is an estimated value.

MDC denotes maximum detected concentration.

mg/kg denotes milligrams per kilogram.

NA denotes not available.

ND denotes not detected.

VQ denotes validation qualifier.

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Table 7-10. Summary of Hazard Quotients for COPECs in Sediment Sampling Units.

Sample Location:	SCsd-070M	SCsd-071M
Sample Number:	SCsd-070M-0001-SD	SCsd-071M-0001-SD
Sample Date:	28-Sep-10	28-Sep-10
Depth (feet bgs):	0–0.5	0–0.5
COPEC	HQ	HQ
Inorganics		
Antimony	**23**	1
Barium	5	2
Cadmium	3	
Chromium		2
Copper	2	
Lead	3	
Mercury	2	
Nickel		
Selenium	2	
Silver	**232**	
Thallium	**27**	**25**
Propellants		
Nitroguanidine		
Polychlorinated Biphenyls		
Arochlor 1254	3	
Arochlor 1262	2	
Pesticides		
4,4'-DDD [a]		
4,4'-DDE	1	
4,4'-DDT	2	
alpha-Chlordane [a]		
beta-BHC [a]		
delta-BHC [a]		
Dieldrin	2	
Endosulfan Sulfate [a]		
Endrin Aldehyde [a]		

Table 7-10. Summary of Hazard Quotients for COPECs in Sediment Sampling Units (continued).

Sample Location:	SCsd-070M	SCsd-071M
Sample Number:	SCsd-070M-0001-SD	SCsd-071M-0001-SD
Sample Date:	28-Sep-10	28-Sep-10
Depth (feet bgs):	0–0.5	0–0.5
COPEC	**HQ**	**HQ**
gamma-Chlordane	2	
Heptachlor [a]		
Methoxychlor [a]		
Semivolatile Organic Compounds		
1,2-Dichlorobenzene [a]		
1,4-Dichlorobenzene [a]		
2-Methylnaphthalene	2	
Di-n-Butyl Phthalate [a]		

Cells in bold exceed an HQ of 10.

Shaded cells exceed an HQ of 100.

[a] denotes MDC is below ESV; COPEC is retained for bioaccumulative effects.

bgs denotes below ground surface.

COPEC denotes chemical of potential ecological concern.

HQ denotes hazard quotient.

MDC denotes maximum detected concentration.

Table 7-11. Bioaccumulation Factors or Regression Equations Used to Model Uptake.

COPEC in Soil	Soil-to-Plant BAF	Source	Soil-to-Earthworm BAF	Source	Soil-to-Mammal BAF	Source
Inorganics						
Mercury	ln (AGP)=0.54(ln[soil])-1.00	Efroymson et al. (2001)[a]	ln (EW)=0.33(ln[soil])+0.078	Sample et al. (1998)	0.192	Sample et al .(1998)

[a] *denotes Efroymson, R.A., et al., 2001, Uptake of Inorganic Chemicals from Soil by Plant Leaves: Regressions of Field Data, Environ. Tox. Chem., 20: 2561–2571.*

[b] *denotes Sample, B.E., et al., 1998, Development and Validation of Bioaccumulation Models for Earthworms, ES/ER/TM-220.*

[c] *denotes Sample, B.E., et al., 1998, Development and Validation of Bioaccumulation Models for Small Mammals, ES/ER/TM-219. The "General: 90th Percentile" was used because of uncertainties regarding the type of mammalian prey items.*

AGP denotes aboveground plant tissue concentration.

BAF denotes Bioaccumulation Factor.

COPEC denotes chemical of potential ecological concern.

EW denotes earthworm tissue concentration.

Table 7-12. Exposure Parameters for Representative Ecological Receptors.

Ecological Receptor Species	Class/Order	Average Body Weight[a] (kg)	Average Home Range[a] (ha)	Dietary Intake[a] (kg[dw]/day)	Soil/Sed. Intake (kg[dw]/day)	Water Intake (L/day)[a]	Temporal Use Factor	Trophic Level	Dietary Composition[a] (percent)
Short-tailed shrew *(Blarina brevicauda)*	Mammalia/ Insectivora	0.017	0.39	0.00952	0.0012 (13%)	0.0038	1	Insectivore	Terr. Inverts.: 87 Plants: 13
American robin (*Turdus migratorius*)	Aves/ Passeriformes	0.081	0.25	0.0972	0.00486 (5%)	0.011	1	Omnivore	Terr. Inverts.: 50 Plants: 50
Meadow vole (*Microtus pennsyvanicus*)	Mammalia/ Rodentia	0.033	0.027	0.01089	0.00022 (2%)	0.00594	1	Herbivore	Plants: 100
Red-tailed hawk (*Buteo jamaicensis*)	Aves/ Falconiformes	1.13	697	0.1243	0	0.06441	1	Carnivore	Animals: 100
Barn owl *(Tyto alba)*	Aves/ Strigiformes	0.466	250	0.05825	0	0.0163	1	Carnivore	Animals: 100
Red fox (*Vulpes vulpes*)	Mammalia/ Carnivora	4.69	596	0.324	0.009 (2.8%)	0.399	1	Carnivore	Animals: 95.4 Plants: 4.6

[a] *denotes reference to RVAAP Facility-Wide Ecological Risk Work Plan, April 2003.*

ha denotes hectare.

kg denotes kilograms.

kg[dw]/day denotes kilograms per day dry weight.

L/day denotes liters per day.

Terr. Inverts. denotes terrestrial invertebrates.

Table 7-13. Toxicity Reference Values for Mammals.

COPEC	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Source	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Source
Inorganics								
Mercury (mink)	--	1	mink	Sample et al. (1996)	1.0 (NOAEL)	5	mink	Sample et al. (1996)
Mercury (mouse)	--	13	mouse	Sample et al. (1996)	--	132	mouse	Sample et al. (1996)

Reference: Sample, B.E., D.M. Opresko, and G.W. Suter II, Toxicological Benchmarks for Wildlife, 1996 Revision, Risk Assessment Program Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee (1996).

COPEC denotes chemical of potential ecological concern.

LOAEL denotes lowest observed adverse effect level.

mg/kg/day denotes milligrams per kilogram per day.

NOAEL denotes no observed adverse effect level.

Table 7-14. Toxicity Reference Values for Birds.

COPEC	Toxicity Value	NOAEL (mg/kg/d)	Test Species	Source	Toxicity Value	LOAEL (mg/kg/d)	Test Species	Source
Inorganics								
Mercury	--	0.45	Japanese quail	Sample et al. (1996)	--	0.9	Japanese quail	Sample et al. (1996)

Reference: Sample, B.E., D.M. Opresko, and G.W. Suter II, Toxicological Benchmarks for Wildlife, 1996 Revision, Risk Assessment Program Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

COPEC denotes chemical of potential ecological concern.

LOAEL denotes lowest observed adverse effect level.

mg/kg/day denotes milligrams per kilogram per day.

NOAEL denotes no observed adverse effect level.

Table 7-15. Wildlife Hazard Quotients for Mercury in Surface Soil with No AUF Adjustment.

Source of EPC	Mercury EPC (mg/kg)	Short-Tailed Shrew		American Robin		Meadow Vole		Red-Tailed Hawk		Barn Owl		Cottontail Rabbit		Red Fox	
		NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Maximum:	*24.6*	*2.62E-01*	*2.58E-02*	*1.02E+01*	*5.10E+00*	*6.53E-02*	*6.43E-03*	*1.15E+00*	*5.77E-01*	*1.31E+00*	*NA*	*2.36E-02*	*2.33E-03*	*3.65E-01*	*7.30E-02*
Average:	*3.6*	*8.55E-02*	*8.42E-03*	*3.66E+00*	*1.83E+00*	*2.05E-02*	*2.02E-03*	*1.69E-01*	*8.45E-02*	*1.92E-01*	*NA*	*6.27E-03*	*6.18E-04*	*5.48E-02*	*1.10E-02*
SCss-057	15.1	1.90E-01	1.87E-02	7.67E+00	3.83E+00	4.82E-02	4.75E-03	7.09E-01	3.54E-01	8.05E-01	NA	1.66E-02	1.63E-03	2.25E-01	4.50E-02
SCss-058	11.1	1.57E-01	1.55E-02	6.47E+00	3.23E+00	3.99E-02	3.93E-03	5.21E-01	2.60E-01	5.92E-01	NA	1.34E-02	1.32E-03	1.66E-01	3.32E-02
SCss-059	24.6	2.62E-01	2.58E-02	1.02E+01	5.10E+00	6.53E-02	6.43E-03	1.15E+00	5.77E-01	1.31E+00	NA	2.36E-02	2.33E-03	3.65E-01	7.30E-02
SCss-060	8.8	1.37E-01	1.35E-02	5.72E+00	2.86E+00	3.47E-02	3.42E-03	4.13E-01	2.07E-01	4.69E-01	NA	1.14E-02	1.12E-03	1.32E-01	2.64E-02
SCss-061	2.7	7.44E-02	7.33E-03	3.20E+00	1.60E+00	1.74E-02	1.71E-03	1.27E-01	6.34E-02	1.44E-01	NA	5.21E-03	5.13E-04	4.13E-02	8.27E-03
SCss-062	0.5	3.64E-02	3.58E-03	1.55E+00	7.75E-01	6.68E-03	6.58E-04	2.35E-02	1.17E-02	2.67E-02	NA	1.86E-03	1.83E-04	8.09E-03	1.62E-03
SCss-063	0.55	3.77E-02	3.72E-03	1.61E+00	8.06E-01	7.04E-03	6.94E-04	2.58E-02	1.29E-02	2.93E-02	NA	1.96E-03	1.93E-04	8.86E-03	1.77E-03
SCss-064	0.078	1.84E-02	1.81E-03	7.55E-01	3.78E-01	2.40E-03	2.36E-04	3.66E-03	1.83E-03	4.16E-03	NA	6.37E-04	6.28E-05	1.43E-03	2.86E-04
SCss-065	0.029	1.31E-02	1.29E-03	5.24E-01	2.62E-01	1.40E-03	1.37E-04	1.36E-03	6.81E-04	1.55E-03	NA	3.67E-04	3.61E-05	5.95E-04	1.19E-04
SCss-066	0.07	1.77E-02	1.74E-03	7.25E-01	3.63E-01	2.26E-03	2.22E-04	3.29E-03	1.64E-03	3.73E-03	NA	6.00E-04	5.91E-05	1.30E-03	2.60E-04
SCss-067	0.026	1.26E-02	1.24E-03	5.04E-01	2.52E-01	1.31E-03	1.29E-04	1.22E-03	6.10E-04	1.39E-03	NA	3.45E-04	3.40E-05	5.42E-04	1.08E-04
SCss-068	0.031	1.34E-02	1.32E-03	5.37E-01	2.69E-01	1.45E-03	1.42E-04	1.45E-03	7.27E-04	1.65E-03	NA	3.80E-04	3.75E-05	6.31E-04	1.26E-04
SCss-069	0.061	1.69E-02	1.66E-03	6.89E-01	3.45E-01	2.09E-03	2.06E-04	2.86E-03	1.43E-03	3.25E-03	NA	5.55E-04	5.47E-05	1.15E-03	2.29E-04
SCss-072	0.063	1.71E-02	1.68E-03	6.98E-01	3.49E-01	2.13E-03	2.10E-04	2.96E-03	1.48E-03	3.36E-03	NA	5.65E-04	5.57E-05	1.18E-03	2.36E-04
SCss-073	0.27	2.88E-02	2.83E-03	1.21E+00	6.07E-01	4.74E-03	4.67E-04	1.27E-02	6.34E-03	1.44E-02	NA	1.29E-03	1.27E-04	4.51E-03	9.02E-04
SCss-074	0.13	2.21E-02	2.17E-03	9.16E-01	4.58E-01	3.17E-03	3.12E-04	6.10E-03	3.05E-03	6.93E-03	NA	8.51E-04	8.38E-05	2.28E-03	4.57E-04
SCss-075	0.054	1.62E-02	1.59E-03	6.59E-01	3.29E-01	1.96E-03	1.93E-04	2.53E-03	1.27E-03	2.88E-03	NA	5.18E-04	5.11E-05	1.03E-03	2.06E-04
SCss-076	0.049	1.56E-02	1.54E-03	6.36E-01	3.18E-01	1.86E-03	1.83E-04	2.30E-03	1.15E-03	2.61E-03	NA	4.91E-04	4.84E-05	9.43E-04	1.89E-04

HQs were calculated without AUFs.
Shaded cells indicate an HQ greater than 1 when rounded.
AUF denotes Area Use Factor.
EPC denotes exposure point concentration.
HQ denotes hazard quotient.
LOAEL denotes lowest observed adverse effect level.
mg/kg denotes milligrams per kilogram.
NA denotes the barn owl represents a threatened species; therefore, effects are based only on the more conservative NOAEL value.
NOAEL denotes no observed adverse effect level
.

Table 7-16. Wildlife Hazard Quotients for Mercury in Surface Soil Using an AUF Adjustment.

Source of EPC	Mercury EPC (mg/kg)	Short-Tailed Shrew		American Robin		Meadow Vole		Red-Tailed Hawk		Barn Owl		Cottontail Rabbit		Red Fox	
		NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Maximum:	*24.6*	*2.62E-01*	*2.58E-02*	*1.02E+01*	*5.10E+00*	*6.53E-02*	*6.43E-03*	*1.76E-03*	*8.82E-04*	*5.59E-03*	*NA*	*8.12E-03*	*7.99E-04*	*6.52E-04*	*1.30E-04*
Average:	*3.6*	*8.55E-02*	*8.42E-03*	*3.66E+00*	*1.83E+00*	*2.05E-02*	*2.02E-03*	*2.58E-04*	*1.29E-04*	*8.17E-04*	*NA*	*2.15E-03*	*2.12E-04*	*9.79E-05*	*1.96E-05*
SCss-057	15.1	1.39E-02	1.37E-03	8.69E-01	4.34E-01	4.82E-02	4.75E-03	2.88E-05	1.44E-05	9.12E-05	NA	1.52E-04	1.49E-05	1.07E-05	2.14E-06
SCss-058	11.1	6.14E-03	6.04E-04	3.92E-01	1.96E-01	2.13E-02	2.10E-03	1.13E-05	5.66E-06	3.58E-05	NA	6.53E-05	6.43E-06	4.22E-06	8.43E-07
SCss-059	24.6	7.55E-03	7.44E-04	4.57E-01	2.28E-01	2.14E-02	2.11E-03	1.54E-05	7.71E-06	4.88E-05	NA	7.10E-05	6.99E-06	5.70E-06	1.14E-06
SCss-060	8.8	3.42E-03	3.37E-04	2.21E-01	1.10E-01	1.14E-02	1.12E-03	5.52E-06	2.76E-06	1.75E-05	NA	3.42E-05	3.37E-06	2.06E-06	4.12E-07
SCss-061	2.7	2.33E-03	2.29E-04	1.55E-01	7.77E-02	7.44E-03	7.32E-04	2.21E-06	1.10E-06	6.99E-06	NA	2.04E-05	2.01E-06	8.42E-07	1.68E-07
SCss-062	0.5	1.74E-03	1.71E-04	1.15E-01	5.76E-02	4.38E-03	4.31E-04	6.26E-07	3.13E-07	1.98E-06	NA	1.11E-05	1.10E-06	2.52E-07	5.04E-08
SCss-063	0.55	4.48E-03	4.41E-04	2.97E-01	1.49E-01	7.04E-03	6.94E-04	1.71E-06	8.54E-07	5.41E-06	NA	2.92E-05	2.88E-06	6.86E-07	1.37E-07
SCss-064	0.078	4.73E-03	4.66E-04	3.02E-01	1.51E-01	2.40E-03	2.36E-04	5.25E-07	2.62E-07	1.66E-06	NA	2.05E-05	2.02E-06	2.40E-07	4.80E-08
SCss-065	0.029	3.40E-03	3.35E-04	2.12E-01	1.06E-01	1.40E-03	1.37E-04	1.98E-07	9.88E-08	6.26E-07	NA	1.20E-05	1.18E-06	1.01E-07	2.02E-08
SCss-066	0.07	3.88E-03	3.82E-04	2.46E-01	1.23E-01	2.26E-03	2.22E-04	4.01E-07	2.00E-07	1.27E-06	NA	1.64E-05	1.62E-06	1.85E-07	3.70E-08
SCss-067	0.026	2.19E-03	2.16E-04	1.37E-01	6.83E-02	4.32E-04	4.25E-05	1.63E-08	8.15E-09	5.16E-08	NA	1.04E-06	1.02E-07	8.46E-09	1.69E-09
SCss-068	0.031	2.33E-03	2.29E-04	2.03E-01	1.01E-01	4.75E-04	4.68E-05	1.94E-08	9.72E-09	6.16E-08	NA	1.14E-06	1.13E-07	9.85E-09	1.97E-09
SCss-069	0.061	8.62E-04	8.49E-05	5.46E-02	2.73E-02	6.88E-04	6.77E-05	3.82E-08	1.91E-08	1.21E-07	NA	1.67E-06	1.64E-07	1.79E-08	3.58E-09
SCss-072	0.063	2.30E-03	2.27E-04	1.46E-01	7.31E-02	2.13E-03	2.10E-04	2.22E-07	1.11E-07	7.04E-07	NA	9.56E-06	9.41E-07	1.04E-07	2.08E-08
SCss-073	0.27	7.20E-03	7.09E-04	4.71E-01	2.36E-01	4.74E-03	4.67E-04	1.77E-06	8.83E-07	5.59E-06	NA	4.06E-05	3.99E-06	7.35E-07	1.47E-07
SCss-074	0.13	8.85E-03	8.71E-04	5.70E-01	2.85E-01	3.17E-03	3.12E-04	1.36E-06	6.82E-07	4.32E-06	NA	4.28E-05	4.21E-06	5.97E-07	1.19E-07
SCss-075	0.054	2.48E-03	2.44E-04	1.57E-01	7.84E-02	1.96E-03	1.93E-04	2.16E-07	1.08E-07	6.85E-07	NA	9.95E-06	9.80E-07	1.03E-07	2.05E-08
SCss-076	0.049	3.56E-03	3.50E-04	2.24E-01	1.12E-01	1.86E-03	1.83E-04	2.92E-07	1.46E-07	9.23E-07	NA	1.40E-05	1.38E-06	1.40E-07	2.80E-08

HQs were calculated using sampling unit–specific AUFs. The summed areas for all sampling units were used to calculate the maximum and average EPC HQs.
Shaded cells indicate an HQ greater than 1 when rounded.
AUF denotes Area Use Factor.
EPC denotes exposure point concentration.
HQ denotes hazard quotient.
LOAEL denotes lowest observed adverse effect level.
mg/kg denotes milligrams per kilogram.
NA denotes the barn owl represents a threatened species; therefore, effects are based only on the more conservative NOAEL value.
NOAEL denotes no observed adverse effect level
.

8.0 SUMMARY OF CONCLUSIONS

This chapter summarizes the results of the RI field activities conducted at the Sand Creek Site between September and November 2010. The scope of this investigation is to complete the assessment of the extent of contamination and the potential impact to human health and the environment for the purpose of reaching a remedial action decision. As a result of the field sampling efforts and the evaluation and analysis of environmental data collected during the field sampling effort, the objectives of the RI have been satisfied.

8.1 Summary of Data Used in the Remedial Investigation

Environmental samples have been collected at the Sand Creek Site since 1996 to assess the potential impact from historical disposal activities associated with the AOC. Available and relevant data include the environmental media sampled at the Sand Creek Site during the 2003 RA that consisted of surface soil, sediment, and surface water. Additionally, a sediment sample and two surface water samples were collected adjacent to the AOC during the 2003 FWBWQS. Between September 21 and November 9, 2010, samples were collected for the RI that included surface soil, sediment, and subsurface soil. During the time between the 2003 RA and the RI field activities, a streamlined approach was developed to evaluate data usability that involved two primary considerations: (1) representativeness with respect to current AOC conditions and (2) sample collection methods (i.e., discrete vs. ISM).

All available sample data were evaluated to determine suitability for use in the various key RI data screens that include evaluation of nature and extent of contamination, fate and transport modeling, and human and ERAs. For the 2003 RA, samples included discrete surface soil within the AOC boundaries, sediment samples from the floodplain adjacent to the AOC and within Sand Creek, and surface water samples from the Sand Creek. Discrete surface water samples and an ISM sediment sample were collected in the Sand Creek adjacent to the AOC as part of the 2003 FWBWQS. The collection of surface soil and sediment samples using ISM and subsurface soil samples using a modified ISM approach were conducted for the RI field activities. Site conditions have changed minimally since 2003. Therefore, the aforementioned data from these sampling events were incorporated into the nature and extent of contamination evaluation. Only the samples collected during the 2010 RI, with the exception of surface water samples from the 2003 RA and the 2003 FWBWQS, were screened for SRCs and carried forward into the risk assessment since ISM is considered to provide a more representative spatial distribution within each sampling unit. The surface water samples from the 2003 RA and 2003 FWBWQS were carried forward to the risk assessment to support the conclusions in the DQO Report (Shaw, 2009) that historical site activities at the site have not impacted the quality of Sand Creek.

8.2 Summary of Nature and Extent of Contamination

The majority of the SRCs identified in the environmental media evaluated for nature and extent of contamination (surface soil, subsurface soil, sediment, and surface water) occurred at the northern portion of the AOC. Between the 2003 RA and RI data, a total of 58 SRCs was identified in surface soil (0 to 1 foot). Subsurface soils were collected during the RI only, and a total of 64 SRCs was identified in the five sample intervals between 1 and 20 feet bgs. A total of 50 SRCs were identified in sediment between the 2003 RA (0 to 1 foot), the 2003 FWBWQS (0 to 0.5 foot), and the RI data sets (0 to 0.5 foot). Eleven SRCs consisting of inorganics, SVOCs, and two nutrient parameters were identified in surface water between the two samples collected for the 2003 FWBWQS. The spatial distribution of the SRCs, particularly inorganics, is consistent among the environmental media and the types of methods used to collect the samples (i.e., discrete vs. ISM).

In surface soils collected during the RI, the greatest concentrations of inorganic, SVOCs, and explosives and propellants SRCs occurred at the northern portion of the AOC where historical disposal activities occurred and where the majority of the RA was conducted in 2003. Explosives were detected at two locations at the northern portion of the AOC. The detections of inorganics and SVOCs were well distributed across the site. However, the greatest concentrations occurred in the northern third portion of the AOC along the slope. The number of detected inorganics and SVOCs and elevated concentrations generally decreased the further south the samples were collected at the AOC.

A total of 22 soil borings was advanced during the RI field activities and subsurface samples were collected at a maximum depth of 20 feet over five depth intervals (1 to 5 feet, 5 to 9 feet, 9 to13 feet, 13 to 17 feet, and 17 to 20 feet) at nine of the soil boring locations. Bedrock was not encountered at any of the borings. Three explosives concentrations were detected at one soil boring location (SCsb-049) at 1 to 5 feet bgs along the slope at the northern portion of the AOC. The spatial distribution of inorganics and SVOCs was similar to that of surface soil with the greatest concentrations detected along and adjacent to the slope at the northern one-third of the AOC. The greatest number of detects and the greatest concentrations for both inorganics and SVOCs were typically found in the 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet sample intervals. However, the number of detections and concentrations generally decreased with the sample distance to the south at the AOC and with boring depth.

For the borings where VOCs, pesticides and PCBs were analyzed, the boring locations with the greatest number of detects were SCsb-038 and SCsb-048 at the 1- to 5-foot sample intervals. These borings were advanced in the northern portion of the AOC.

Similar to surface soils, the greatest concentrations of SRCs in the two ISM sediment samples collected for the RI occurred at the northern portion of the AOC. The SRCs included primarily

inorganics, SVOCs, and pesticides. Two PCB analytes were detected in the northern floodplain sediment sampling unit. One propellant (nitrocellulose) was detected in the both sediment sampling units. The majority of the SRCs identified in sediment during the 2003 RA were detected north of the former rail bed and correlate with the results from the RI . Only one ISM sediment sample was collected adjacent to the AOC during the 2003 FWBWQS, and the exact location of the ISM sampling unit is not known; therefore, the distribution of detected contaminants identified during this event cannot be evaluated.

A total of 11 SRCs was identified in surface water during the 2003 FWBWQS. The two surface water samples collected during this survey were collected at the same location adjacent to the AOC during separate sample events. These SRCs include seven inorganics, two SVOCs, and two nutrient parameters. No SRCs were identified in any of the three surface water samples collected as part of the 2003 RA. A cursory review of the overall surface water data collected along the Sand Creek as part of the 2003 FWBWQS indicates that detected analyte concentrations in the samples collected adjacent to the AOC are consistent with the other surface water samples collected both upstream and downstream of the site. Based on these results, it appears that surface water conditions downstream of the AOC have not been impacted by historical disposal activities at the Sand Creek Site.

8.3 Contaminant Fate and Transport Summary

Contaminant fate and transport analyses were conducted for the chemicals detected in the impacted media (surface soil, subsurface soil, sediment, and surface water) at the Sand Creek Site. The sources of contamination of the impacted media at the site are presumed to be the existing surface soil which debris was previously disposed on top of but may also be remaining subsurface debris identified during the 2010 DGM survey. SESOIL modeling was performed for constituents identified as CMCOPCs after screening against the 1,000-year travel time criteria. Modeling was performed to predict concentrations of constituents in the leachate immediately beneath the selected source areas, just above the water table. Fate and transport analysis indicates that SRCs may leach from soil into the groundwater beneath the source. The CMCOPCs identified as having the potential for impacting groundwater and surface water include 2,4,6-trinitrotoluene and 2-amino-4,6-dinitrotoluene, 1,4-dichlorobenzene, carbazole, pentachlorophenol, benzene, alpha-BHC, and beta-BHC.

8.4 Human Health Risk Assessment Summary

A human health risk assessment (HHRA) was performed to evaluate whether site conditions may pose a risk to current or future human receptors and to identify which, if any site conditions need to be addressed in the FS. The data sets used for the risk assessment process were primarily from the RI and included the ISM surface soil and sediment samples and subsurface samples. The surface water samples from the 2003 RA and the 2003 FWBWQS

were also used. Also, the RI included data that was used to evaluate the need for restrictions such as land-use controls.

The Sand Creek Site is located in the central portion of the facility. The AOC is not currently used for military training activities but may receive periodic foot traffic during maintenance, restoration, and security activities. The most likely future land use for the AOC is the Military Training. The Representative Receptor for this Land Use is the NGT per the *USACE's Facility-Wide Human Health Risk Assessment Manual* (HHRAM - USACE, 2005b) and the 2014 Risk Assessment Tech Memo. This anticipated future Land Use, in conjunction with the evaluation of Unrestricted (Residential) Land Use, form the basis for identifying chemicals of concern (COCs) in this RI. Unrestricted (Residential) Land Use is included to evaluate COCs for Unrestricted (Residential) Land Use at the AOC, as required by the CERCLA process and as outlined in the HHRAM (USACE, 2005b).

A third Land Use was also included in this revised RI. The third Land Use, Commercial Industrial Land Use was identified in the Risk Assessment Tech Memo as a means to evaluate the site to determine if it is suitable for full-time, permanent employees. According to the Risk Assessment Tech Memo (NGB, 2014), if the criteria for the Commercial Industrial Land Use is met, then no additional remedial actions are required except for the development of Land Use Controls through the CERCLA process (FS, PP, ROD, etc.). The Military Training Land Use is the primary Land Use and is protective of all activities that the OHARNG may conduct on the site except for full-time, permanent-occupational use. Evaluation of the three Land Uses in the RI will allow better risk management decisions in an FS is needed.

The Sand Creek Site was considered as a single EU based on the future land use. Although the site is being evaluated as a single EU, soil data collected within and adjacent to the AOC were aggregated by depth intervals since different future use receptors with different depths of potential exposure are required to be evaluated. This RI includes analyses to determine potential risks at various depths from contact with deep surface soil and subsurface soil intervals for the NGT. The soil intervals for Unrestricted (Residential) Land Use and Commercial Industrial Land Use were also assessed. Sediment samples collected for the RI and previously collected surface water samples were evaluated in the same manner for the identified receptors. The purpose of evaluating the receptors in this manner is to provide information for further evaluation in the FS, if required, and to determine the best remedial action to meet the evaluation criteria. The COPC identification was completed for the following data sets:

- Resident Receptor (Adult and Child)—Surface soil (0–1 foot bgs)
- Industrial Receptor—Surface soil (0–1 foot bgs)

- National Guard Trainee —Deep Surface soil (0–4 feet bgs)
- Resident Receptor (Adult/Child)—Subsurface soil (1–13 feet bgs)
- Industrial Receptor —Subsurface soil (1–13 feet bgs)
- National Guard Trainee—Subsurface soil (4–7 feet bgs))
- Resident Receptor (Adult and Child), Industrial Receptor, and National Guard Trainee—Sediment
- Resident Receptor (Adult and Child), Industrial Receptor, and National Guard Trainee—Surface water.

The COPCs were further assessed in the HHRA to determine if they were COCs and needed further evaluation in an FS, the next step in the CERCLA process. The following presents the COCs that were identified per Land Use and per exposure medium.

COCs in Surface Soil and Deep Surface Soil

Surface soil for Unrestricted (Residential) Land Use and the Commercial Industrial Land Use is defined as the 0- to 1-foot interval. The COC determination for each receptor was determined separately for noncancer (by target organ/critical effect) and for cancer risks. The COCs were identified using the maximum detected concentration for each COPC at any of the ISM locations and not by individual ISM location.

COCs Unrestricted (Residential/Commercial Industrial Land Uses in Surface Soil

Only arsenic was identified as a COCs based on noncancer effects for the Unrestricted (Residential) Land Use receptors (based on the child) in surface soil (**Table 6-38**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC for the Unrestricted (Residential) Land Use.

No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in surface soil (**Table 6-38**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene for the Commercial Industrial Land Use. These COCs were based on the maximum detected concentration for each COPC at any of the ISM locations and not by ISM location.

COCs Military Training Land Use in Deep Surface Soil

Deep surface soil for the Military Training Land Use receptors is defined as the 0- to 4-foot interval. Samples from this interval include the ISM surface soil samples from 0 to 1 foot and the subsurface samples from the 1- to 5-foot interval were also used.

No COCs based on noncancer effects were identified for the Military Training Land use in the surface samples using ISM maximum sample concentrations in the 0- to 1 foot interval (**Table 6-38**). Three COCs were identified based on cancer risks and using the SOR. These were arsenic, cobalt, and benzo(a)pyrene for the Military Training Land Use.

In the discrete samples from the 1 to 5 foot interval, the 95% UCL was estimated and used in the calculations. No COCs based on noncancer effects were identified for the Military Training Land Use in the deep surface samples (1-to 5 foot interval) using the 95% UCL (**Table 6-38**). Four COCs were identified based on cancer risks and using the SOR for this interval. These were arsenic, cobalt, benzo(a)pyrene, and benzo(b)fluoranthene for the Military Training Land Use.

COCs Unrestricted (Residential) Land Use in Subsurface Soil

Based on the results of this HHRA, there are several COCs identified in the subsurface soil for the Unrestricted (Residential) Land Use. These were identified using the 95% UCL or the MDC (if it was larger than the 95% UCL) for each COPCs regardless of location. No COCs based on noncancer effects were identified for the Unrestricted (Residential) Land Use receptors in subsurface soil. ISM DU from 1 to 5 feet, 5 to 9 feet, and 9 to 13 feet.

No COCs based on noncancer effects were identified for the Unrestricted (Residential) Land Use receptors in surface soil (**Table 6-38**). Two COCs were identified based on cancer risks and using the SOR. These were arsenic and benzo(a)pyrene. These were determined using the maximum concentration of any of the ISM surface soil results for each COPC.

COCs in Subsurface Soil for the Commercial Industrial Land Use

No COCs based on noncancer effects were identified for the Commercial Industrial Land Use receptors in subsurface soil. Four COCs were identified based on cancer risks and using the SOR. These were arsenic, benzo(a)anthracene, dibenzo(a,h)anthracene, and benzo(a)pyrene. These COCs were derived using the 95% UCL for each COC at any of the ISM locations and not for each individual ISM locations. This type of re-assessment should be completed in the FS, so that the minimum area to be evaluated can be focused where there is the most contamination. This would help focus the FS so that only the contaminated areas are evaluated.

COCs in Subsurface Soil for the Military Training Land Use

Subsurface soil for the National Guard Trainee is defined as the 4- to 7-foot interval. Samples from the 4- to 7-foot interval include the subsurface samples from 5 to 9 feet since the sample intervals overlap. No COCs were identified for the Military Training Land Use in the subsurface interval for the NGT (should have been only 4-to7 feet but this also included data from 5-to 9 feet).

COCs in Sediment Summary for all Land Uses

No COCs were identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or Military Training Land Use in the sediment at the AOC. This media does not require further evaluation in an FS. A "No further Action" (NFA) determination is obtained for sediment at the Sand Creek Site.

Surface Water Summary

No COCs were identified for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, or Military Training Land Use in the surface water. This media does not require further evaluation in an FS. An NFA determination is obtained for surface water at the Sand Creek Site.

Conclusions

Results of the HHRA indicate the presence of several COCs in surface soil and subsurface soil for Unrestricted (Residential) Land Use, Commercial Industrial Land Use, and Military Training Land Use. Arsenic and benzo(a)pyrene are the primary risk drivers. These COCs should be further evaluated in an FS to determine the appropriate remedial actions for soil at this AOC.

No COCs were identified in sediment or surface water at the Sand Creek Disposal Road Landfill. An NFA determination is indicated for both sediment and surface water and an FS is not warranted.

8.5 Summary of Ecological Risk Assessment

A screening level ecological risk assessment (SLERA) was conducted to evaluate the potential for adverse ecological effects to ecological receptors from SRCs at the Sand Creek Site and to determine if any ecological receptors need to be recommended for further evaluation in the FS. The SLERA included characterizing the ecological communities in the vicinity of the site, determining the particular contaminants present, identifying pathways for receptor exposure, and estimating the magnitude of the likelihood of potential adverse effects to identified receptors. Site-specific analyte concentration data for surface soil, sediment, and surface water from the Sand Creek Site were included in the SLERA. The ecological receptor species selected for evaluation in the SLERA were identified in the *RVAAP Facility-Wide Ecological Risk Assessment Work Plan* (USACE, 2003).

The SLERA was prepared in accordance with the Ohio Environmental Protection Agency (2008) *Ecological Risk Assessment Guidance Document* Level I Scoping through Level III Baseline. The Level I Scoping is designed to efficiently determine whether further ecological risk should be evaluated at a particular site. The Level II Screen is to be completed after the full nature and extent of the site contamination has been determined. The purpose of a Level

II Screen is to select the list of detected chemicals per media as appropriate, evaluate aquatic habitats potentially impacted by the site, and if necessary, revise the conceptual site model, complete a list of ecological receptors, identify chemicals of potential ecological concern (COPECs) and nonchemical stressors, and other tasks required for further ecological evaluation of the site and impacted habitats. The purpose of a Level III Baseline is to identify the potential for ecological harm at a site. Specifically, the Level III Baseline is a formal ecological risk assessment process that includes an exposure assessment, toxicity assessment, risk characterization, and an uncertainty analysis. Potential ecological hazards are evaluated by using the COPECs and nonchemical stressors identified in a Level II Screen, generic receptors, direct contact evaluations, and food-web models that are provided in the guidance document.

Mercury in surface soil was the only COPEC recommended to be evaluated under the Level III Baseline evaluation following the Level II Screen. The only species identified as having a hazard quotient (HQ) greater than 1 associated with mercury was the robin, which indicates that potential hazards could exist to omnivorous birds foraging exclusively at the site. It is important to state that the finding of HQs greater than 1 does not necessarily indicate that adverse impacts are occurring. Additionally, the size of the entire AOC would only support one breeding pair of the American robin. The AOC is not large enough to support very many birds, especially as foraging habitat. Therefore, no further evaluation from an ecological risk perspective is warranted.

8.6 Conceptual Site Model

A discussion of the preliminary CSM, based on previous data and historical information identified prior to the RI activities is presented in this RI. This section provides an update to the preliminary CSM based on the analytical results of the RI field data, an evaluation of nature and extent of contamination, fate and transport, and risk evaluations associated with human health and ecological receptors. Elements of this revised CSM include the following:

- Primary and secondary contaminant sources and release mechanisms
- Contaminant migration pathways and discharge points
- Potential receptors with unacceptable risk
- Uncertainties

8.6.1 Primary and Secondary Contaminant Sources and Release Mechanisms

Little information is available regarding the historical operations at the Sand Creek Site except that the AOC was used by the Army as an open dump for concrete, wood, asbestos debris, lab bottles, 55-gallon drums and fluorescent light tubes. An RA was conducted by MKM in 2003

that included the removing of all existing unconsolidated surface debris, the limited removal of subsurface debris, transportation and disposal of debris and site restoration. The remaining subsurface debris as well as some visible remaining surface debris is identified as the primary contaminant sources for the Sand Creek Site.

Analysis of data collected by MKM following the RA and as part of the RI identified surface soil (0 to 1 foot bgs) as the primary source of contamination, in particular surface soil at the northern portion of the AOC along the slope and soils adjacent to the top of slope. Inorganics (antimony, arsenic, copper, mercury, silver, and thallium) and PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene) were identified at concentrations that were sufficient to be considered COCs. Surface soils appear to be a secondary source of contamination as arsenic, lead, benzo(a)pyrene, and benzo(b)fluoranthene were identified as COCs in subsurface soils (1 to 20 feet bgs) at the northern portion of the site where the COCs in surface soil were identified. No COCs were identified for sediment or surface water situated downgradient of the AOC, however, fate and transport analysis suggested that the SRCs detected in the sediments and surface water may have originated from these soil sources.

The mechanisms for releases of contaminants at the site include the following:

- Much of the native soil was reworked, removed, or used as cover material during historical dumping activities. Overland surface flow from the reworked areas following rain events and snowmelt may have contaminated the downgradient surface soils at the AOC.
- The SRCs in the subsurface soil (greater than 1 foot bgs) appear to have originated from the fill material placed after the native soil was disturbed and the fill material were placed along the embankment and slopes of the Sand Creek.
- The source of the SRCs measured in the sediment is assumed to be surface soil (0 to 1 foot bgs).
- The SRCs measured in the surface water could potentially have derived from the surface soil and sediment, dissolved in the rainwater and snowmelt running off the land surface and Sand Creek slopes. It could also have originated from the surface and subsurface soils, whose chemical constituents may have been dissolved in the rainwater and snowmelt infiltrating vertically downwards to the groundwater and then discharging to the Sand Creek.

Groundwater samples were not collected during the RI, and no historical groundwater data exists for the site. Fate and transport modeling was used to determine the potential for the SRCs present in surface and subsurface soils to migrate vertically downwards and impact

groundwater quality underneath the AOC and eventually the surface water quality in the nearby Sand Creek. Although the model is considered conservative and various assumptions were used in place of unknown parameters, 2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 1,4-dichlorobenzene, carbazole, pentachlorophenol, benzene, alpha-BHC, and beta-BHC were identified as SRCs that have to the potential to leach from surface soil to groundwater at the site and ultimately to the Sand Creek.

8.6.2 Contaminant Migration Pathways and Discharge Points

One of the principal migration pathways at the Sand Creek Site is infiltration through the unsaturated soil (approximately 13 feet thick) to the underlying groundwater that has the potential to cause SRCs to leach from surface and subsurface soils into groundwater present in the unconsolidated water-bearing zone. Due to the very heterogeneous nature of the unconsolidated glacial materials, groundwater flow patterns within the unconsolidated water-bearing zone are difficult to predict. Site-specific groundwater data are not available at the AOC.

Some of the precipitation falling as rainfall and snow leaves the site as surface runoff to the Sand Creek, carrying dissolved SRCs that are present in the surface soil at the site. The fraction of the precipitation that does not leave the AOC as surface runoff infiltrates into the subsurface. Some of the infiltrating water is lost to the atmosphere as evapotranspiration. The remainder of the infiltrating water recharges the groundwater. The rate of infiltration and eventual recharge of the groundwater is controlled by soil cover, ground slope, saturated hydraulic conductivity of the soil, and meteorological conditions.

In theory, the infiltrating water leaches the contaminated soil impacted with SRCs and carries the dissolved SRCs to deeper soil and groundwater. The factors that affect the leaching rate include the amount of infiltration, the SRCs' solubility in water and partitioning between solids and water. The impacted groundwater would eventually discharge to the surface water in Sand Creek, carrying dissolved SRCs with it.

8.6.3 Potential Receptors

This section summarizes the potential Receptors identified for the Sand Creek Site and the COCs identified for each of the receptors. The revised CSM that includes the distribution of the COCs for three Land Uses: Unrestricted (Residential), Commercial Industrial, and Military Training is presented in **Figure 6-38**.

Given the potential future use of the site for Military Training, the National Guard Trainee was selected as the most Representative Receptors. The NGT was conservatively evaluated for potential exposure for deep surface soil (0 to 4 feet bgs); and was further evaluated for potential exposures associated with subsurface soils (4 to 7 feet bgs), sediment, and surface water.

Arsenic and benzo(a)pyrene, along with a few other chemicals were identified as COCs for all three Land Uses in surface and subsurface soils. The exposure risks associated with several of the COCs are from the evaluation of potential additive effects calculated from the maximum EPCs at the AOC from exposure to multiple chemicals or exposure to multiple chemicals that can cause the same effect (i.e., cancer) or affect the same target organ.

The only ecological receptor identified for the Sand Creek Site was the American robin, an avian species. The American robin is a worm-eating and insectivorous species that may forage at the AOC and is therefore, potentially exposed to SRCs in soil.

8.6.4 Uncertainties

There are various sources of uncertainty that are inherent when evaluating a CSM. Uncertainties identified for the Sand Creek Site include the following:

- Operational records for the site are incomplete. A RA was completed at the AOC in 2003. However, residual waste materials are still visible on the ground surface and evident in the subsurface as a result of a 2010 DGM investigation.
- Groundwater beneath the Sand Creek Site was not evaluated as part of the RI field activities; therefore, SRCs for groundwater were not identified. Fate and transport modeling was used to determine the potential for the SRCs present in surface and subsurface soils to migrate vertically downwards and impact groundwater quality underneath the AOC and eventually the surface water quality in the nearby Sand Creek. Throughout the screening and modeling processes, conservative approaches were used, which may overestimate the contaminant concentration in the leachate for migration from observed soil concentrations.
- There are various sources of uncertainty in the evaluation of exposure and human health risk. These uncertainties generally relate to sampling considerations, the determination of EPCs, and the selection of appropriate receptors. There are numerous uncertainties related to the FWCUGs/RSLs, including exposure assumptions and toxicity values. These uncertainties are inherent to the use of these values, and are similar for all assessments using them.
- Uncertainty, with regards to ecological risk evaluation, is associated primarily with deficiency or irrelevancy of effects, exposure, or habitat data to actual ecological conditions at the site. Species physiology, feeding patterns, and nesting behavior are poorly predictable. Therefore, all toxicity information derived from toxicity testing, field studies, or observations have uncertainties associated with them.

8.7 Recommendations

Based on the RI results, the Sand Creek Site has been adequately characterized and the project objectives have been achieved. Surface and subsurface soil and sediment samples were collected during the RI field activities to define the nature and extent of contamination and support the preparation of an FS and a subsequent Record of Decision for the AOC. Therefore, the recommended path forward is to proceed to the FS phase of the CERCLA process. The FS will evaluate remedial alternatives to address the COCs identified in surface and subsurface soil only. The FS will include a Risk Management Evaluation to fully assess each COCs before proceeding to the alternative analysis for human health. Since no COPECs in soil were identified in the ERA, no additional remedial actions are warranted at the AOC from an ecological perspective. Because no COCs or COPECs were identified in sediment or surface water no analysis of remedial activities in a FS is not warranted for sediment or surface water at the Sand Creek Site.

The COCs identified for each potential exposure medium per exposure interval for three Land Uses: Unrestricted (Residential), Commercial Industrial, and Military Training., the associated land use receptor scenarios and the recommended cleanup goals based on the most likely future land use and unrestricted land uses are summarized in **Table 6-38**. Primary risk drivers for all three Land Uses were arsenic and benzo(a)pyrene based on carcinogenic effects.

In addition to the FS to assess soils at the AOC, further analysis of the groundwater should be conducted for this AOC. An analysis of remedial alternatives for surface and subsurface soil is recommended based on fate and transport results of the leaching potential to groundwater that is associated with the identified CMCPOCs for these media. Evaluation of groundwater at the AOC should be conducted as part of the Facility Wide Groundwater Investigation (RVAAP-66).

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Appendix A
Field Documentation

Field Logs

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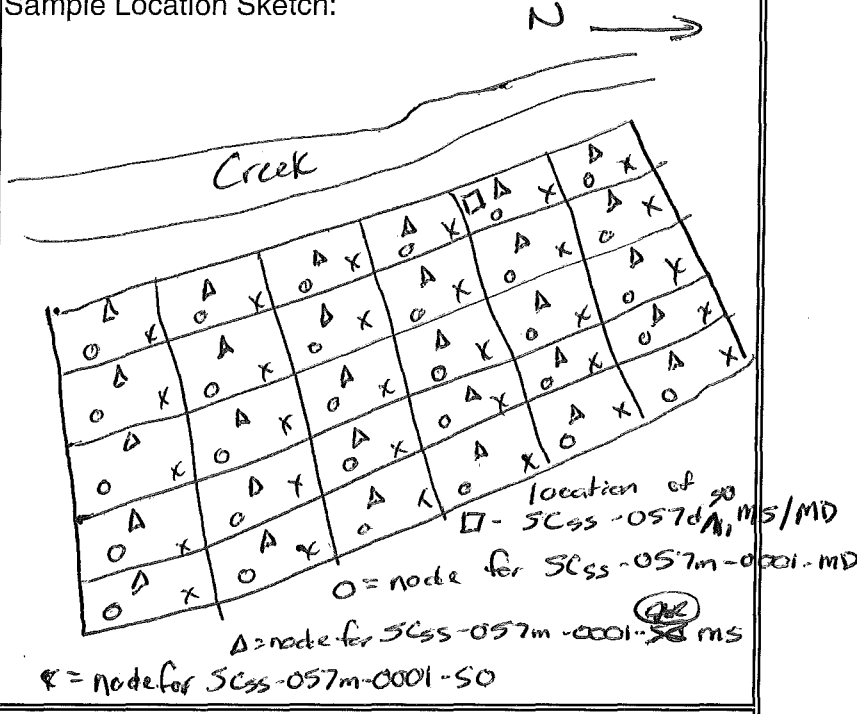
Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-057m-0001-SO	Sample Location Sketch: 
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/24/10	
Time Sampled: 1105	
Depth (ft bgs): 1 foot	
Physical description: Silt, Clay, trace sand	
Analyses requested: TAL Metals, Explosives, SVOCs, Hex Cr, Pesticides, PCBs, Cyanide, Propellants.	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, Sunny	
Temperature: 80 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: ~~Liquinox~~ Liquinox, Isopropyl Alcohol, DI rinse	
QC Samples: SCss-057m-0001-MS SCss-057m-0001-MD	
Analytical Laboratory: CT Laboratory	
Comments: Thick vegetation, steep terrain	
Field Technician: (Print) Joseph Rasnack	Date: 9/24/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-057m-0001-SO MS	Sample Location Sketch:
Sample Type*: SOR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	See page 1 for Sample Location sketch.
Date Sampled: 9/24/10	
Time Sampled: 1135	
Depth (ft bgs): 1 foot	
~~Physical description~~: Analyses: TAL Metals, Explosives, SVOCs, Hex Cr. Pesticides, PCBs, Cyanide, Propellants	
~~Analyses requested~~: Physical description: Silt, Clay, trace Sand	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, Sunny	
Temperature: 80 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Liquinox, Isopropyl Alcohol, DI rinse	
QC Samples: This is MS sample for SCss-057m-0001-SO	
Analytical Laboratory: CT Laboratories	
Comments: Thick vegetation, Steep terrain	
Field Technician: (Print) Joseph Rasnack	Date: 9/24/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, Old Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-057m-0001-MD	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	See page 1 for Sample Location Sketch
Date Sampled: 9/24/10	
Time Sampled: 1240	
Depth (ft bgs): 1	
Physical description: Silt, Clay, trace Sand	
Analyses requested: TAL Metals, Explosives, SVOCs Hex Cr, Pesticides, PCBs, Cyanide, Propellants	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, Sunny, Windy	
Temperature: 85 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Liquinox, Isopropyl Alcohol, DI rinse	
QC Samples: This MD sample for SCss-057m-0001-SD	
Analytical Laboratory: CT Laboratories	
Comments: Thick vegetation, steep terrain	
Field Technician: (Print) Joseph Rasnack	Date: 9/24/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-057d-0001-SO	Sample Location Sketch:
Sample Type*: SOR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/24/10	
Time Sampled: SO = 1300 MS = 1305 MD = 1310	
Depth (ft bgs): 1	
Physical description: Clay, Silt, trace Sand	
Analyses requested: VOCs	
	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA

See page 1 for Sample location Sketch

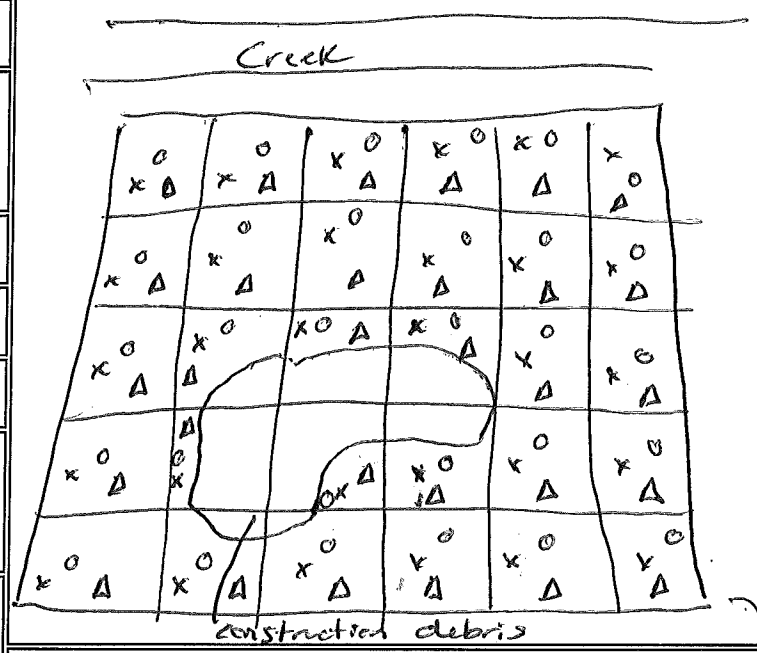
Weather:	Windy, Sunny, Hot
Temperature:	90 °F
Sampling Equipment:	Terra Core
Equipment Decontamination Technique:	NA
QC Samples:	SCss-057d-0001d-MS, SCss-057d-0001d-MD
Analytical Laboratory:	CT Laboratories
Comments:	Steep terrain
Field Technician: (Print)	Joseph Rasnack Date: 9/24/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-058m-0001-SO	Sample Location Sketch: N →
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/23/10	
Time Sampled: 1340	
Depth (ft bgs): 1 feet	
Physical description: Silt, Clay, trace sand	
Analyses requested: TAL Metals, Explosives, SVOCs	
Photograph Log #: NA	
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, hot, humid, slight breeze	
Temperature: 90 °F	
Sampling Equipment: SS push probe	
Equipment Decontamination Technique: Alconox, Isopropyl Alcohol, DI rinse	
QC Samples: SCss-085m-0001-SO	
Analytical Laboratory: CT Laboratories	
Comments: Steep terrain, construction debris, thick vegetation	
Field Technician: (Print) Joseph Rasnek Date: 9/23/10	



X = node for SCss-058m-0001-SO
O = node for SCss-085m-0001-SO
Δ = node for SCss-058m-0001-SO (Army Dup.)

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna OH Sand Creek Disposal Rd. Landfill Project #: 133616

Sample ID: SCss-085m-0001-SO	Sample Location Sketch: See page 1 for ~~Sight~~ Site diagram.
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/23/10	
Time Sampled: 1445	
Depth (ft bgs): 1 ft.	
Physical description: Silt, clay, trace sand	
Analyses requested: TAL Metals, Explosives, SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Hot humid	
Temperature: 90 °F	
Sampling Equipment: SS push probe	
Equipment Decontamination Technique: Alcinox, isopropyl alcohol, DI rinse	
QC Samples: This is dupicate for SCss-058m-0001-SO	
Analytical Laboratory: CT Laboratories	
Comments: Steep terrain, thick vegetation	
Field Technician: (Print) Joseph Rasnack	Date: 9/23/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

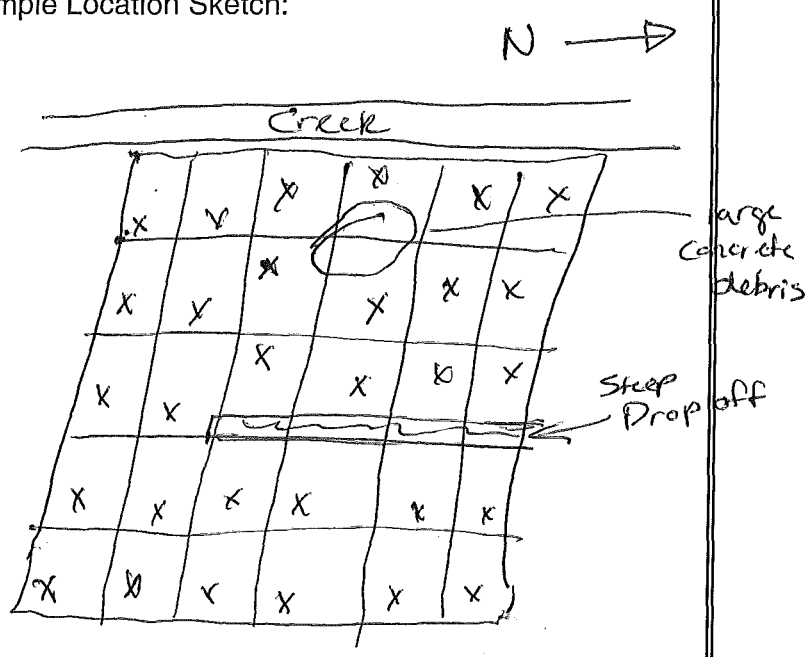
Sample ID: SCss-058m-0001-SO (Army Dup.)	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	See page 1 for location Sketch.
Date Sampled: 9/23/10	
Time Sampled: 1535	
Depth (ft bgs): 1 ft.	
Physical description: ~~Silt~~ Silt, Clay, trace sand.	
Analyses requested: TAL Metals, Explosives, SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, hot, humid, Slight breeze	
Temperature: 90 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Alcinox, Isopropyl Alcohol, DI rinse	
QC Samples: This is the Army Dup. for SCss-058m-0001-SO	
Analytical Laboratory: CT Laboratories	
Comments: Steep terraine, thick vegetation.	
Field Technician: (Print) Joseph Rasnack	Date: 9/23/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-059m-0001-SO	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/23/10	
Time Sampled: 1140	
Depth (ft bgs): 1 foot	
Physical description: Silt, clay, trace sand	
Analyses requested: TAL Metals, Explosives SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA



x = node for SCss-059m-0001-SO

Weather:	Clear, Sunny, humid, warm
Temperature:	85 °F
Sampling Equipment:	Stainless Steel push probe
Equipment Decontamination Technique:	Alcinox, Isopropyl Alcohol, DI rinse
QC Samples:	None
Analytical Laboratory:	CT Laboratories
Comments:	Steep Terrain, Thick Vegetation, Construction Debris
Field Technician: (Print)	Joseph Rasnack Date: 9/23/10

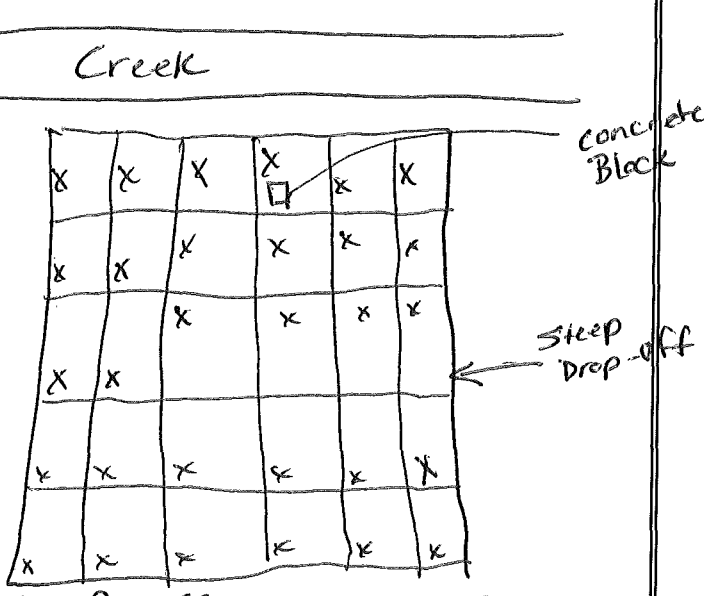
Hex Cr Sample

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-060m-0001-SO	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/23/10	
Time Sampled: 1020	
Depth (ft bgs): 1 foot	
Physical description: Silt, clay, trace sand	
Analyses requested: TAL Metals, Explosives, SVOCs, Hex Chrome	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA



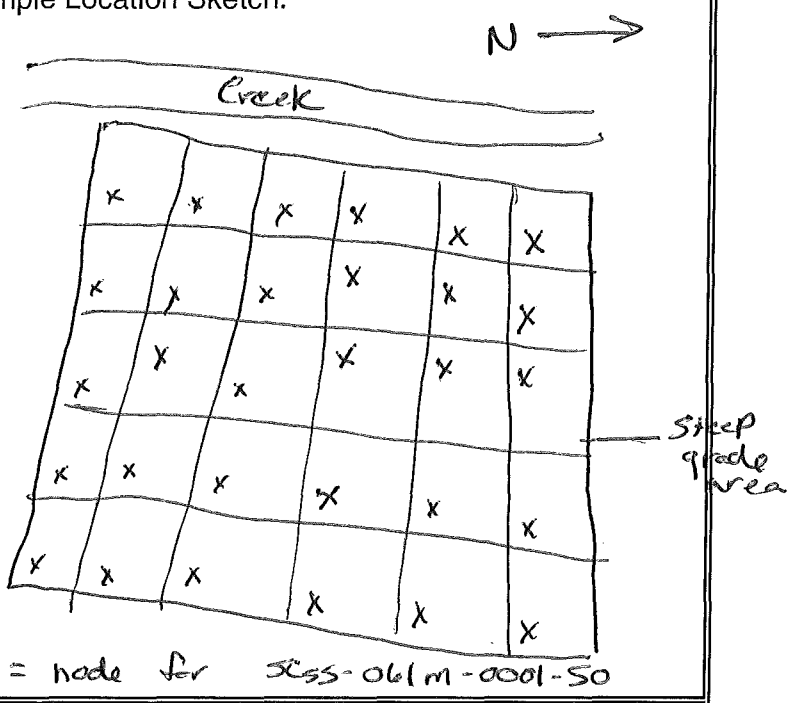
X = node for SCss-060m-0001-SO

Weather: Clear, humid, light breeze	
Temperature: 75 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Alconox, isopropyl Alcohol, DI rinse	
QC Samples: None	
Analytical Laboratory: CT Laboratories	
Comments: Steep terrain, Thick vegetation.	
Field Technician: (Print) Joseph Rasnack	Date: 9/23/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Landfill Road Project #: 133616

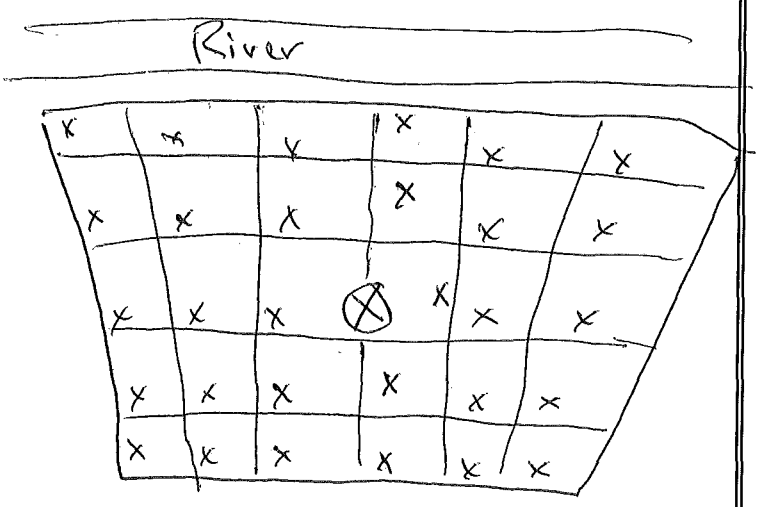
Sample ID: SCss-061m-0001-SO	Sample Location Sketch: 
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/23/10	
Time Sampled: 0915	
Depth (ft bgs): 1 foot	
Physical description: Silt, clay, trace sand	
Analyses requested: TAL metals, Explosives, SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Foggy, cool, humid, light breeze	
Temperature: 65 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Alconox, isopropyl alcohol, DI rinse	
QC Samples: None	
Analytical Laboratory: CT Laboratories	
Comments: Steep terrain, moderately thick vegetation.	
Field Technician: (Print) Joseph Rasnack	Date: 9/23/10

Hex Chrome Sample

Shaw™ Shaw E&I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH — Sand Creek Disposal Rd. Landfill — Project #: 133616

Sample ID: SCss-062m-0001-SO	Sample Location Sketch: N →
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/22/10	
Time Sampled: 1630	
Depth (ft bgs): 1 foot	
Physical description: primary silt, some clay, trace sand	
Analyses requested: TAL Metals, Explosives, SVOCs, Hex Chrome	Photograph Log #: NA
PID: N/A	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA

X = node for SCss-062m-0001-SO

⊗ = large tree

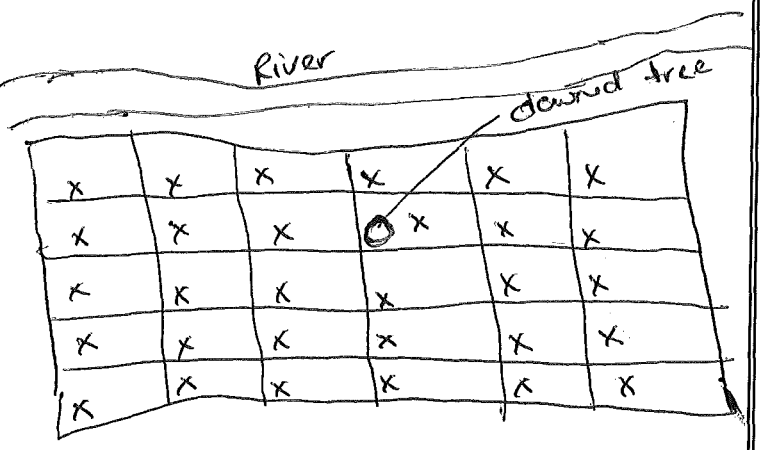
Weather:	Cloudy, humid, warm
Temperature:	85-90° F
Sampling Equipment:	Stainless Steel push probe
Equipment Decontamination Technique:	Alconox, Isopropyl, DI Rinse
QC Samples:	None
Analytical Laboratory:	CT Laboratories
Comments:	Heavy vegetation, dense soil, hard to obtain samples
Field Technician: (Print)	Joseph Rasnack — Date: 9/22/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Sand Creek Disposal Rd. Landfill Project #: 133616

Sample ID: SCss-063m-0001-SO	Sample Location Sketch: N →
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/22/10	
Time Sampled: 1510	
Depth (ft bgs): 1 foot	
Physical description: Mostly silty soils some clay and fill.	
Analyses requested: - TAL Metals - Explosives - SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA



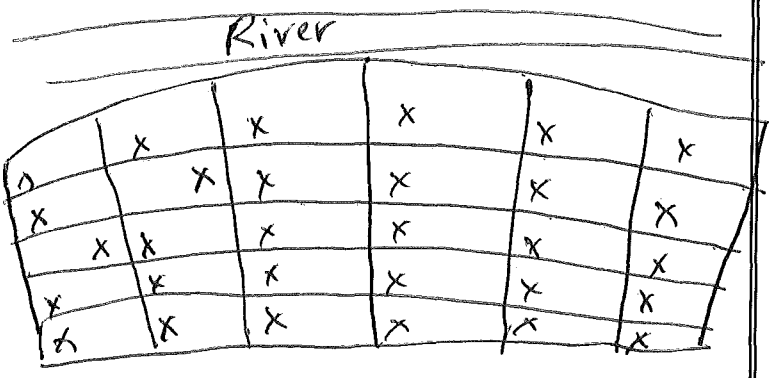
Weather:	Partly cloudy, humid
Temperature:	85+ °F
Sampling Equipment:	Stainless Steel & push probe
Equipment Decontamination Technique:	
QC Samples:	None
Analytical Laboratory:	CT Laboratories
Comments:	Very high vegetation, steep terrain
Field Technician: (Print)	Joseph Rasnack Date: 9/22/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Hex Creme Sample

Site Name: Ravenna, OH Sand Creek Disposal Ra. Landfill Project #: 133616

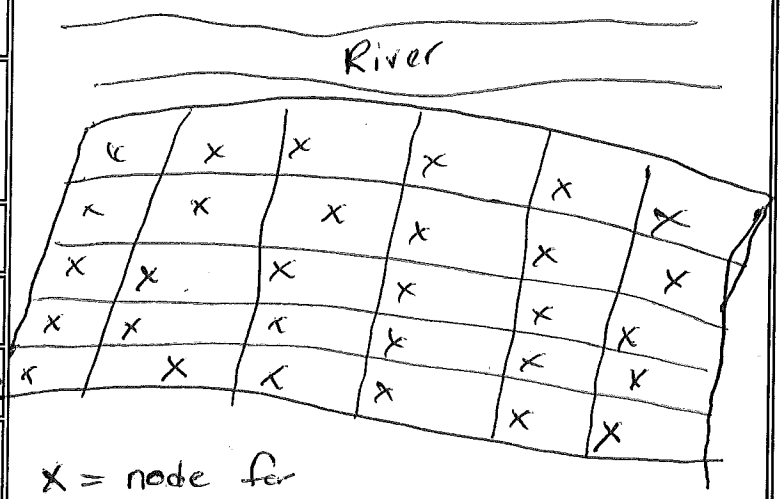
Sample ID: SCss-064m-0001-SO	Sample Location Sketch: N →  X = node for SCss-064m-0001-SO
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/22/10	
Time Sampled: 1350	
Depth (ft bgs): 1 foot	
Physical description: Mixed, clay, silty sand, unknown white material + some rock	
Analyses requested: TAL Metals, Explosives, SVOCs, Hex Chrome	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA

Weather:	Partly cloudy, very humid
Temperature:	85-90 °F
Sampling Equipment:	Stainless Steel push probe
Equipment Decontamination Technique:	Alcinox, isopropyl, DI rinse
QC Samples:	None
Analytical Laboratory:	CT Laboratories
Comments:	Very steep terrain, rocky soil
Field Technician: (Print)	Joseph Rasnack
Date:	9/22/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Sand Creek Disposal Rd. Landfill Project #: 133616

Sample ID: SCss-065m-0001-SO	Sample Location Sketch: N →  X = node for SCss-065m-0001-SO
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/22/10	
Time Sampled: 1125	
Depth (ft bgs): 1 ft.	
Physical description: Clay, mixed sandy & silty	
Analyses requested: Tal Metals, Explosives, SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA

Weather:	partly cloudy, humid
Temperature:	85 °F
Sampling Equipment:	Stainless Steel push probe
Equipment Decontamination Technique:	Alconox scrub, isopropyl, DI rinse
QC Samples:	None
Analytical Laboratory:	CT Laboratories
Comments:	Steep terraine, thick vegetation
Field Technician: (Print)	Joseph Rasnack Date: 9/22/10

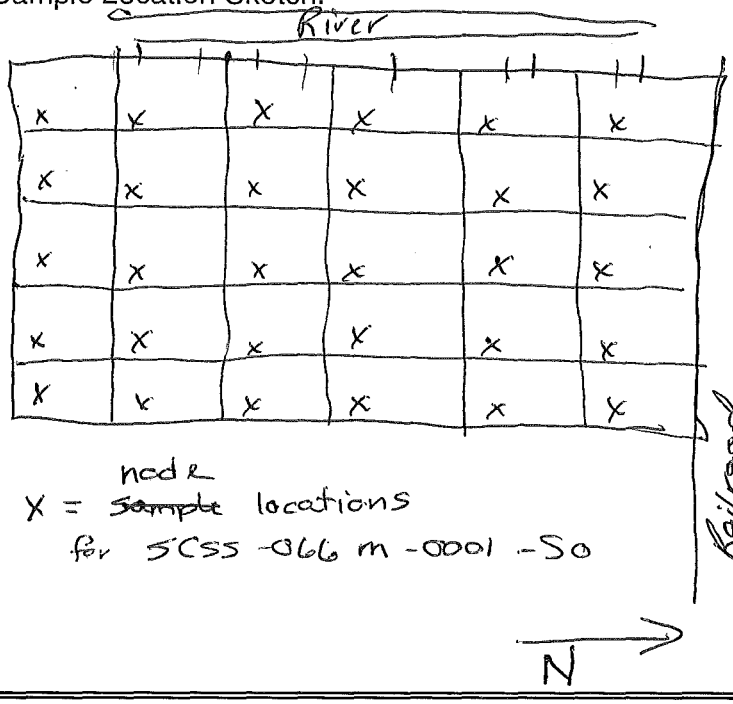
Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Hex Chrome Sample

Site Name: Ravenna, OH Sand Creek Disposal Rd. Landfill Project #: 133616

Sample ID: SCss-066m-0001-SO	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/22/10	
Time Sampled: 1005	
Depth (ft bgs): 1 ft.	
Physical description: Silty Sand and Clay trace ~~Some~~ GR wet	
Analyses requested: Tal Metals, Explosives, SVOC's, Hex Chrome	



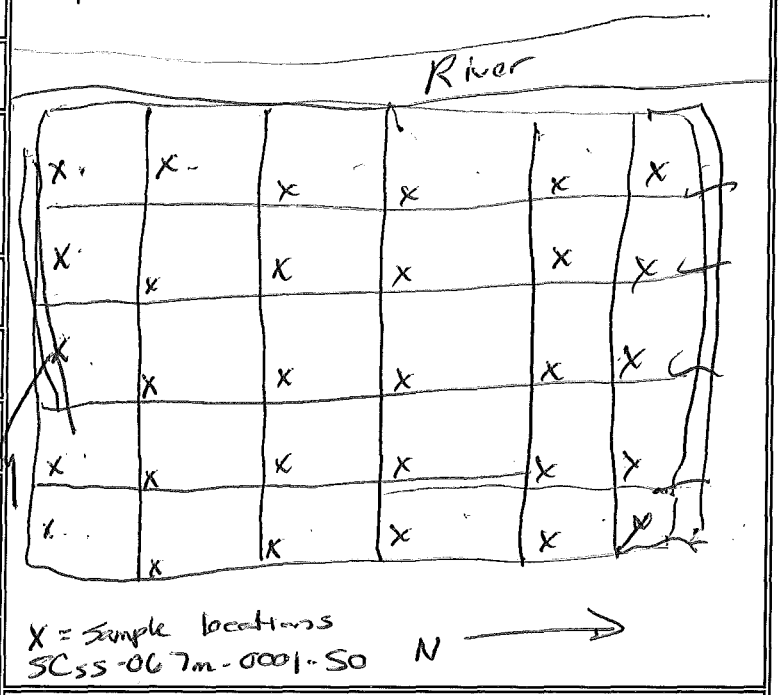
X = ~~sample~~ node locations for SCss-066m-0001-SO

Photograph Log #: NA	
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Rain (scattered), partly cloudy, humid.	
Temperature: 80° °F	
Sampling Equipment: Stainless Push ~~Proble~~ Probe GR	
Equipment Decontamination Technique: Alconox scrub, isopropyl, dI rinse	
QC Samples: None	
Analytical Laboratory: CT Labratory	
Comments: Steep terraine	
Field Technician: (Print) Joe Rasnack	Date: 9/22/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Project #: 133616

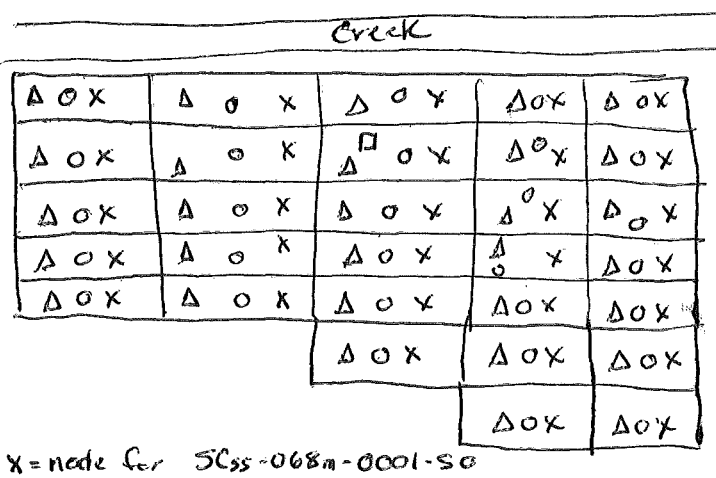
Sample ID: SCss-067m-0001-SO	Sample Location Sketch: 
Sample Type*: MT Surface Soil	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/21/10	
Time Sampled: 1610	
Depth (ft bgs): 1 foot	
Physical description: trace wet, sand, clay	
Analyses requested: Tal Metals, Explosives, 5VOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, Sunny	
Temperature: 80 °F	
Sampling Equipment: Push probe (Stainless steel) to 1'	
Equipment Decontamination Technique:	
QC Samples: None	
Analytical Laboratory:	
Comments: Wet soil near river.	
Field Technician: (Print) Joseph Rasnack	Date: 9/21/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-068m-0001-SO	Sample Location Sketch: N →
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/21/10	
Time Sampled: 1200	
Depth (ft bgs): 1 ft.	
(AN) ~~Physical description~~: Analyses requested: TAL Metals, Explosives, SVOCs, Pesticides, PCBs, Cyanide, Propellants	
(AN) ~~Analyses requested~~: Description: Mixed clay w/ sand	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA



X = node for SCss-068m-0001-SO
O = node for SCss-086m-0001-SO
Δ = node for SCss-068m-0001-SO (Army Dup.)
□ = VOC sample locations (see page 4)

Weather: Clear	
Temperature: 60-80 °F	
Sampling Equipment: Push probe to 1'	
Equipment Decontamination Technique:	
QC Samples: SCss-086m-0001-SO (AN) SCss-068m-0001-SO (Army dup)	
Analytical Laboratory: CT Laboratories	
Comments: Soil varies from clay to sandy.	
Field Technician: (Print) Joseph Rasnack	Date: 9/21/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Road Disposal Landfill Project #: 133616

Sample ID: SCss-086m-0001-SO	Sample Location Sketch: See page 1 for Sample Location Sketch
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/21/10	
Time Sampled: 1315	
Depth (ft bgs): 1 ft.	
Physical description: Mixed Clay w/ Sand	
Analyses requested: TAL Metals, Explosives, SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear	
Temperature: 80 °F	
Sampling Equipment: Stainless Steel Push Probe (ONE)	
Equipment Decontamination Technique: Liquinox, (ONE) Isopropyl Alcohol, HCl, DI water rinse	
QC Samples: This is QA sample for SCss-068m-0001-SO	
Analytical Laboratory: CT Laboratories	
Comments: Steep terrain, Soil varies from clay to sandy	
Field Technician: (Print) Joseph Rasnack	Date: 9/21/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna OH Sand Creek Disposal Road Landfill Project #: 13616

Sample ID: SCss-068m-0001-SO (Army Dup)	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	See page 1 for site sketch
Date Sampled: 9/21/10	
Time Sampled: 1450	
Depth (ft bgs): 1 ft.	
Physical description: Mixed clay w/ sand	
Analyses requested: TAL Metals, Explosives, SVOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, Sunny	
Temperature: 80 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Liquinox, Isopropyl Alcohol, HCl, DI rinse	
QC Samples: This is (Army Dup) QA Sample for SCss-068m-0001-SO	
Analytical Laboratory: CT Laboratories	
Comments: Steep terrain, Soil varies from clay to sandy.	
Field Technician: (Print) Joseph Rasnack	Date: 9/21/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna OH Sand Creek Disposal Road Landfill Project #: 133616

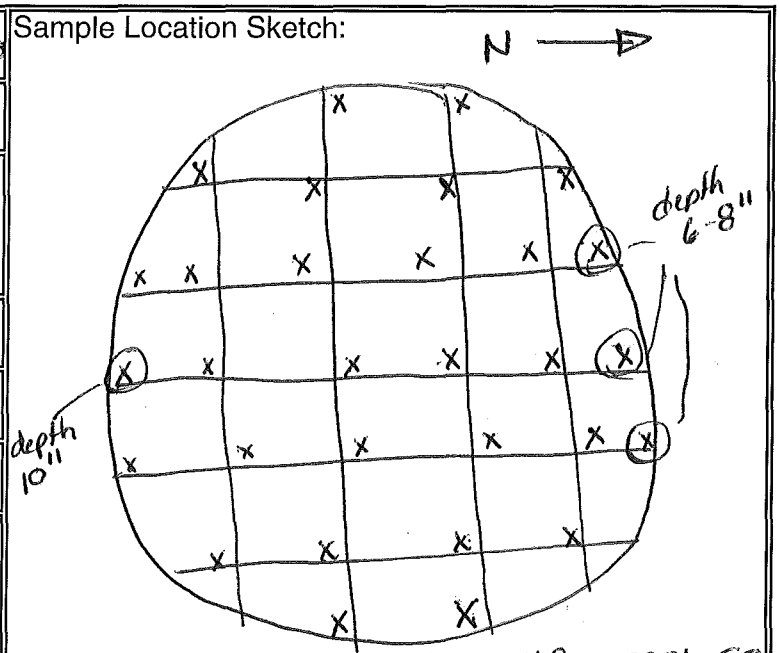
Sample ID: SCss-068d-0001-SO	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	See page 1 for Sample location Sketch
Date Sampled: 9/21/10	
Time Sampled: 1500	
Depth (ft bgs): 1 ft.	
Physical description: Mixed Clay w/ Sand	
Analyses requested: VOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA

Weather:	Clear
Temperature:	80 °F
Sampling Equipment:	Terra Core
Equipment Decontamination Technique:	NA
QC Samples:	SCss-086d-0001-SO @ 1505 ; SCss-068d-0001-SO (Army Dup) @ 1510
Analytical Laboratory:	CT Laboratories
Comments:	Steep Terrain
Field Technician: (Print)	Joseph Rasnack Date: 9/21/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

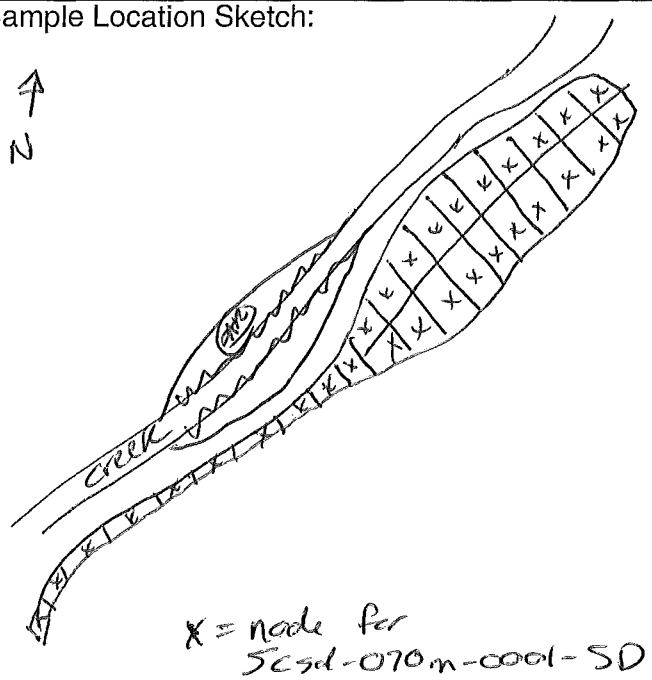
Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCss-069m-0001-SO	Sample Location Sketch:  X = node for sample SCss-069m-0001-SO * see comment below regarding depth.
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/24/10	
Time Sampled: 1020	
Depth (ft bgs): 1ft * see below	
Physical description: Silt, clay, trace sand.	
Analyses requested: TAL Metals, SVOCs, Explosives	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Clear, Sunny, Breezy	
Temperature: 75 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: ~~Alconox~~ (ANC) Liquinox, Alconox (ANC), Isopropyl Alcohol, DI rinse	
QC Samples: None	
Analytical Laboratory: CT Laboratories	
Comments: Hard debris underlying surface. Collection depth 4-6" except where noted on sketch.	
Field Technician: (Print) Joseph Rasnack	Date: 9/24/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

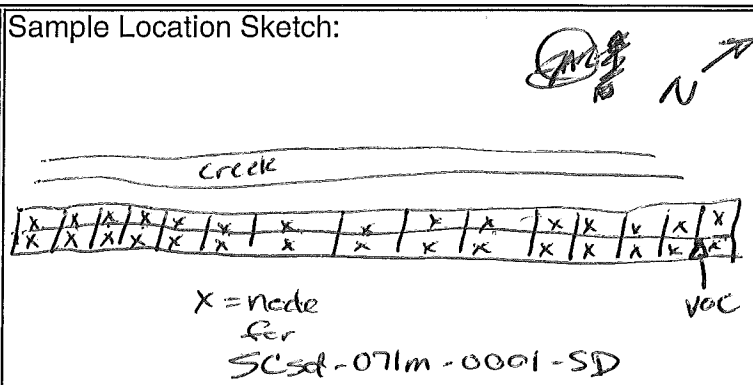
Sample ID: SCsd-070m-0001-SD	Sample Location Sketch: 
Sample Type*: SED	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/28/10	
Time Sampled: 1420	
Depth (ft bgs): 6"	
Physical description: Med brown Sediment w/ mixed grey clay	
Analyses requested: TAL metals, Explosives, Sucs, Hex Cr, Pesticides, PCB, Cyanide, Propellants	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Cloudy, drizzle, cool	
Temperature: 55 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Liquinox, Isopropyl Alcohol, DI rinse	
QC Samples: None	
Analytical Laboratory: CT Laboratories	
Comments: Slick ~~bank~~ bank.	
Field Technician: (Print) Joseph Rasnack	Date: 9/28/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCsd-071m-0001-SD	Sample Location Sketch:
Sample Type*: SED	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 9/28/10	
Time Sampled: 1325	
Depth (ft bgs): 6"	
Physical description: Light brown / dark brown Sediment w/ mixed clay	
Analyses requested: TAL Metals, Explosives, SVOCs, Hex Cr, Pesticides, PCBs, Cyanide, Propellants	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: ~~Clear~~ (OVC) cloudy, drizzle, cool	
Temperature: 55 °F	
Sampling Equipment: Stainless Steel push probe	
Equipment Decontamination Technique: Liquinox, Isopropyl Alcohol, DI rinse	
QC Samples: None	
Analytical Laboratory: CT Laboratories	
Comments: ~~None~~ (GW) Sediment Sample	
Field Technician: (Print) Joseph Rasnack	Date: 9/28/10



Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: Ravenna, OH Sand Creek Disposal Road Landfill Project #: 133616

Sample ID: SCsd-071d-0001-SD	Sample Location Sketch:
Sample Type*: SED	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	See page 1 for sample location sketch
Date Sampled: 9/28/10	
Time Sampled: 1340	
Depth (ft bgs): 6"	
Physical description: Light brown / dark brown Sediment w/ mixed clay	
Analyses requested: VOCs	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: Cloudy, drizzle, cool	
Temperature: 55 °F	
Sampling Equipment: Terra Core	
Equipment Decontamination Technique: NA	
QC Samples: None	
Analytical Laboratory: CT Laboratories	
Comments: Sediment Sample	
Field Technician: (Print) Joseph Rasnack	Date: 9/28/10

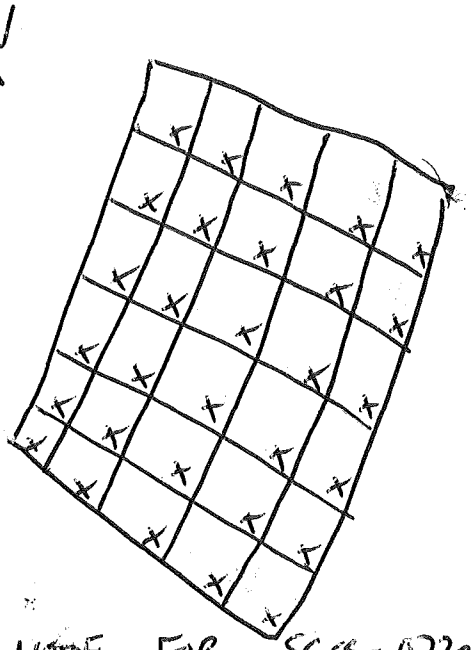
Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

SAND CREEK

Site Name: RAVENNA, OH LANDFILL Project #: 133616

Sample ID: SCSS-072m-0001-SO	Sample Location Sketch:
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: 1128	
Depth (ft bgs): 1 ft.	
Physical description: CLAY MIXED W/ SAND	
Analyses requested: TAL METALS, SVOC's EXPLOSIVES	Photograph Log #:
PID: NA	Calibration Date:
O2/LEL: NA	Calibration Date:



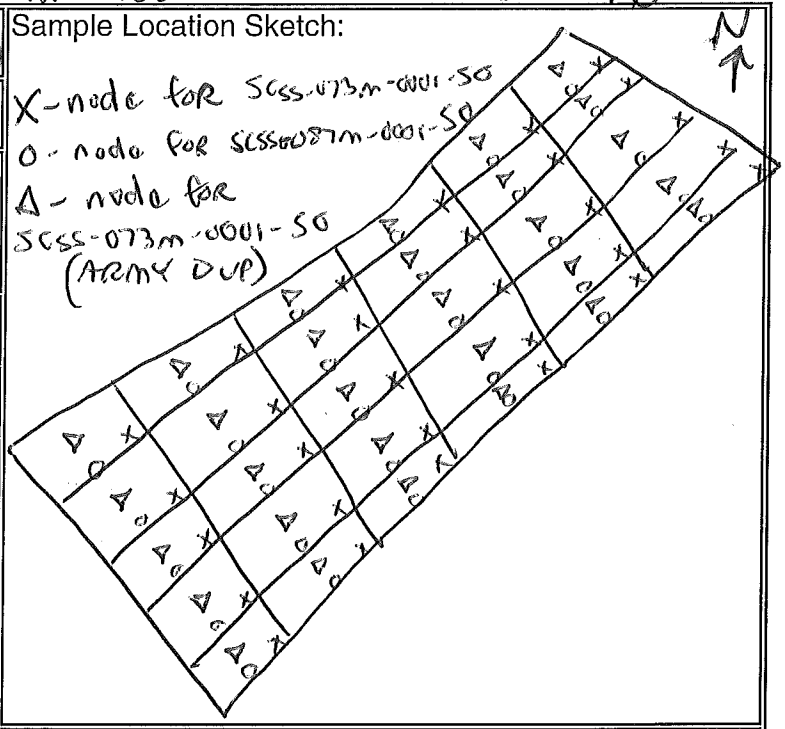
X - NODE FOR SCSS-072m-0001-SO

Weather: CLEAR	
Temperature: 65° °F	
Sampling Equipment: PUSH PROBE TO 1 ft.	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: NA	
Analytical Laboratory: CT LABORATORIES	
Comments: SOIL VARIES FROM CLAY TO SANDY	
Field Technician: (Print) KYLE HAVENS	Date: 11/9/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: RAVENNA, OH SAND CREEK LANDFILL Project #: 133616

Sample ID: SCSS-073m-0001-SO	Sample Location Sketch: 
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: 1410	
Depth (ft bgs): 1ft.	
Physical description: MIX OF CLAY & SAND	
Analyses requested: TAL METALS, SVOC'S EXPLOSIVES	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: CLEAR	
Temperature: 65° °F	
Sampling Equipment: PUSH PROBE TO 1ft.	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: SCSS-087m-0001-SO SCSS-073m-0001-SO (ARMY DUP)	
Analytical Laboratory: CT LABORATORIES	
Comments: SOIL VARIES FROM CLAY TO SANDY	
Field Technician: (Print) KYLE HAVENS	Date: 11/9/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

Site Name: RAVENNA, OH SAND CREEK LANDFILL Project #: 133616

Sample ID: SC55-087m-0001-SO	Sample Location Sketch: SEE PAGE 1 FOR SAMPLE LOCATION SKETCH
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: 1500	
Depth (ft bgs): 1 ft.	
Physical description: MIX OF CLAY & SAND	
Analyses requested: TAL METALS, SVOC'S EXPLOSIVES	Photograph Log #:
PID: NA	Calibration Date:
O2/LEL: NA	Calibration Date:
Weather: CLEAR	
Temperature: 65° °F	
Sampling Equipment: PUSH PROBE TO 1 ft.	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: THIS IS QA SAMPLE FOR SC55-073m-0001-SO	
Analytical Laboratory: CT LABORATORIES	
Comments: SOIL VARIES FROM CLAY TO SANDY	
Field Technician: (Print) KYLE HAWKINS	Date: 11/9/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

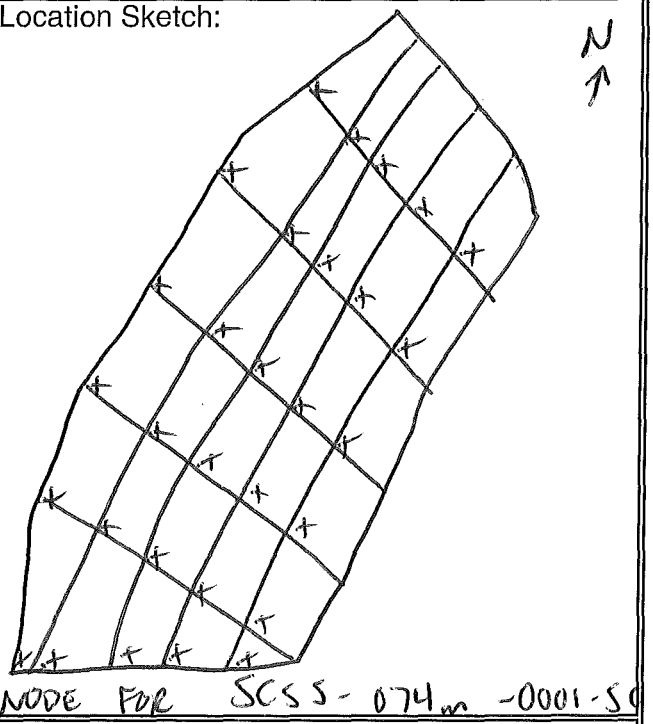
Site Name: RAVENNA OH SAND CREEK LANDFILL Project #: 133616

Sample ID: SCSS-073m-0001-SO (ARMY DUP)	Sample Location Sketch: SEE PAGE 1 FOR SITE SKETCH
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: (KH) ~~1500~~ 1500	
Depth (ft bgs): 1 ft.	
Physical description: MIX OF CLAY & SAND	
Analyses requested: TAL METALS, SVOC'S, EXPLOSIVES	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: CLEAR	
Temperature: 65° °F	
Sampling Equipment: PUSH PROBE TO 1 ft.	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: (ARMY DUP) THIS IS QC SAMPLE FOR SCSS-073m-0001-SO	
Analytical Laboratory: CT LABORATORIES	
Comments: SOIL VARIES FROM CLAY TO SANDY	
Field Technician: (Print) KYLE HAVENS	Date: 11/9/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: RAVENNA, OH SAND CREEK LANDFILL Project #: 133616

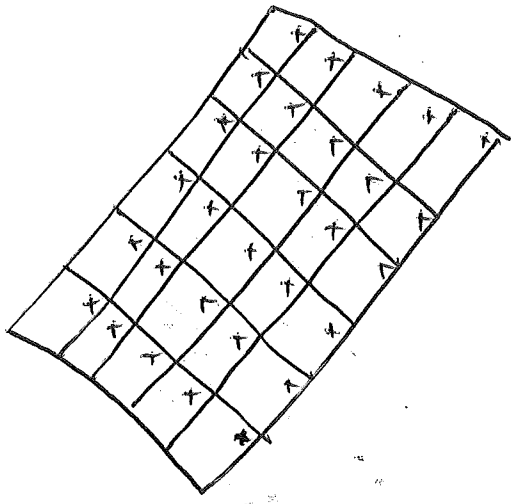
Sample ID: SCSS-074m-0001-SO	Sample Location Sketch:  X- NODE FOR SCSS-074m-0001-SO
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: 1532	
Depth (ft bgs): 1 ft.	
Physical description: MIX OF CLAY, SILT & FINE SAND	
Analyses requested: TAL METALS, SVOC'S EXPLOSIVES	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: CLEAR	
Temperature: 65 °F	
Sampling Equipment: PUSH PROBE TO 1 ft.	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: NA	
Analytical Laboratory: CT LABORATORIES	
Comments: SOIL VARIES FROM CLAY, SILT, TO SAND	
Field Technician: (Print) KYLE HAVENS	Date: 11/9/10

Shaw™ Shaw E & I

Soil / Sediment Field Logsheet

SAND CREEK

Site Name: RAVENNA OH LANDFILL Project #: 133616

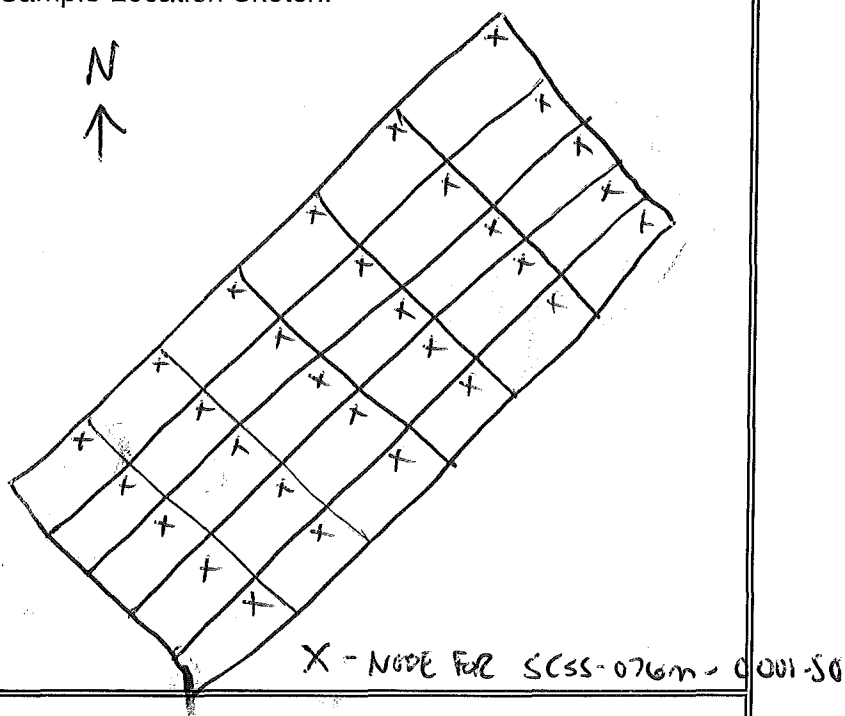
Sample ID: SCSS-075m-0001-SO	Sample Location Sketch: N ↑  X - NODE FOR SCSS-075m-0001-SO
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: 1048	
Depth (ft bgs): 1 ft.	
Physical description: CLAY MIXED W/ SAND	
Analyses requested: TAL METALS, SVOC's EXPLOSIVES	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA

Weather: CLEAR	
Temperature: 63 °F	
Sampling Equipment: PUSH PROBE TO 1'	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: NA	
Analytical Laboratory: CT LABORATORIES	
Comments: SOIL VARIES FROM CLAY TO SANDY	
Field Technician: (Print) KYLE HAVENS	Date: 11/9/10

Soil / Sediment Field Logsheet

Shaw™ Shaw E & I

Site Name: RAVENNA, OH SAND CREEK LANDFILL Project #: 133616

Sample ID: SCSS-076m-0001-SO	Sample Location Sketch: 
Sample Type*: SUR	
*: SED=Sediment; SUR=Surface soil; SUB=Subsurface Soil; OTH=Other. grab=Grab, comp=Composite	
Date Sampled: 11/9/10	
Time Sampled: 1000	
Depth (ft bgs): 1ft	
Physical description: CLAY / SAND	
Analyses requested: TAL METALS EXPLOSIVES SVOC'S	Photograph Log #: NA
PID: NA	Calibration Date: NA
O2/LEL: NA	Calibration Date: NA
Weather: CLEAR	
Temperature: 60 °F	
Sampling Equipment: PUSH PROBE TO 1'	
Equipment Decontamination Technique: LIQUINOX, DI, ISOPROPYL	
QC Samples: NA	
Analytical Laboratory: CT LABORATORIES	
Comments: SOILS VARY FROM CLAY TO SANDY	
Field Technician: (Print) KYLE HAVENS	Date: 11/9/10

HTRW DRILLING LOG

DISTRICT		HOLE NUMBER: SC56-035
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 1 SHEET

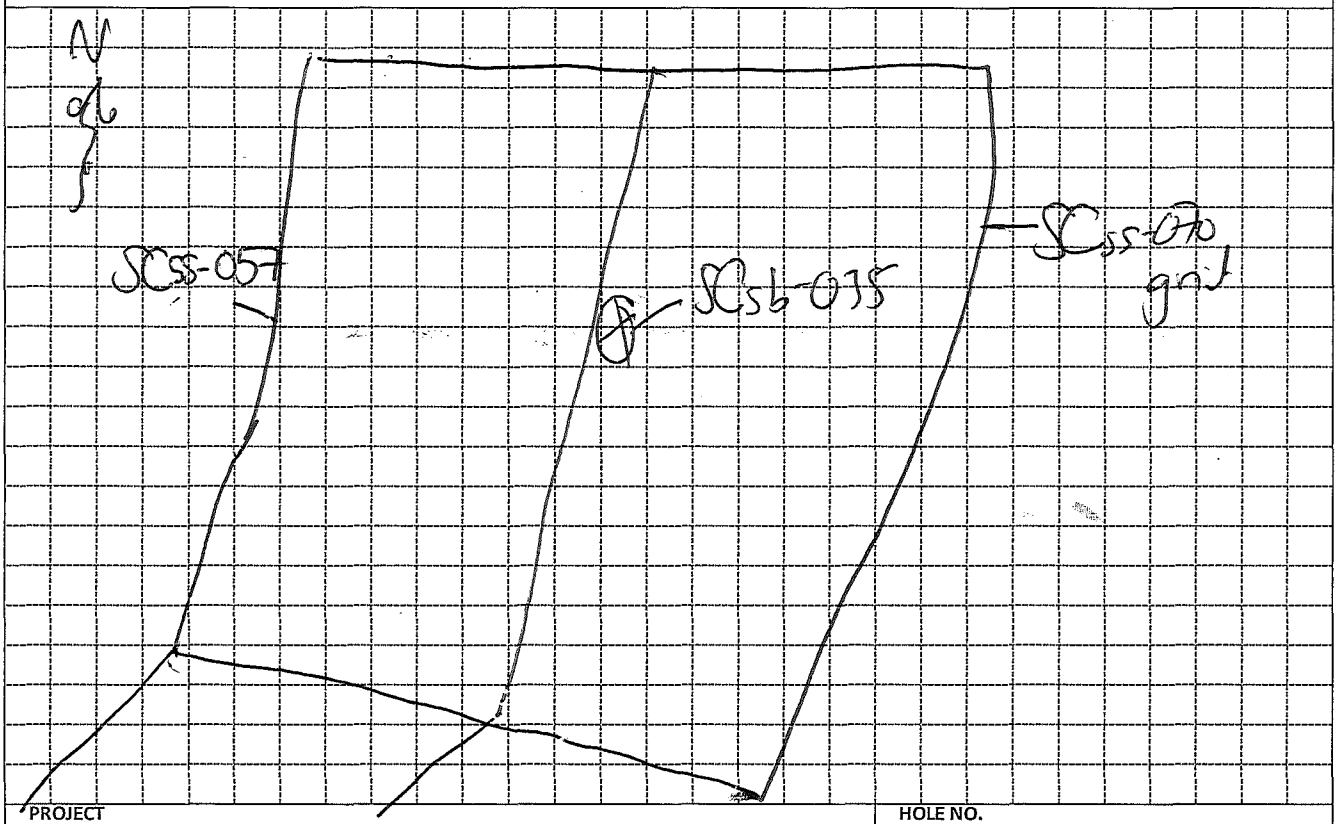
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio
5. NAME OF DRILLER: Jeremy L.	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620DT
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620DT Truck mounted rig	8. HOLE LOCATION: SC56-035
	9. SURFACE ELEVATION: 960'
10. DATE STARTED: 9/22/10	11. DATE COMPLETED: 9/22/10
12. OVERBURDEN THICKNESS: NA	15. DEPTH OF GROUNDWATER ENCOUNTERED: ~13'
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: —
14. TOTAL DEPTH OF HOLE: 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): —

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
		✓	Explosives	SVOC		see pg 2

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Bentonite	—	—	

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SC56-035

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCS5-035

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Barny, R. Hallison

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–5	Brown, dry sand, fine to med to sm gravel to sm gravel & organic material (roots)	0.0 ppm	NA	~~0001~~	NA	SCS5-035M-0001-SO 1105
	6–9	Gray, dry dense M-F Sand, slag, little rock, glass (fill)	0.0 ppm	NA	~~0002~~	NA	SCS5-035M-0002-SO 50% sand recovery 1110
	10–13	Gray, moist, dense sandy, silt	0.0 ppm	NA	~~0003~~	NA	SCS5-035M-0003-SO 50% sand recovery 1115
	14–17	Gray wet dense silty sand (13/14') light brown, wet dense, fine sand, little silt	0.0 ppm	NA	~~0004~~	NA	SCS5-035M-0004-SO 50% recovery 1120
	18–20	light brown, moist dense, fine sand, little silt (17-18.5') Gray wet dense silty clay (18.5-19) light brown/gray, moist dense silty clay (19.5-20')	0.0 ppm	NA	~~0005~~	NA	SCS5-035M-0005-SO 75% recovery 1125

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCS5-035

HTRW DRILLING LOG

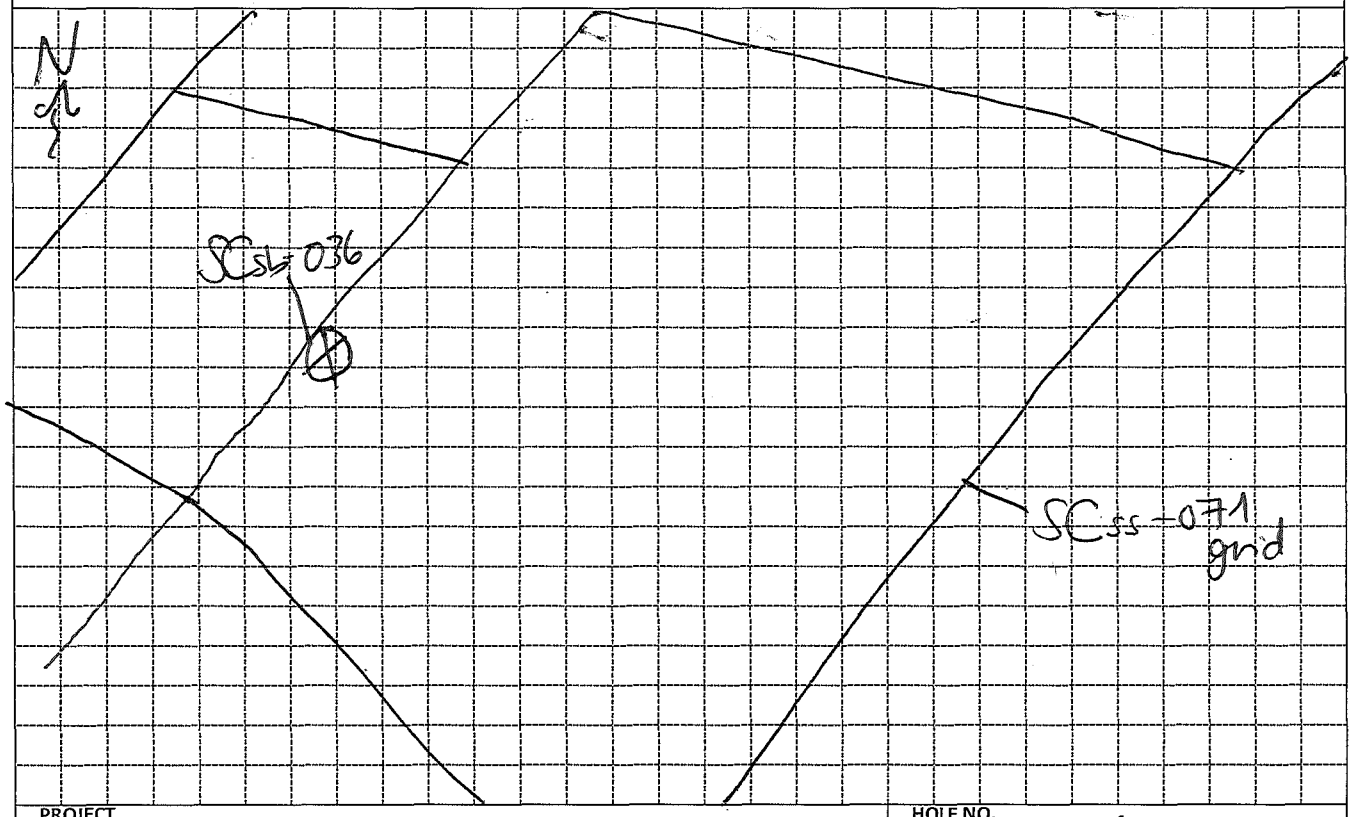
	DISTRICT	HOLE NUMBER: SCsb-036
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Jeremy L.	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620DT	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620DT Trackmounted Rig	8. HOLE LOCATION: SCsb-03	
	9. SURFACE ELEVATION: 961'	
	10. DATE STARTED: 9/22/10	11. DATE COMPLETED: 9/22/10
12. OVERBURDEN THICKNESS: NA	15. DEPTH OF GROUNDWATER ENCOUNTERED: ~13'	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
	NA	✓	Explosives	SVOC	Hexchrom	100

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
—	Bentonite	NA	NA	

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-036

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCS6-036

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Bailey, R. Harrison

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–5	Brown, dry, med-fine sand, trace med-sm gravel & organic material (roots), slag, brick (fill mat)	0.0 ppm	NA	~~0001~~	NA	SCS6-036M-0001-SO 1305
	6–9	Brown, dry m-f sand, trace gravel (sm-med)	0.0 ppm	NA	~~0002~~	NA	SCS6-036M-0002-SO 1310
	10–13	Black/gray fine sand, little silty, trace sm gravel, glass (9-11.5'); Brown dry, m-f sand w/ sm rocks, gravel (11.5-13')	0.0 ppm	NA	~~0003~~	NA	SCS6-036M-0003-SO 1315
½ 13' ▽	14–17	Gray, wet clay (13-14'); Gray/light brown, wet silty clay (14-17')	0.0 ppm	NA	~~0004~~	NA	SCS6-036M 0004-SO 1320
	18–20	Gray wet, dense silty clay	0.0 ppm	NA	~~0005~~	NA	SCS6-036M 0005-SO 1325

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCS6-036

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT

HOLE NUMBER: SCsb-037

1. COMPANY NAME: The Shaw Group - Shaw E&I

2. DRILL CONTRACTOR: Frontz Drilling

SHEET 1 OF 2

3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

4. LOCATION: Ravenna, Ohio

5. NAME OF DRILLER: Jeremy L.

6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620DT

7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620DT Trackmounting

8. HOLE LOCATION

9. SURFACE ELEVATION: 964'

10. DATE STARTED: 9/22/10

11. DATE COMPLETED: 9/22/10

12. OVERBURDEN THICKNESS: NA

15. DEPTH OF GROUNDWATER ENCOUNTERED: ~13' bgs ?

13. DEPTH DRILLED INTO ROCK: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA

14. TOTAL DEPTH OF HOLE: 20'

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

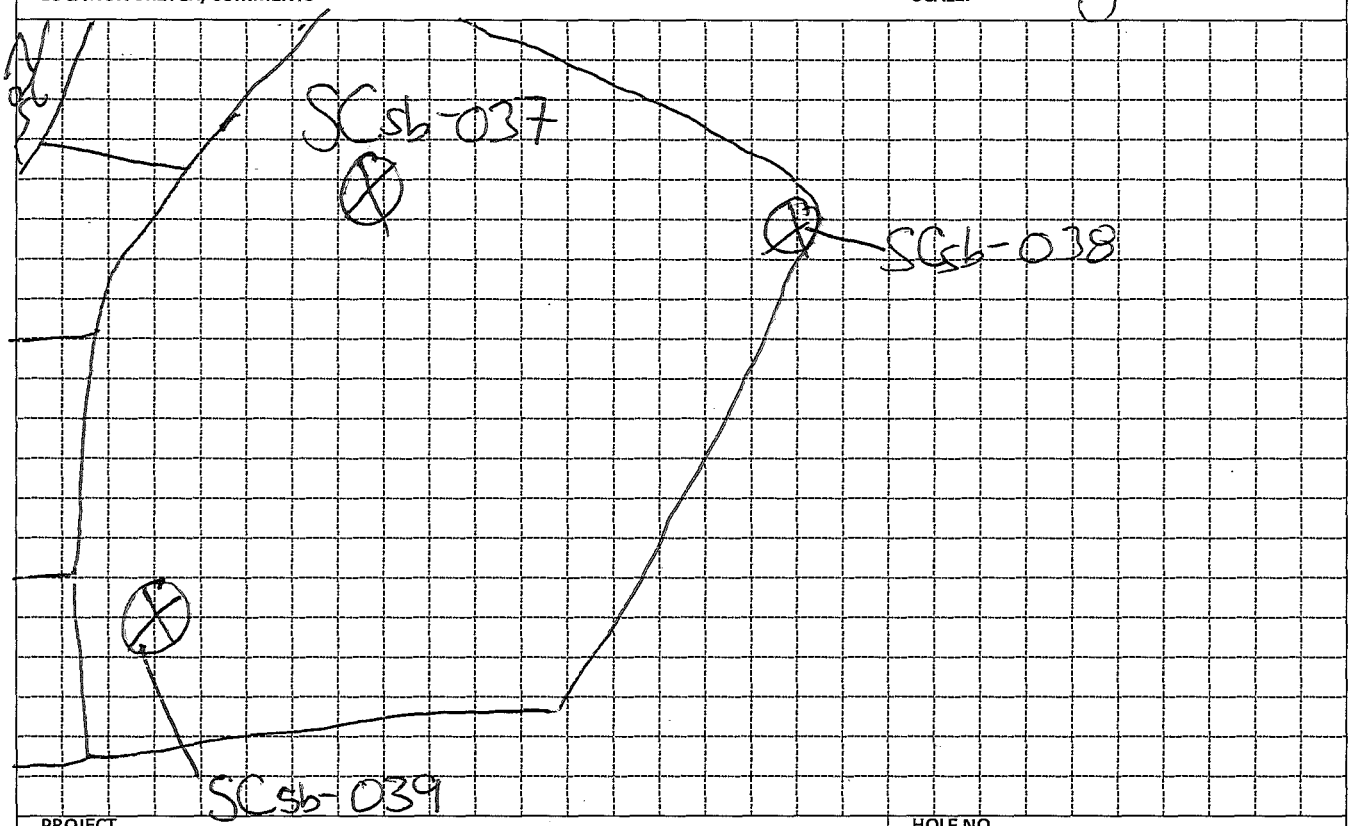
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	V + DUP	✓	Propellants Explosives	Pesticides SVOC	PCB's Cyanide	See COC %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Bentonite			Scott Ng

LOCATION SKETCH/COMMENTS

SCALE:



PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-037

ENG FORM 5056-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCS5-037

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Barry, R. Hannon

SHEET 2 OF 2 SHEET

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–5	Black/brown (mottled) dense, vf-f sand, trace silt & gravel (metal debris)	0.0 ppm	NA	0001	NA	SCS5-037M-0001-SO SCS5-037d-0001-SO (VOC @ 3') SCS5-050d-0001 (dup) SCS5-050M-0001 (dup) SCS5-037M-0001-SO(QA) 1030
	6–9	Dark brown/gray, dry brick (coal ash?) (5-6.5') Black, fine sand w/ little gravel (fill, coal ash (6.5-8') w/ lt brown silty sand lens	0.0 ppm	NA	0002	NA	SCS5-037M-0002-SO Drilled twice in same zone for better recovery 25% recovery originally 1045
	10–13	Brown, fine sand, trace silt, gravel, moist	0.0 ppm	NA	0003	NA	SCS5-037M-0003-SO 40% recovery 1052
~13.5'	14–17	Brown, wet dense, fine sand, trace silt, gravel	0.0 ppm	NA	0004	NA	SCS5-037M-0004-SO 1055
	18–20	Gray, wet dense, silty clay (17-19') Brown/gray wet dense fine sand, little silt (19-20')	0.0 ppm	NA	0005	NA	SCS5-037M-0005-SO 1100

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCS5-037

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

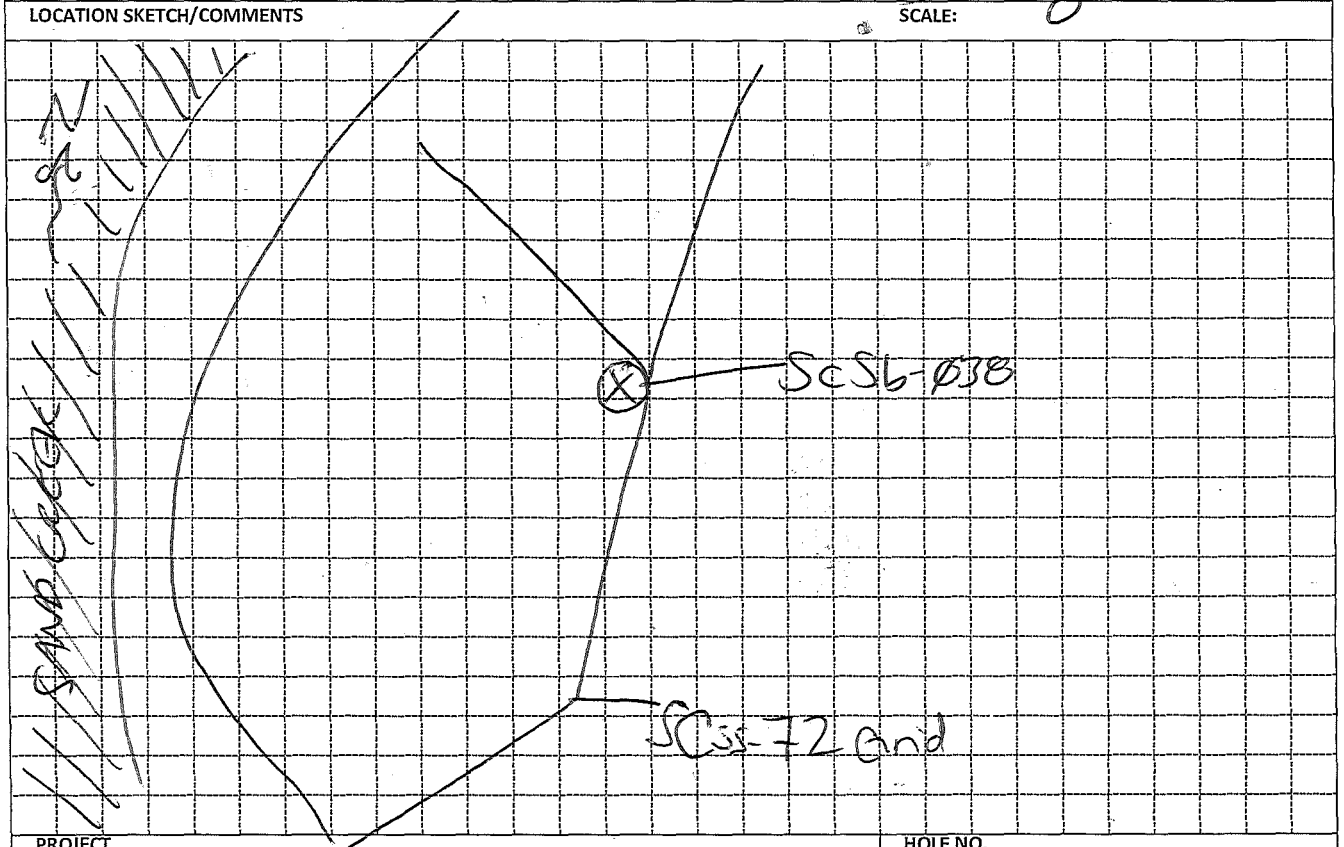
DISTRICT		HOLE NUMBER: SCSb-038
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Jeremy L.	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620DT	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620DT Trackmounted rig	8. HOLE LOCATION: SCSb-038	
	9. SURFACE ELEVATION: 969'	
	10. DATE STARTED: 9/22/10	11. DATE COMPLETED: 9/22/10
12. OVERBURDEN THICKNESS: NA	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
	+Dup ✓	✓	Explosives SVOC	Pesticides Cyanides	PCBs Propellants	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Bentonite	—	—	

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCSb-038

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-038

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Barry, R. Harrison

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–5	~~Dark brown~~ Charcoal gray/brown M-F SAND, trace gravel (shale) (1-2'); Light brown, M-F SAND, trace gravel & Silt & roots (organic material) (2-5')	0.0 ppm	NA	0001	NA	SCsb-038m-0001-SO; SCsb-038m-0001-MS; SCsb-038m-0001-MD; MS MSD; ~~1015~~ BRM 1015
	6–9	Light brown, dry, dense, FINE SAND, trace small gravel	0.0 ppm	NA	0002	NA	SCsb-038m-0002-SO; 1110
	10–12	Light brown, dry, dense, FINE SAND, trace small gravel	0.0 ppm	NA	0003	NA	SCsb-038m-0003-SO; 1115
	14–16	Gray, moist, dense, SILTY CLAY	0.0 ppm	NA	0004	NA	SCsb-038m-0004-SO; 1120
	17–19	Gray, moist, dense, SILTY CLAY (17-18'); gray, wet, dense, CLAY (18-19'); gray, wet, dense, SILTY CLAY (19-20')	0.0 ppm	NA	0005	NA	SCsb-038m-0005-SO x2 (QA); SCsb-081d & 081m-0005-SO (@ 17.5'); VOC + VOC DUP + full suite DUP + QA; 1125

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-038

HTRW DRILLING LOG

	DISTRICT	HOLE NUMBER SCsb-039
1. COMPANY NAME The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR Frontz Drilling	SHEET 1 OF 1 SHEET

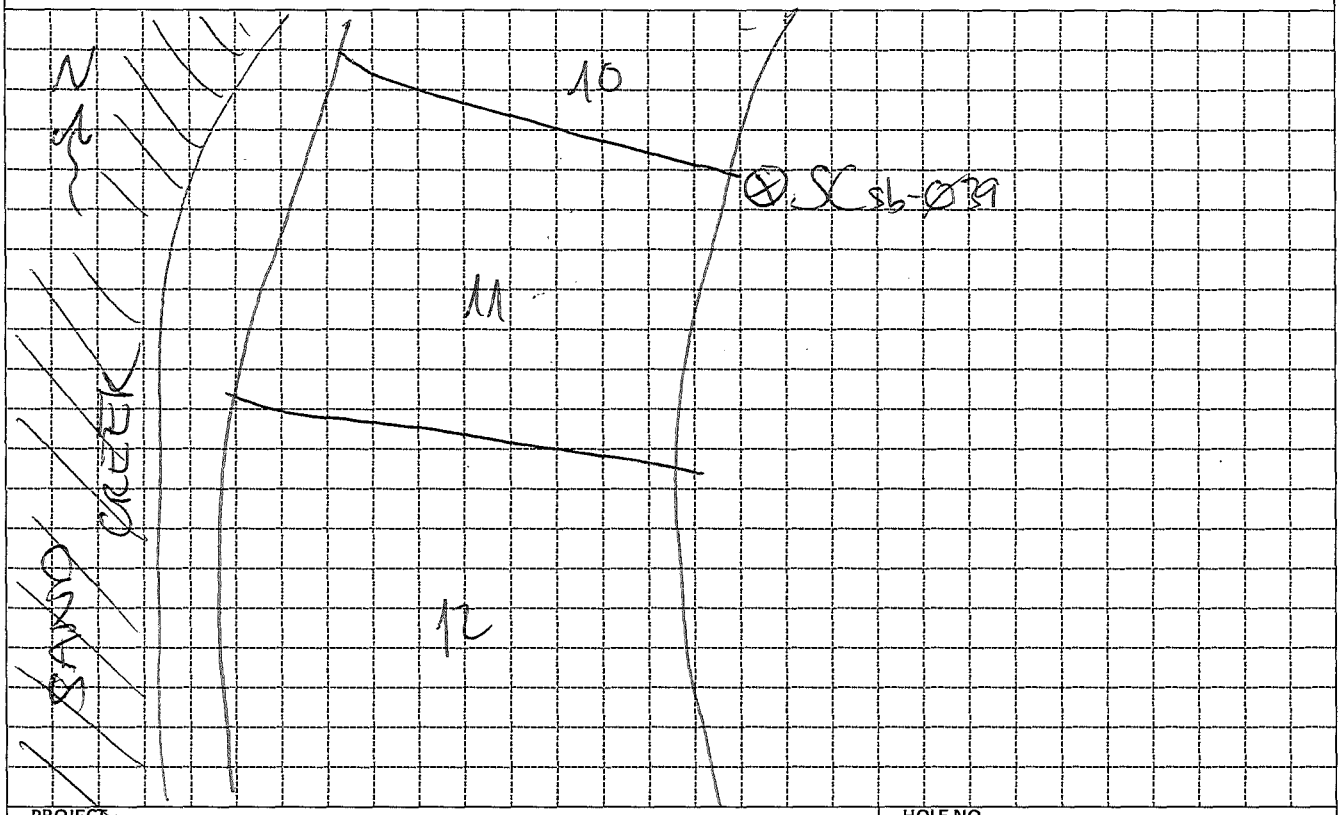
3. PROJECT RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION Ravenna, Ohio
5. NAME OF DRILLER Jeremy	6. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6620DT
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT Geoprobe 6620DT Trackmanted rig	8. HOLE LOCATION SCss-039
	9. SURFACE ELEVATION 968'
	10. DATE STARTED 9/21/10 / 11. DATE COMPLETED 9/21/10
12. OVERBURDEN THICKNESS NA	15. DEPTH OF GROUNDWATER ENCOUNTERED NA
13. DEPTH DRILLED INTO ROCK NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED NA
14. TOTAL DEPTH OF HOLE 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY) NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY 100 %
		✓	Explosives SVOC's			

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓ bentonite			Steve Ramey

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb 039

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-039

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S-Barry, R. Harrison, P. Macarron

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–5	Brown, FINE SAND, trace silt & gravel, dense, dry (SB)	0.0 ppm	NA	0001	NA	SCsb-039m-0001-SO 1600
	5–9	Brown/gray mottled, dry, dense, SILTY SAND (SB)	0.0 ppm	NA	0002	NA	SCsb-039m-0002-SO 1610
	9–13	Light Brown, dry, dense, SILTY SAND	0.0 ppm	NA	0003	NA	SCsb-039m-0003-SO 1615
	13–16	Gray, dry, dense, SILT	0.0 ppm	NA	0004	NA	SCsb-039m-0004-SO 1625
	17–19	Gray, dry, dense, SILTY CLAY (17-19') Gray, moist, dense, SILTY CLAY (17-19')	0.0 ppm	NA	0005	NA	SCsb-039m-0005-SO 1630 Moist soil, may be getting close to water

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-039

HTRW DRILLING LOG

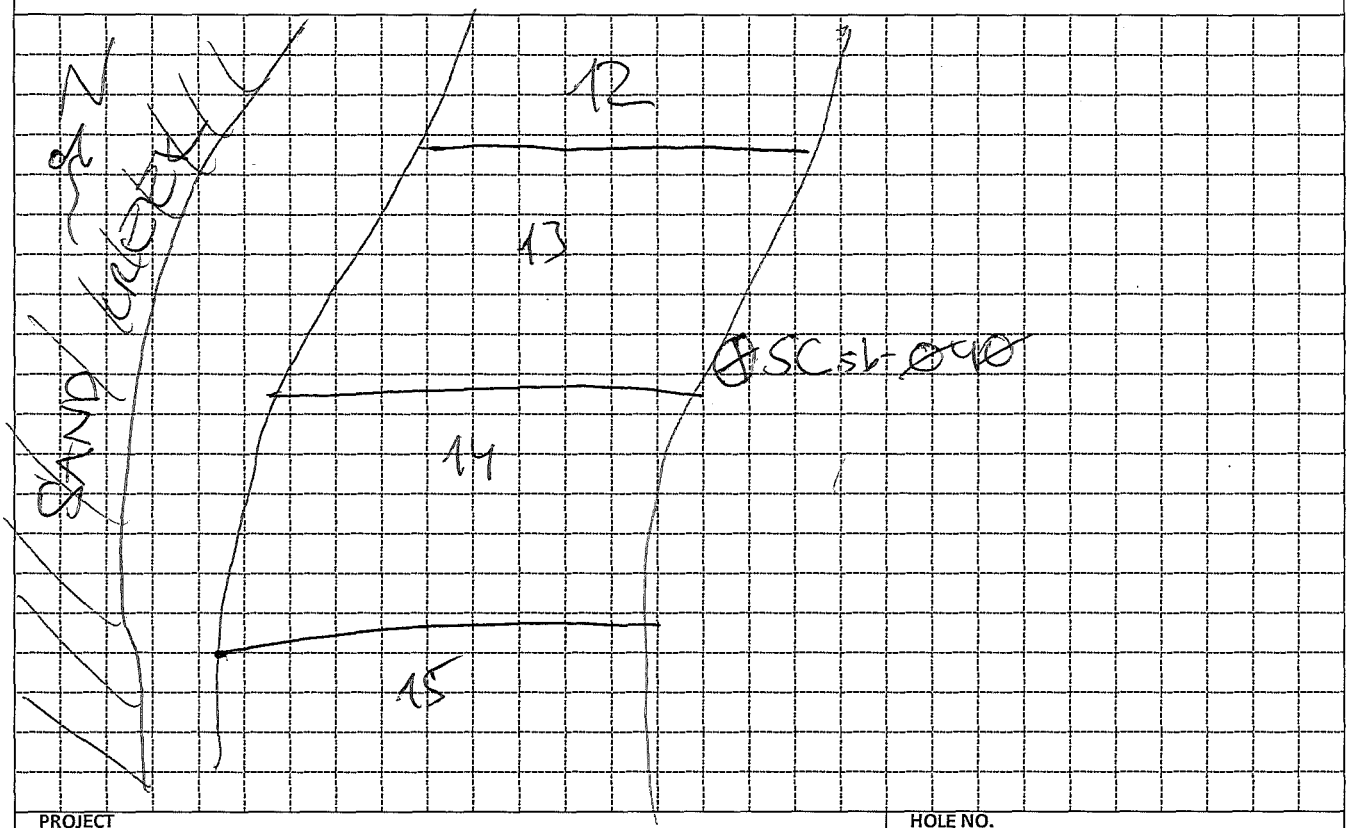
DISTRICT		HOLE NUMBER SCsb-040
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620 DT Track mounted rig	8. HOLE LOCATION: SCsb-040	
	9. SURFACE ELEVATION: ~~ESTIMATED~~ 971'	
	10. DATE STARTED: 9/21/10	11. DATE COMPLETED: 9/21/10
12. OVERBURDEN THICKNESS: NA	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Explosives	SVOCs	Pesticides PCBs	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	Bentonite ✓			Agellants

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-040

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-040

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Barry, Paul M, R. Harry

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1 2 3 4 5	Brown, dry, med. dense, M-F SAND, trace gravel	0.0 ppm	NA	0001	NA	SCsb-040m-0001-SO 1525
	6 7 8 9	Brown, dry, dense, FINE SAND, SILT, trace gravel	0.0 ppm	NA	0002	NA	SCsb-040m-0002-SO VOC (6') QA DUP-SCsb-082m-0002-SO 1535
	10 11 12	Brown, dry, dense, SILTY SAND	0.0 ppm	NA	0003	NA	SCsb-040m-0003-SO 1540
	13 14 15 16	Brown, dry, dense, SILTY SAND (13-14') Gray, dry, dense, SILT (14-17')	0.0 ppm	NA	0004	NA	SCsb-040m-0004-SO 1545
	17 18 19	Gray, dry, dense, SILTY CLAY	0.0 ppm	NA	0005	NA	SCsb-040m-0005-SO 1550

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-040

HTRW DRILLING LOG

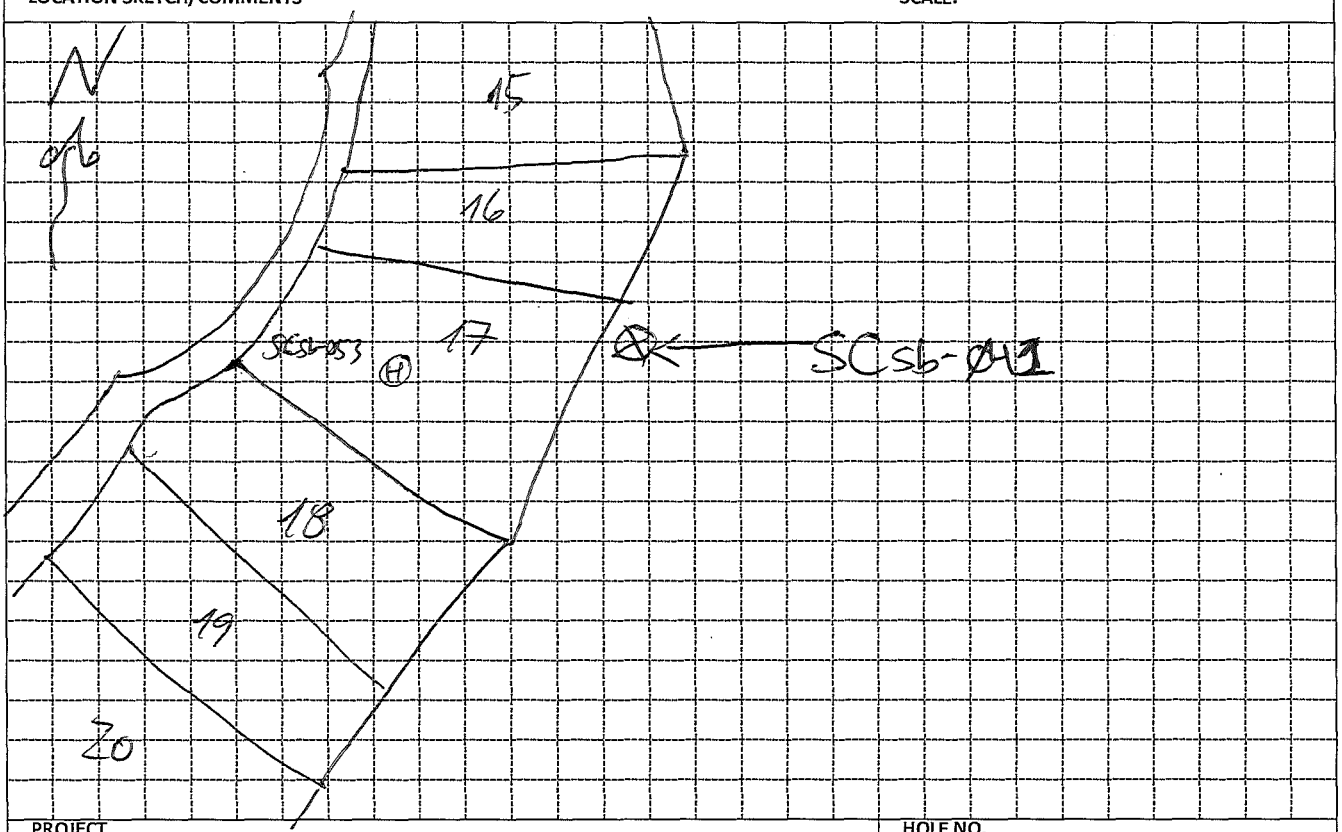
DISTRICT		HOLE NUMBER: SCSb-041
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Jeremy	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6610DT Track-mounted rig	8. HOLE LOCATION: SCSb-041	
	9. SURFACE ELEVATION: ~~ES~~ NA 968'	
	10. DATE STARTED: 9/21/10	11. DATE COMPLETED: 9/21/10
12. OVERBURDEN THICKNESS: NA	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives	SVOC's		100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓ Bentonite			Stacy

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCSb-041

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-041-SO

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Berry, P. MacCann, R. Hanson

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–4	Brown, dry, dense, M-F SAND, trace silt & gravel	0.0	NA	ØØØ1	NA	SCsb-041m-ØØØ1-SO 1425
	5–8	Brown, dry, dense, FINE SAND trace silt, trace gravel	0.0	NA	ØØØ2	NA	SCsb-041m-ØØØ2-SO MS/MSD 1435
	9–12	Brown, dry, dense, FINE SAND, trace silt & gravel	0.0	NA	ØØØ3	NA	SCsb-041m-ØØØ3-SO 1440
	13–16	Gray, dry, dense SILT	0.0	NA	ØØØ4	NA	SCsb-041m-ØØØ4-SO 1450
	17–19	Gray, dry, dense SILTY CLAY	0.0	NA	ØØØ5	NA	SCsb-041m-ØØØ5-SO 1455

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-041

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT	HOLE NUMBER
	SCsb-042

1. COMPANY NAME	2. DRILL CONTRACTOR	SHEET	SHEET
The Shaw Group - Shaw E&I	Frontz Drilling	1	OF 2

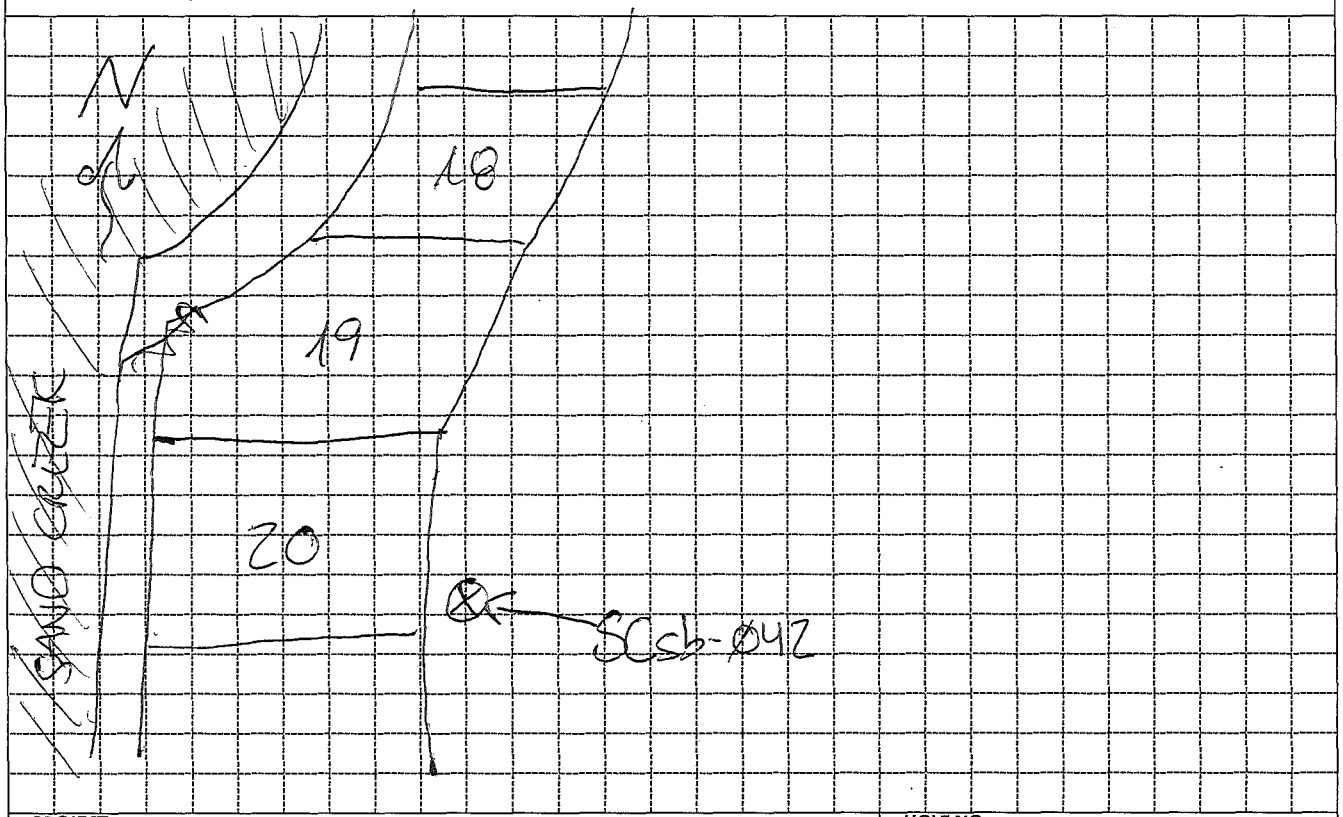
3. PROJECT	4. LOCATION
RVAAP - MI Sampling (Ravenna A/E: 133616)	Ravenna, Ohio
5. NAME OF DRILLER	**6. MANUFACTURER'S DESIGNATION OF DRILL**
Jeremy L.	Geoprobe 6620 DT
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	**8. HOLE LOCATION**
Geoprobe 6620 DT Trackmounted Rig	SCsb-042
	9. SURFACE ELEVATION 971'
	10. DATE STARTED 9/21/10 — **11. DATE COMPLETED** 9/21/10
12. OVERBURDEN THICKNESS NA	**15. DEPTH OF GROUNDWATER ENCOUNTERED** NA
13. DEPTH DRILLED INTO ROCK NA	**16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED** NA
14. TOTAL DEPTH OF HOLE 20'	**17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)** NA

18. GEOTECHNICAL SAMPLES	DISTRICT	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Explosive VOC	Pesticides PCB	Explosives Propellants	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓ bentonite			

LOCATION SKETCH/COMMENTS — **SCALE:**



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-042

HTRW DRILLING LOG

HOLE NUMBER: SCsb-Ø42

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: BRIAN P. McCARTHY

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1–4	Brown, f-m SAND, w/ 1.5" gravel, trace root mat., Dry	0.0	NA	ØØØ1	NA	SCsb-Ø42m-ØØØ1-SO 1330
	5–8	Brown, FINE SAND, trace gravel, dry (5-9')	0.0	NA	ØØØ2		SCsb-Ø42m-ØØØ2-SO (5-9') 1335
	8–12	Brown, F SAND, dry (8-9.5') Gray, SILTY CLAY, dry (9.5-13')	0.0	NA	ØØØ3 Collect VOC		SCsb-Ø42m-ØØØ3-SO (9-13') 1345
	12–16	Gray, SILTY CLAY dry (13-17')	0.0		ØØ4		SCsb-Ø42m-ØØØ4-SO (13-17') 1350
	16–19	Gray, SILTY, dry (17-20')	0.0		ØØØ5		SCsb-Ø42m-ØØØ5-SO (17-20') 1400

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCsb-Ø42

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

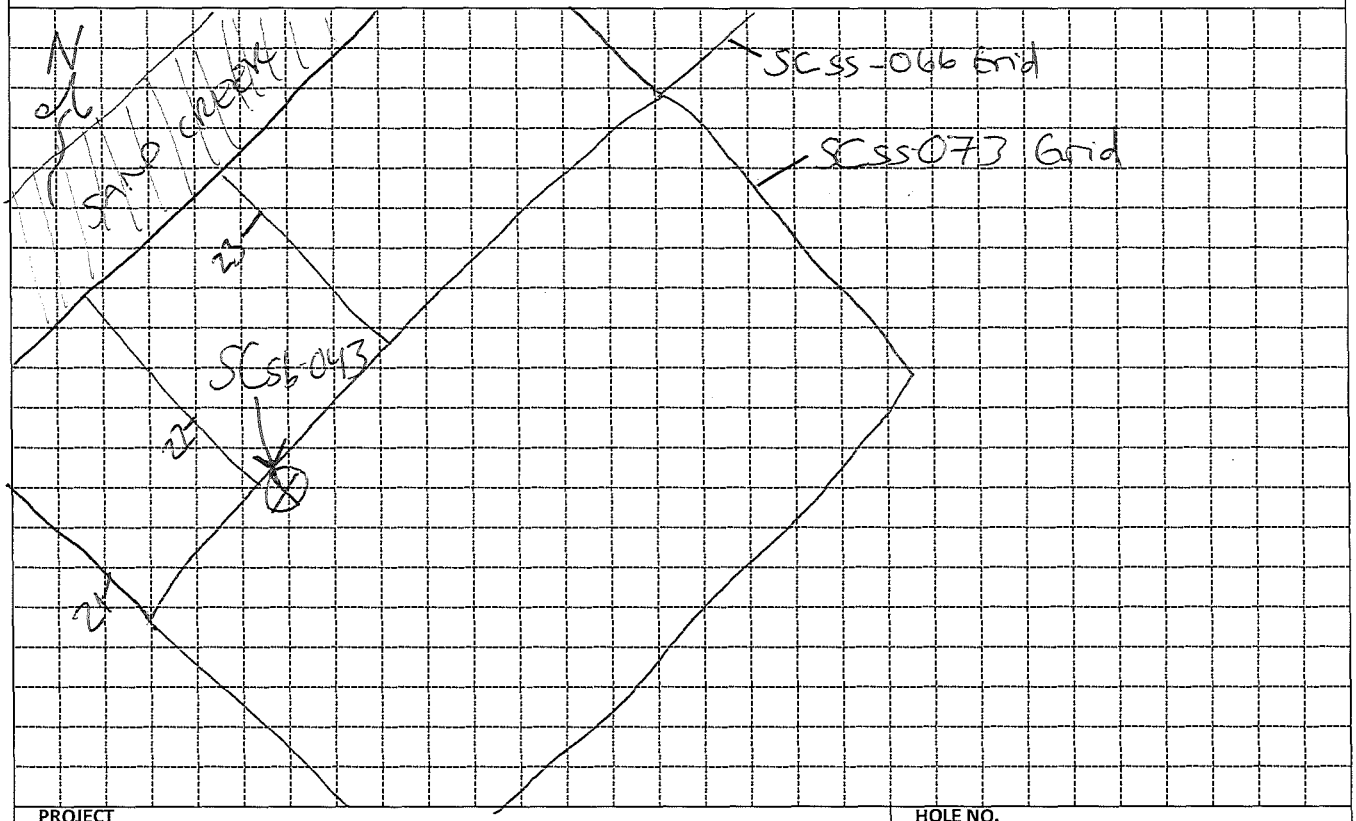
	DISTRICT	HOLE NUMBER: SCSb-043
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Jeremy L.	6. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6620 DT	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: Geoprobe 6620 DT Trackmounted rig	8. HOLE LOCATION: SCSb-043	
	9. SURFACE ELEVATION: 973'	
	10. DATE STARTED: 9/21/10	11. DATE COMPLETED: 9/21/10
12. OVERBURDEN THICKNESS: NA	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 20'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives	SVOC		100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓ bentonite			

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCSb-043

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCSB-043

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: S. Barry, P. McCann, R. Harvin

SHEET 1 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	2–5	Light brown, dry, loose, FINE SAND, tr. gravel	0.0 ppm	NA	See Remarks	NA	SCSb-043m-0001-SO 1100
	5–7			NA	See Remarks		SCsb-043m-0002-SO 1105
	8–9	Brown, moist, dense F. SAND, little silt	0.0 ppm	NA	See Remarks		SCsb-043m-0003-SO 1115
	12–13	Gray, moist, dense, SILT (12–14.3')	0.0 ppm	NA	See Remarks		SCsb-043m-0004-SO 1120
	14–15	L. brown, moist, dense, FINE SAND & SILT (14.3–16')					
	17–19	Gray, moist, dense, CLAY	0.0 ppm	NA	See Remarks		SCsb-043m-0005-SO 1135

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCSb-043

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

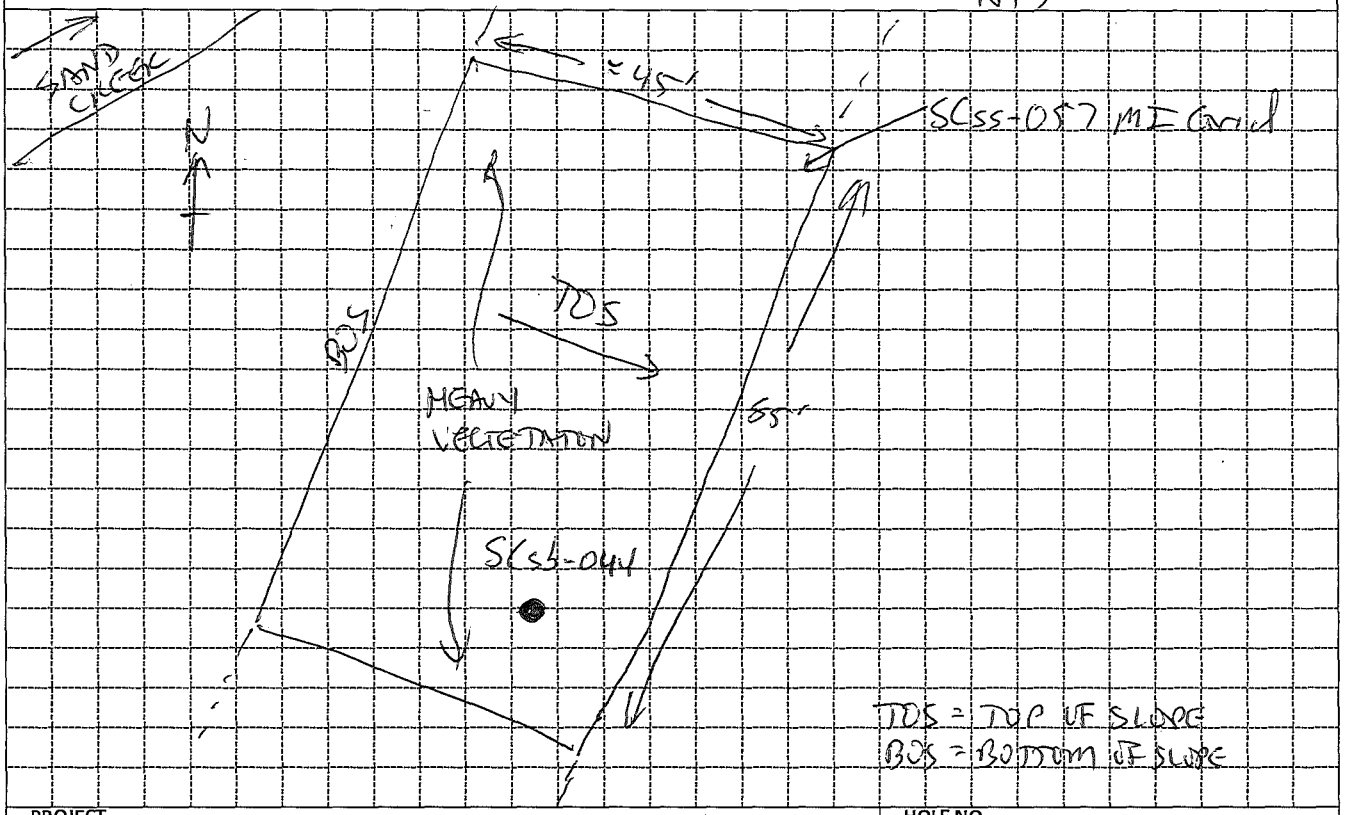
DISTRICT		HOLE NUMBER: SCSS-044
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: JOE RASNACK, KYLE HAVENS, DAVID CRISPO	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS HAND AUGER	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER	8. HOLE LOCATION: SCSS-044	
	9. SURFACE ELEVATION: 958'	
	10. DATE STARTED: 9/24/10	11. DATE COMPLETED: 9/24/10
12. OVERBURDEN THICKNESS: >5' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: ≈ 4.5'	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTRICT	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	EXPLOSIVES	SVOCS	NA	/00 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	GROUT	Dan

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCSS-044

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-044

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: [illegible]

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
		Loamy, dark organic soil					
		dense, brown, moist silty clay	0.0 ppm	NA	NA	NA	No sample collected for 0-1' interval
	1	dense light brown moist silty clay w/ dark material (1-2.5')	0.0 ppm		SCsb-044		SCsb-044 via cyclone, to MI for 1-5' interval
	2	dense, dark brown silty clay (2.5-3.5')	0.0 ppm				
	3	gray, moist, dense silty clay (3.5-4.5')	0.0 ppm				
	4						
▽		wet, brown, sandy silt	0.0 ppm				gwat @ 4.5'
		EOB @ 5'					

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-044

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

Sample # SCsb-044m-0001-SO @ 1525

HTRW DRILLING LOG

DISTRICT	HOLE NUMBER
	SCsb-045

1. COMPANY NAME	2. DRILL CONTRACTOR	SHEET / SHEET
The Shaw Group - Shaw E&I	~~Econtz Drilling~~ NA	1 OF 2

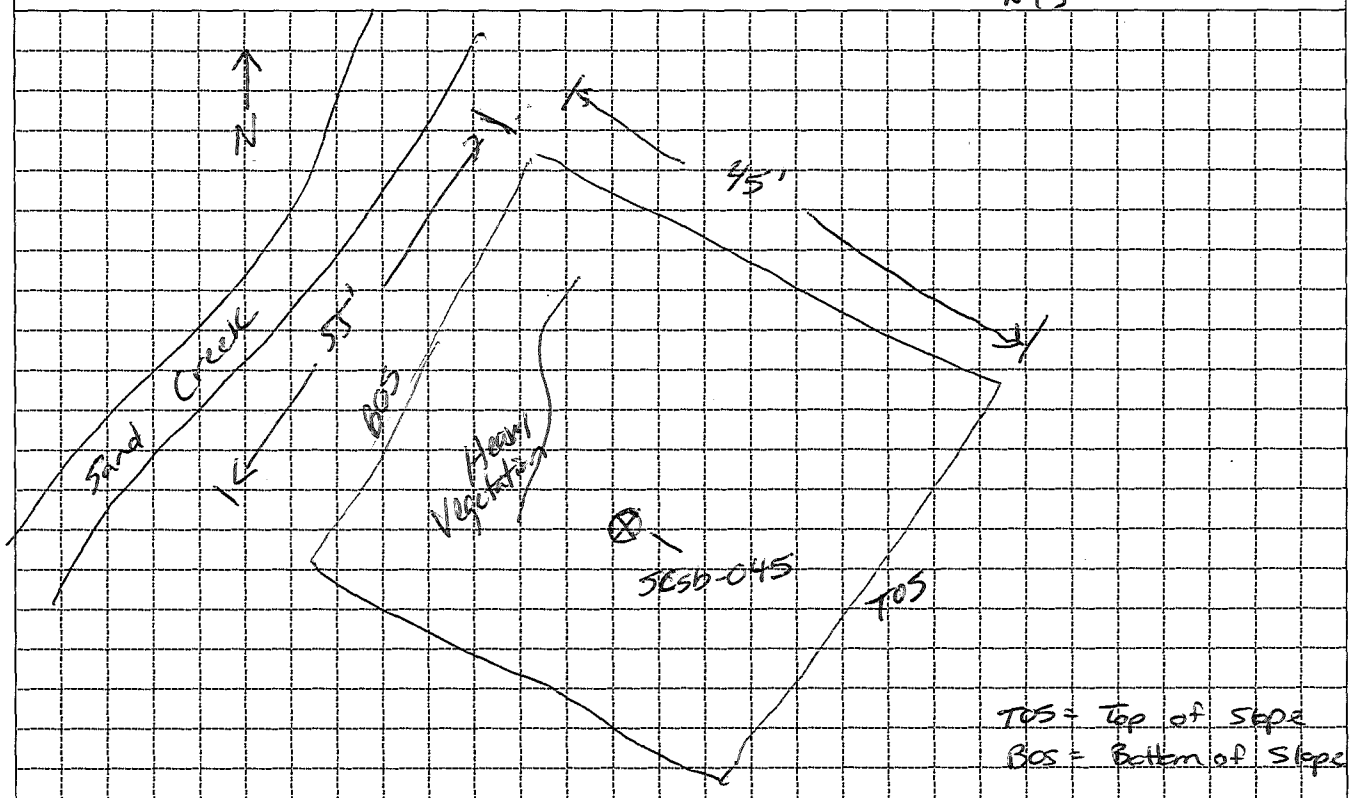
3. PROJECT	4. LOCATION
RVAAP - MI Sampling (Ravenna A/E: 133616)	Ravenna, Ohio
5. NAME OF DRILLER	**6. MANUFACTURER'S DESIGNATION OF DRILL**
Joe Rasnack, Kyle Havens	AMS Hand Auger
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	**8. HOLE LOCATION**
3" Hand Auger	SCsb-045
	9. SURFACE ELEVATION 958'
	10. DATE STARTED 9/25/10 / **11. DATE COMPLETED** 9/25/10
12. OVERBURDEN THICKNESS >5' (max Depth)	**15. DEPTH OF GROUNDWATER ENCOUNTERED** NA
13. DEPTH DRILLED INTO ROCK NA	**16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED** NA
14. TOTAL DEPTH OF HOLE 4'	**17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)** NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives	SVOCs	NA	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	Grout	

LOCATION SKETCH/COMMENTS ~~SCALE:~~ NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-045

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-045

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
		Organics loam, silty clay w/ some mixed white debris	0.0ppm	NA	NA	NA	No sample collected for 0-1' interval
	1	dense light brown silty w/ mixed white debris	0.0ppm		SCsb-045		SCsb-045 via composite MI for 1-5' interval
	2	dark brown/ black dense material, with mixed white material	0.0ppm				
	3	grey mixed silt and clay w/ mixed white material	0.0ppm				
	4	Hit Refusal.					

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCsb-045

ENG FORM 5056A-R. AUG 94 (Proponent: CECW-EG)

Sample # SCsb-045m-0001-SO @ 1000

sampled @ 0905

HTRW DRILLING LOG

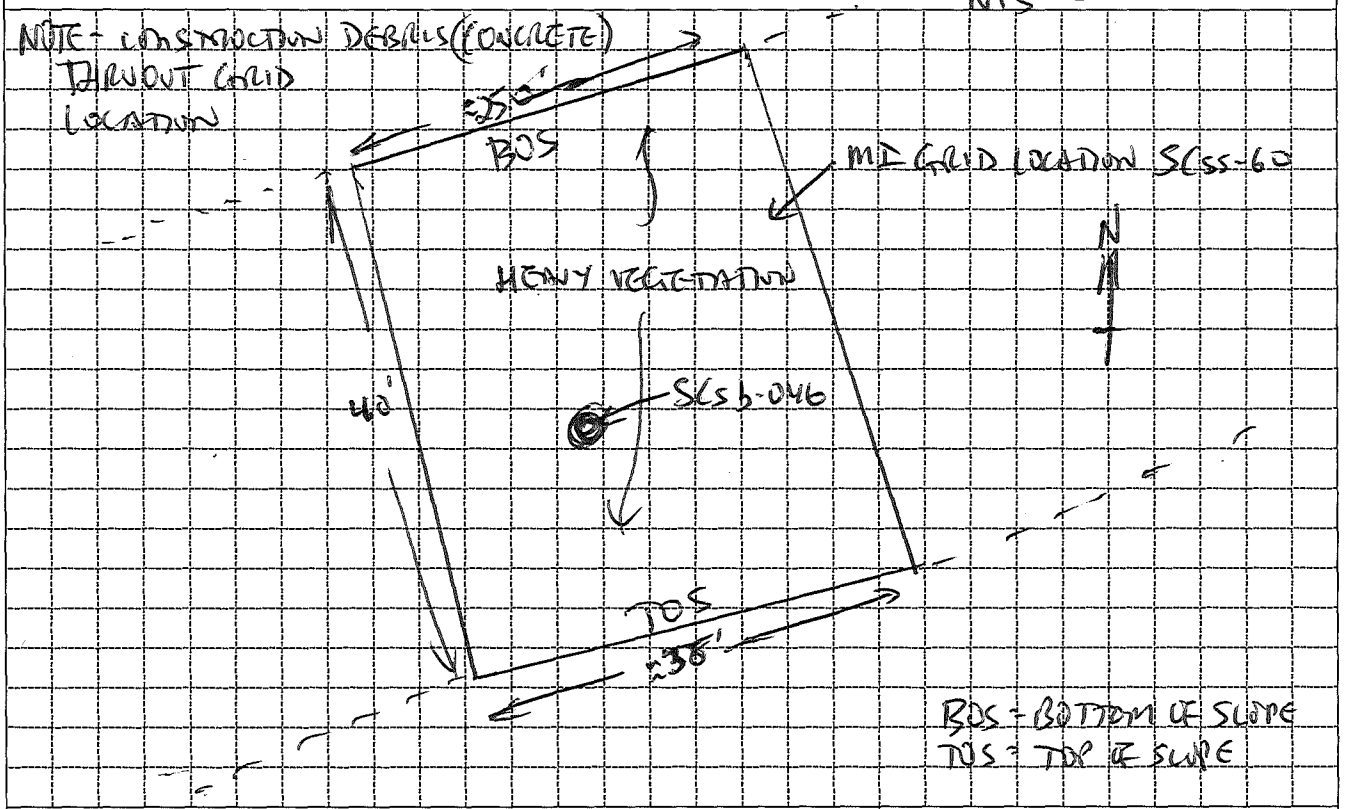
DISTRICT		HOLE NUMBER: SCss-046
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA (DC) 9/29/10	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: BRIAN McCARTHY, HARRY HARRISON, DAVID CRISPO	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER	8. HOLE LOCATION: SCss-046	
	9. SURFACE ELEVATION: 958'	
	10. DATE STARTED: 9/29/10	11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: > 5' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	NA	✓	Explosives	SVOCs	Cr+6	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCss-046

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCSb-046

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: DTC

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	moist, dark organic soils to light brown clay silt w/ silt	0.0 ppm	NA	NA	NA	No sample collected 0-1' interval
	1	moist, loose to dense light brown clay w/ sand to gray clay (1-3')	0.0 ppm		SCSb-046		SCSb-046 via composite MI for 1-5' interval
	2		0.0 ppm				
	3	moist, dense light brown clay w/ silt	0.0 ppm				
	4	Dense gray silty clay w/ brick	0.0 ppm				
	5						

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCSb-046

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

Sampled @ 10:15

HTRW DRILLING LOG

DISTRICT

HOLE NUMBER: SCSS-047

1. COMPANY NAME: The Shaw Group - Shaw E&I

2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA (SV) 9/29/10

SHEET 1 OF 2

3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

4. LOCATION: Ravenna, Ohio

5. NAME OF DRILLER: BRIAN MCCARDY, HARRY HARRISON, DAVID CRISP

6. MANUFACTURER'S DESIGNATION OF DRILL: AMS

7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER

8. HOLE LOCATION: SCSS-047

9. SURFACE ELEVATION: 958'

10. DATE STARTED: 9/29/10

11. DATE COMPLETED: 9/29/10

12. OVERBURDEN THICKNESS: >3' (MAX DEPTH)

15. DEPTH OF GROUNDWATER ENCOUNTERED: NA

13. DEPTH DRILLED INTO ROCK: NA

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA

14. TOTAL DEPTH OF HOLE: 3' (STOPPED OUT 3 TIMES FROM 1ST LOCATION)

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

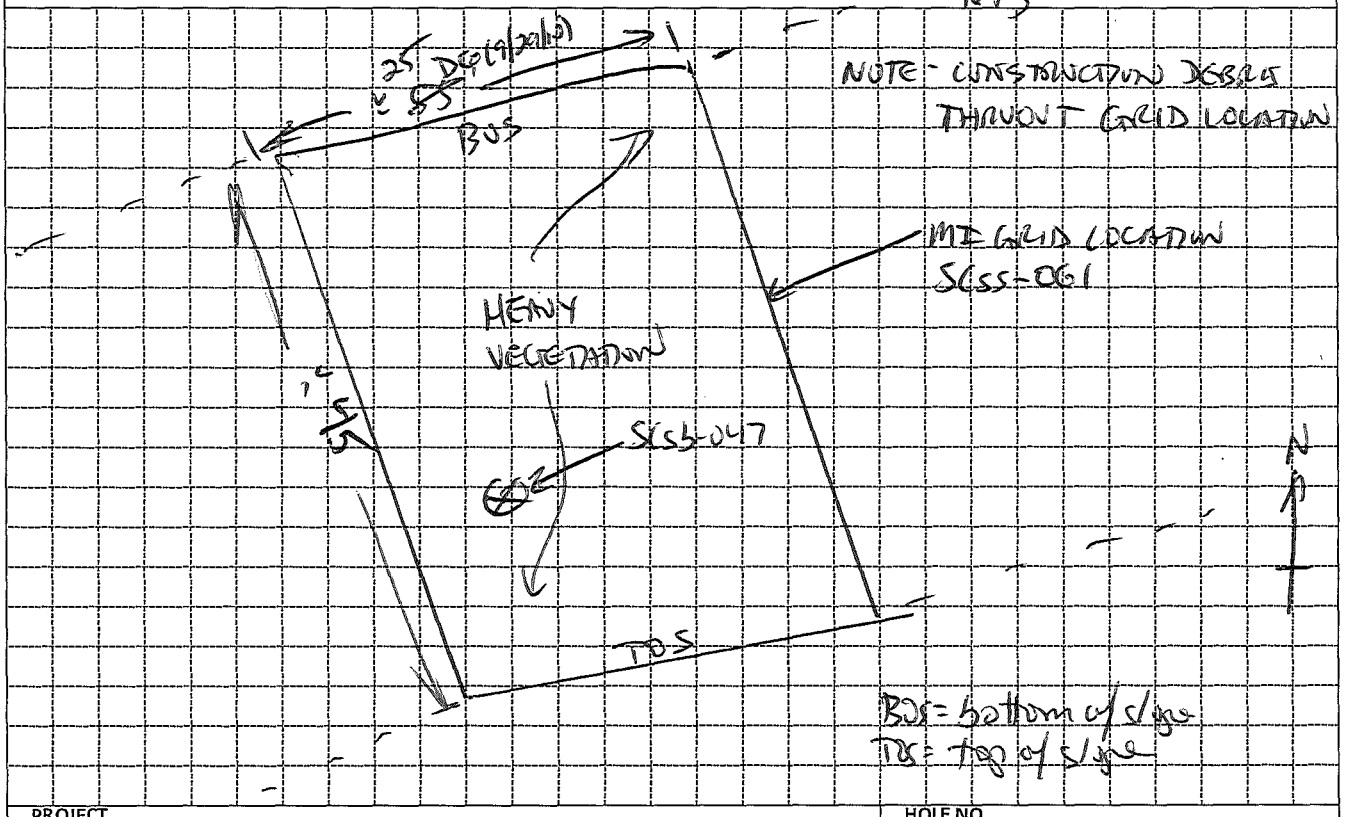
18. GEOTECHNICAL SAMPLES: DISTURBED ✓ | UNDISTURBED

19. OTAL NUMBER OF CORE BOXES: NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	NA	✓	EXP	SVOCS		100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓		GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCSS-047

ENG FORM 5056-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCS5-047

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1	Fill material, dark brown soil w/ organics w/ concrete and slag (0-1.5')	0.0 ppm	NA		NA	No samples collected @ 0-1' interval
	1.5	light to dark brown sand soil (fill material) w/ slag	0.0 ppm		SCS5-047		SCS5-047 via composite MI for 1-3' interval
	2		0.0 ppm				
	3	Refusal at 3' (consistently encountered slag)					

NOTE: stepped out from original boring location ≈ 10 feet due west. MAX Depth of penetration was 3' at third step out location.

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCS5-047

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

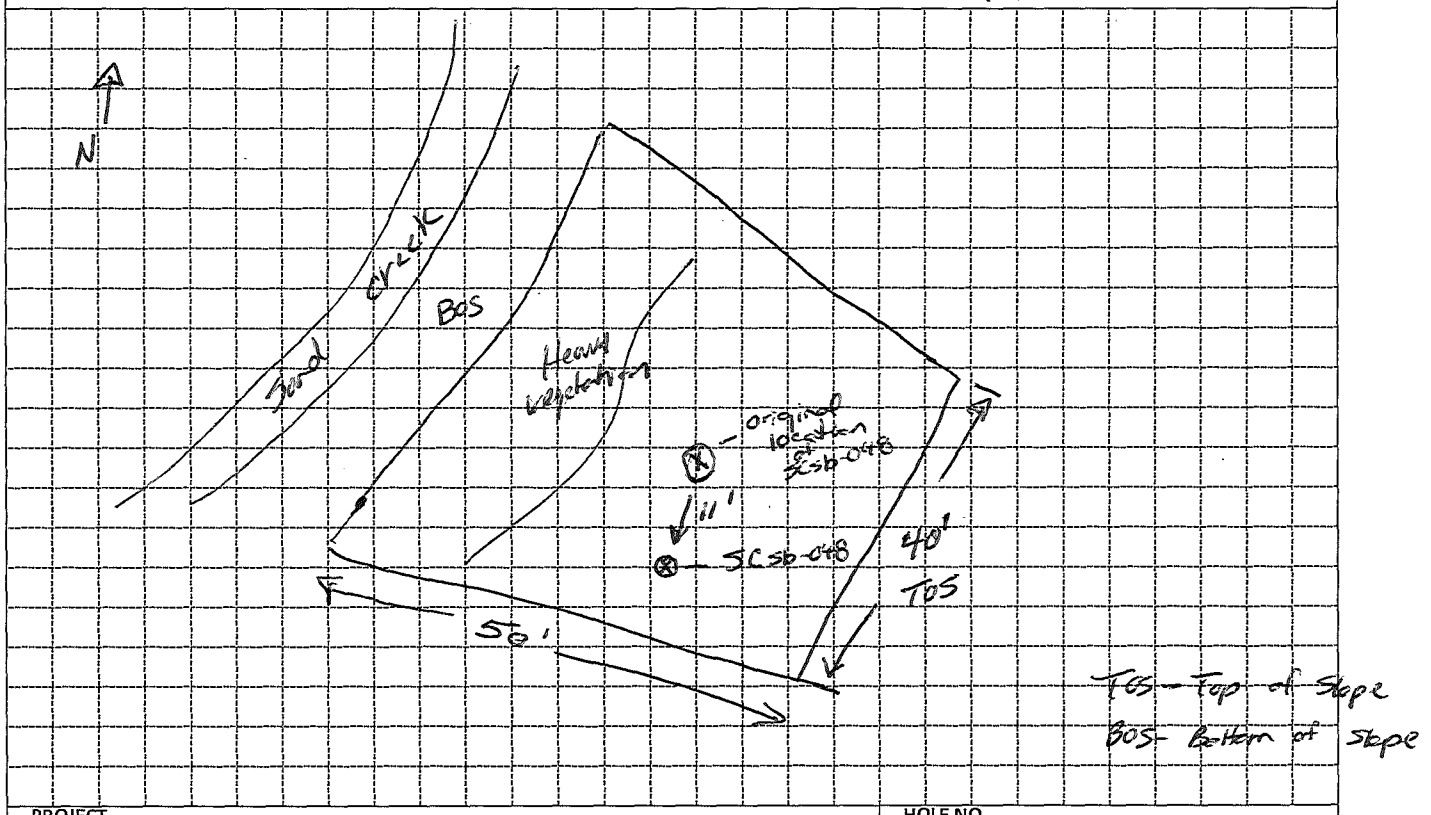
DISTRICT		HOLE NUMBER: SCsb-048
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Kyle Havens, Joe Rasnack	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS Hand Auger	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" Hand Auger	8. HOLE LOCATION: SCsb-048	
	9. SURFACE ELEVATION: 954'	
	10. DATE STARTED: 9/29/10	11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: > 5' (max. Depth)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 3.5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
NA	✓		~~NA~~ PCBs, Cyanide, Propellants

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	✓	✓	Explosives	SVOCs	Pesticides	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	~~Grout~~	

LOCATION SKETCH/COMMENTS — SCALE: ~~NTS~~



TOS - Top of Slope
BOS - Bottom of Slope

PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-048

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-048

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	Dark brown loam, dry, w/ organics	0.0 ppm	NA	NA	NA	No sample collected for 0-1' interval
	1	Dark brown dry silt w/ numerous rocks	0.0 ppm	~~SCsb-048~~	SCsb-048		SCsb-048 via composite MI for 1-3.5' interval
	2	Dark brown dry silt w/ mixed light brown clay, many rocks	0.0 ppm				
	3	Dark brown dry silt w/ mixed light brown clay, many rocks. Hit Refusal 3.5'	0.0 ppm				
	4						
	5	~~EOB~~					

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCsb-048

ENG FORM 5056A-R. AUG 94 (Proponent: CECW-EG)

Samples:
SCsb-048m-0001-SO @ 0925
SCsb-084m-0001-SO @ 0930
SCsb-048m-0001-SO (Army Dup.) @ 0935
SCsb-048d-0001-SO @ 0940
SCsb-084d-0001-SO @ 0945

HTRW DRILLING LOG

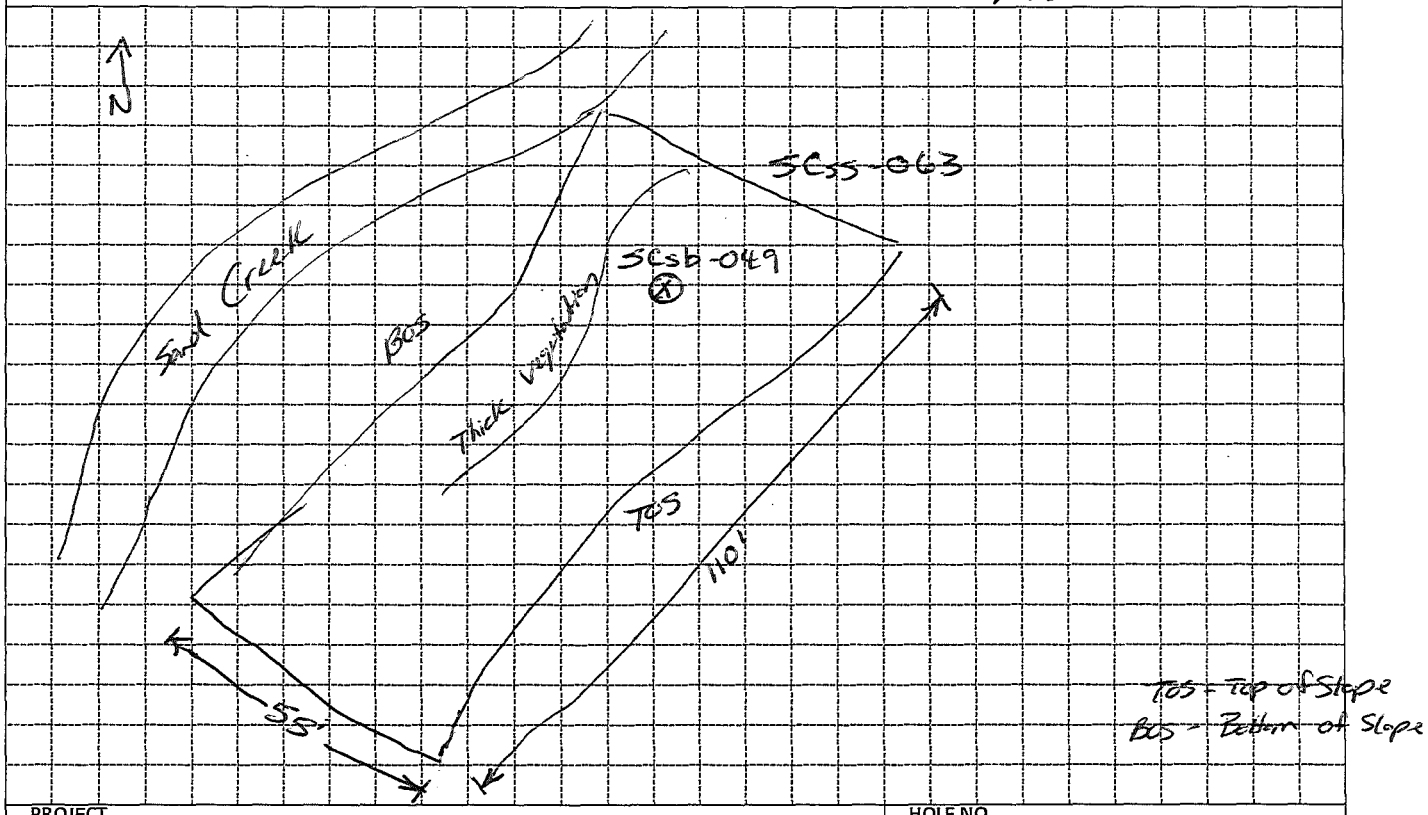
DISTRICT		HOLE NUMBER: SCsb-049
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Kyle Havens, Joe Rasnack	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS Hand Auger	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" Hand Auger	8. HOLE LOCATION: SCsb-049	
	9. SURFACE ELEVATION: 958'	
	10. DATE STARTED: 9/29/10	11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: >5' (max. depth)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTRICT	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY: 100 %
		✓	Explosives	SVOCs	NA	

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	Grout	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-049

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-049

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: [signature]

SHEET: 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1	Damp dark brown loam w/ mixed clay and organics	0.0ppm	NA	NA	NA	No sample collected for 0-1' interval
	2	Damp dark brown loam w/ mixed clay and plastic debris	0.0ppm		SCsb-049		SCsb-049 via composite MI for 1-5' interval
	3	Damp light brown clay w/ mixed dark brown silt	0.0ppm				
	4	Damp/wet light brown to dark brown clay w/ some grey clay (trace)	0.0ppm				
	5	wet Light brown / grey clay, w/ some dark silt	0.0ppm				

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO.: SCsb-049

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

Sample # SCsb-049m-0001-SO @ 1025

Sampled @ 11:10

HTRW DRILLING LOG

DISTRICT	HOLE NUMBER
	SCS5-050

1. COMPANY NAME	2. DRILL CONTRACTOR	SHEET	SHEET
The Shaw Group - Shaw E&I	~~Frontz Drilling~~ NA (SD) 9/29/10	1	OF 2

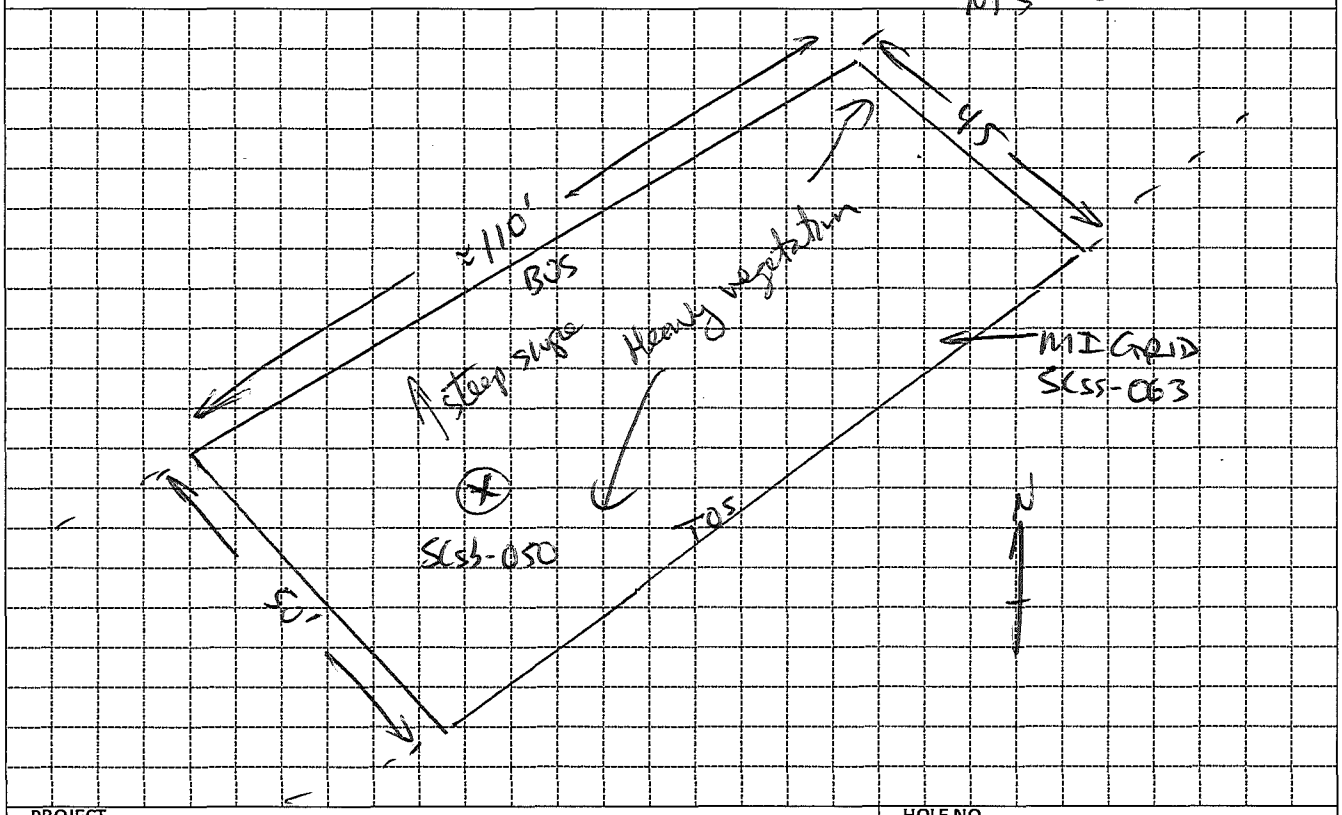
3. PROJECT	4. LOCATION
RVAAP - MI Sampling (Ravenna A/E: 133616)	Ravenna, Ohio
5. NAME OF DRILLER: McCarthy, Harrison, Crispo	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER	8. HOLE LOCATION: SCS5-050
	9. SURFACE ELEVATION: 954'
	10. DATE STARTED: 9/29/10 — 11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: >4.5' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA
14. TOTAL DEPTH OF HOLE: 4.5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	EXPLOSIVES	SVOCs		100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓		GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCS5-050

HTRW DRILLING LOG

HOLE NUMBER: SCSB-050

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1	Dark brown top soil w/organics (0-2')	0.0 ppm	NA	NA	NA	No samples collected at 0-1'
	2		0.2 ppm		SCSB-050		SCSB-050 via composite MI for 1-4.5' interval
	3	loose sandy soil, light to darker brown w/ some gravel	0.0 ppm				
	4	loose, light brown sandy clay	0.0 ppm				
		Refusal @ 4.5' (roots)					

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCSB-050

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

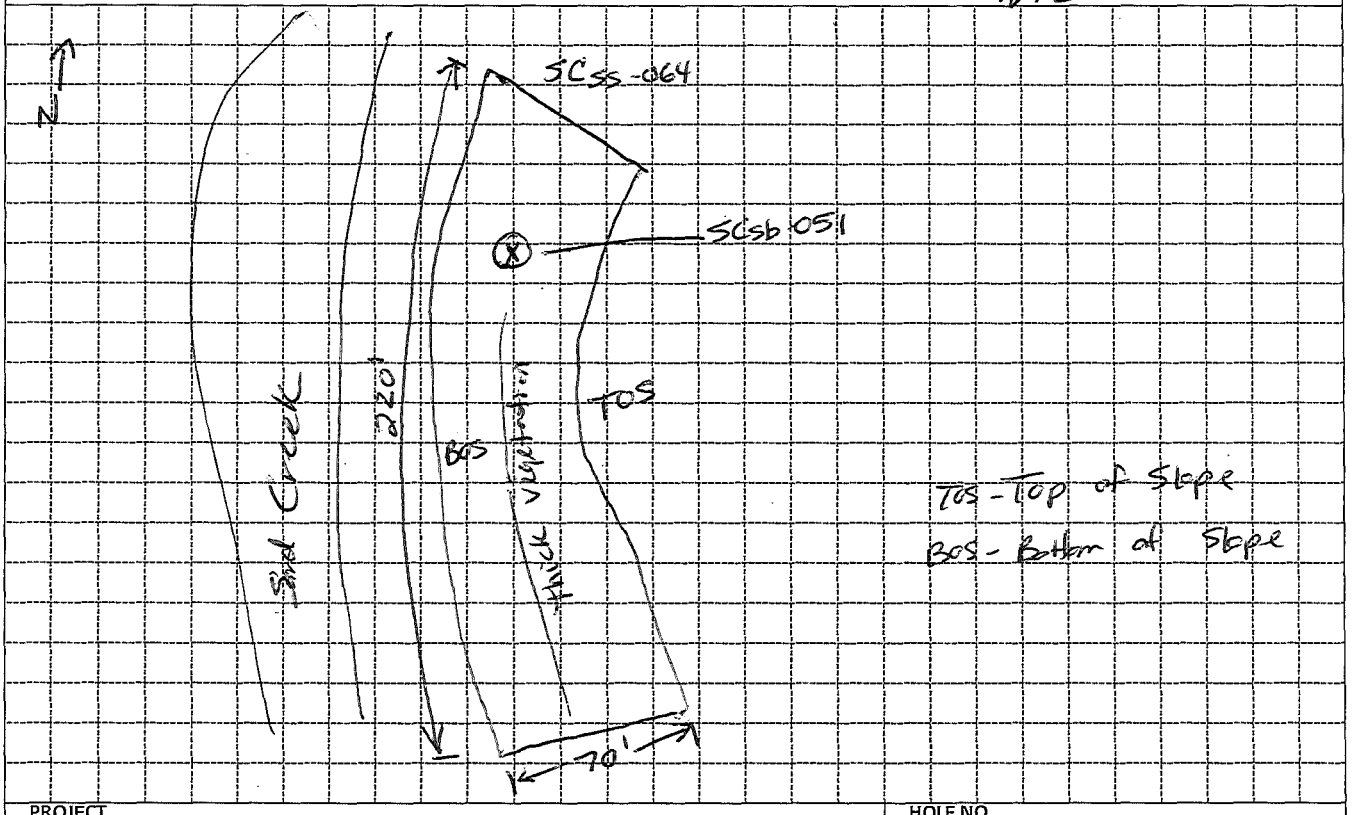
	DISTRICT	HOLE NUMBER: SCsb-051
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: Kyle Havens, Joe Rasnack	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS Hand Auger	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" Hand Auger	8. HOLE LOCATION: SCsb-051	
	9. SURFACE ELEVATION: 954'	
	10. DATE STARTED: 9/29/10	11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: >5' (Max Depth)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTRIBUTED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives	SVOCs	Hex Cr.	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	Grout	

LOCATION SKETCH/COMMENTS — SCALE: NTS



TOS - Top of Slope

BOS - Bottom of Slope

PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-051

HTRW DRILLING LOG

HOLE NUMBER: SCsb-051

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	Light brown dry loam w/ mixed organics	0.0ppm	NA	NA	NA	No Sample collected for 0-1' interval
	1	Light brown silt, dry, w/ sparse clay	0.0ppm		SCsb051		SCsb-051 via composite MI for 1-5' interval
	2	Light brown dry silt w/ mixed grey clay	0.0ppm				
	3	Light brown dry silt w/ mixed grey clay	0.0ppm				
	4	Grey clay, dry.	0.0ppm				
	5	EOB @ 5'					

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCsb-051

ENG FORM 5056A-R. AUG 94 051 (Proponent: CECW-EG)

Sample #: SCsb-051m-0001-SO @ 1130
SCsb-051m-0001-MS @ 1135
SCsb-051m-0001-MD @ 1140

HTRW DRILLING LOG

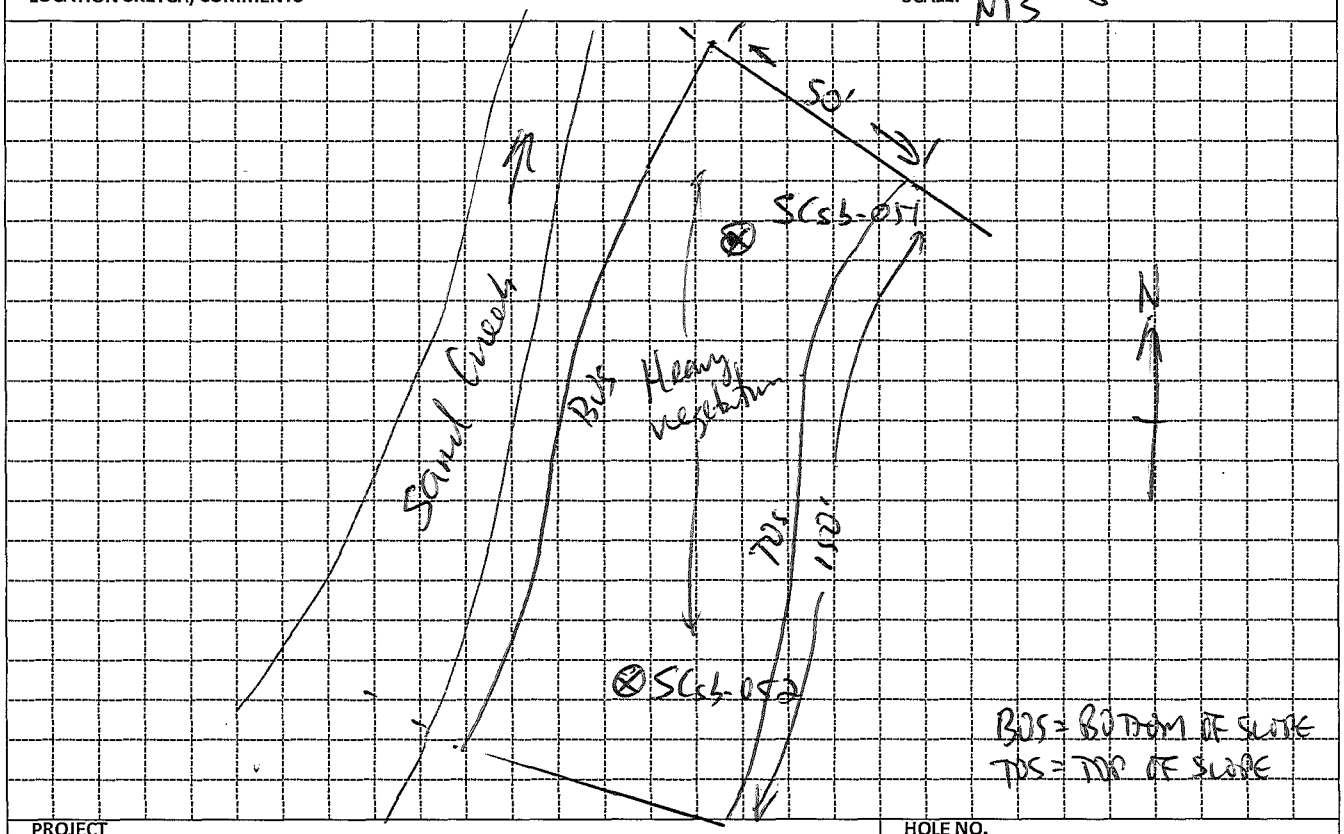
DISTRICT		HOLE NUMBER: SCsb-052
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: ~~Frontz Drilling~~ NA (DC) 9/29/10	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: McCarthy, Harrison, Crisco	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER	8. HOLE LOCATION: SCsb-052	
	9. SURFACE ELEVATION: 954'	
	10. DATE STARTED: 9/29/10	11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: 75' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
	NA	✓	EXPLOSIVES	SVOCs	—	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓		GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-052

ENG FORM 5056-R, AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCS6-052

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: DLG

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1	Dark to gray dense silty clay (1-2.5')	0.0 ppm	NA	NA	NA	NO samples collected at 0-1'
	2		0.0 ppm		SCS6-052		SCS6-052 via composite MI for 1-5' interval
	3	Light brown dense silty clay	0.0 ppm				
	4	Very dense gray silty clay	0.0 ppm				
	5		0.0 ppm				

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCS6-052

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

Sample collected @ 12:40

HTRW DRILLING LOG

DISTRICT	HOLE NUMBER
	SCSS-053

1. COMPANY NAME	2. DRILL CONTRACTOR	SHEET	SHEET
The Shaw Group - Shaw E&I	~~Frontz Drilling~~ NA (ISC) 9/29/10	1 OF	2

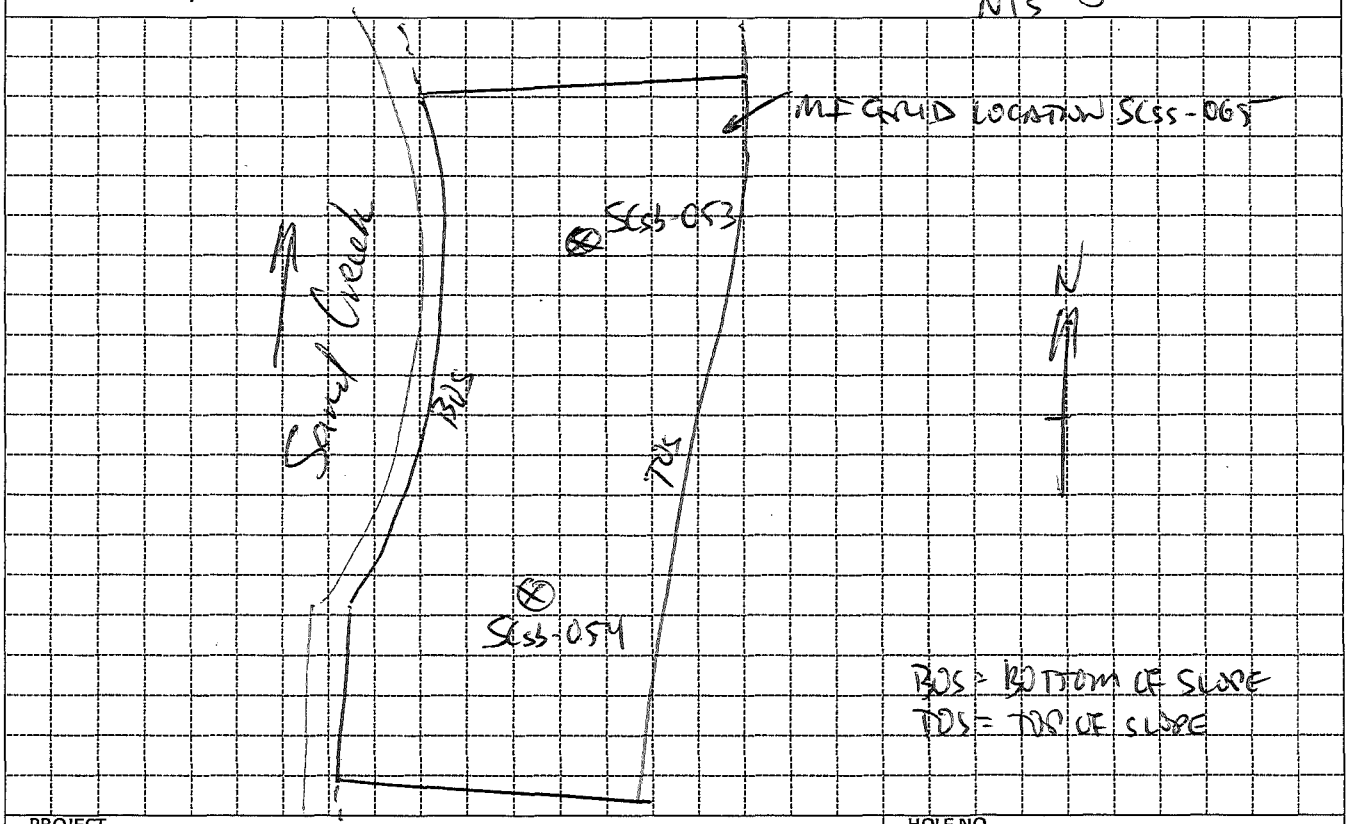
3. PROJECT	4. LOCATION
RVAAP - MI Sampling (Ravenna A/E: 133616)	Ravenna, Ohio
5. NAME OF DRILLER: McCarthy, Harrison, Crisp	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION: SCSS-053
	9. SURFACE ELEVATION: 958'
	10. DATE STARTED: 9/29/10 — 11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: 75' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives	SVOCs		100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓		GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCSS-053

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCSB-053

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	light brown sandy soil w/ trace organics	0.0 ppm	NA	NA	NA	NO samples collected from 0-1' interval
	1	SAME	0.0 ppm		SCSB-053		SCSB-052 via MD subs for Sampling for 1-5' interval
	2	light brown sandy soil	0.0 ppm				
	3	dense gray silty clay	0.0 ppm				
	4	SAME	0.0 ppm				
	5						

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCSB-053

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

HTRW DRILLING LOG

DISTRICT	HOLE NUMBER
	SCsb-054

1. COMPANY NAME	2. DRILL CONTRACTOR	SHEET
The Shaw Group - Shaw E&I	~~Frontz Drilling~~ NA	1 OF 2

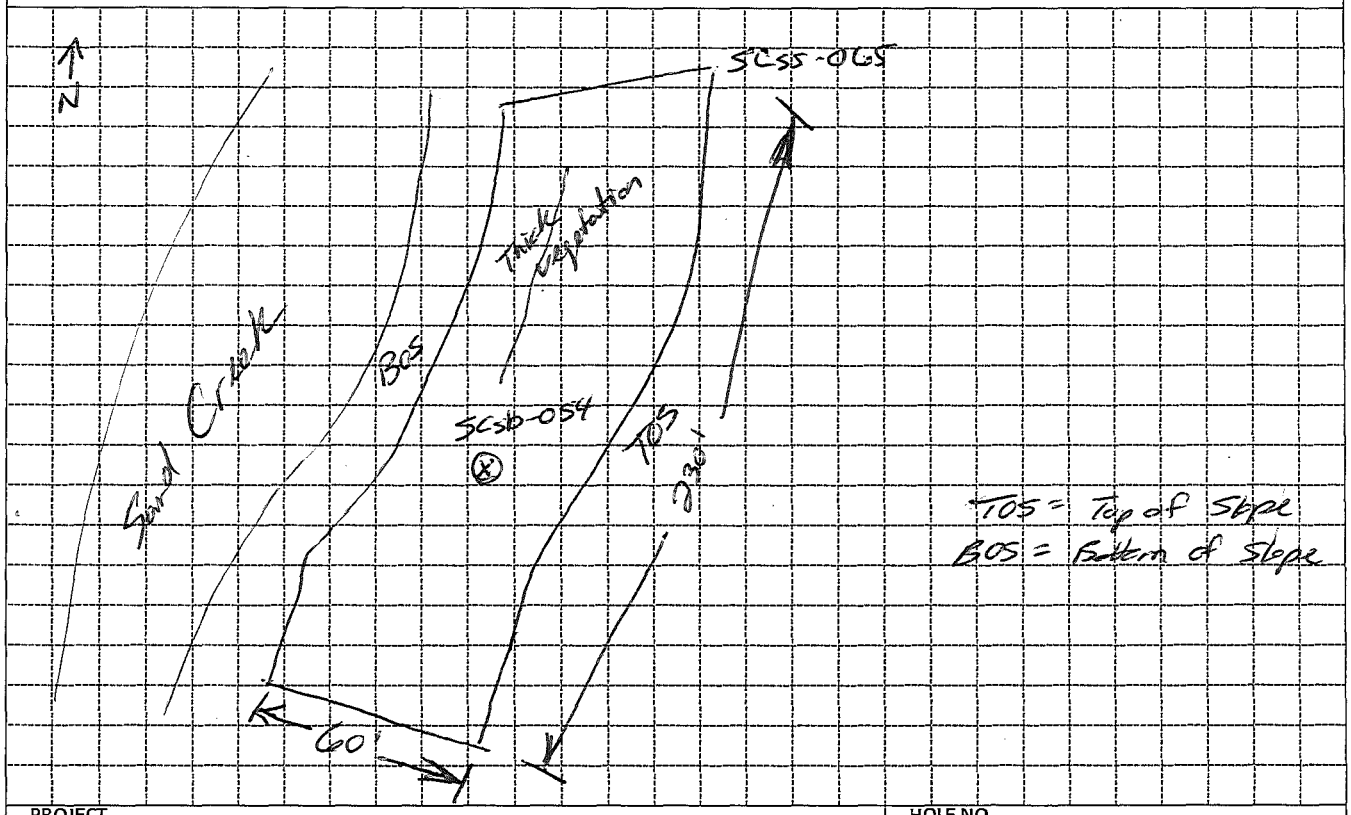
3. PROJECT	4. LOCATION
RVAAP - MI Sampling (Ravenna A/E: 133616)	Ravenna, Ohio
5. NAME OF DRILLER: Kyle Havens, Joe Rasnack	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS Hand Auger
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" Hand Auger	8. HOLE LOCATION: SCsb-054
	9. SURFACE ELEVATION: 958'
	10. DATE STARTED: 9/29/10 / 11. DATE COMPLETED: 9/29/10
12. OVERBURDEN THICKNESS: > 5' (max depth)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES	DISTRICT	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA	✓		NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	Explosives	SVOCs	NA	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	Grout	

LOCATION SKETCH/COMMENTS — SCALE:



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCsb-054

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-054

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR:

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1	Light brown silty clay w/ mixed organics	0.0 ppm	NA	NA	NA	No Sample collected for 0-1' interval
	2	Light brown/grey clay, dry	0.0 ppm		SCsb-054		SCsb-054 via composite MI for 1'-5' interval
	3	Light brown/grey clay, dry	0.0 ppm				
	4	Light brown/grey clay, dry	0.0 ppm				
	5	Light brown/grey clay, dry EOB @ 5'	0.0 ppm				

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCsb-054

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

Sample # SCsb-054m-0001-SO @ 1235

HTRW DRILLING LOG

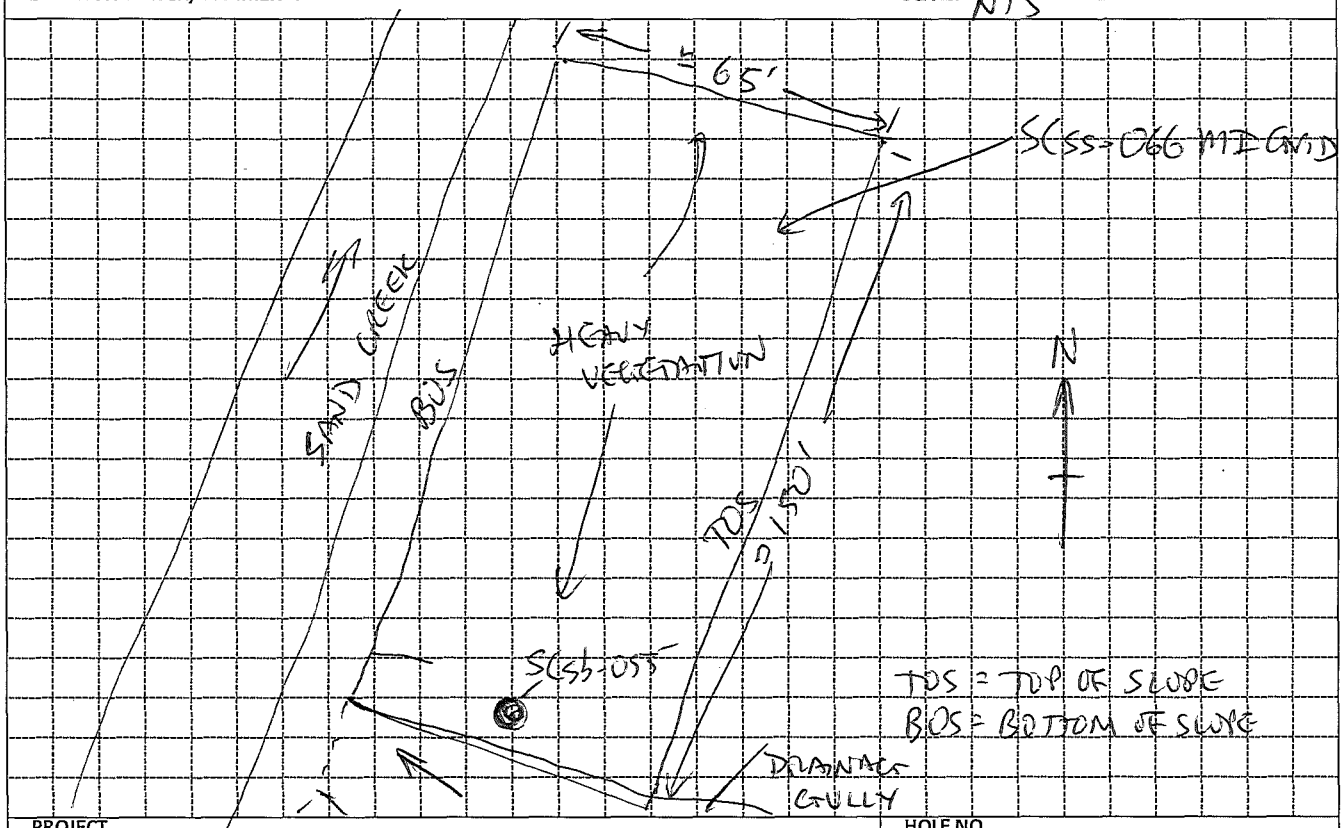
DISTRICT		HOLE NUMBER: SCSS-055
1. COMPANY NAME: The Shaw Group - Shaw E&I	2. DRILL CONTRACTOR: Frontz Drilling	SHEET 1 OF 2
3. PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)	4. LOCATION: Ravenna, Ohio	
5. NAME OF DRILLER: JOE FLASNACK, KYLE HANGNS, DAVID CRISPO	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS HAND AUGER	
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER	8. HOLE LOCATION: SCSS-055	
	9. SURFACE ELEVATION: 938'	
	10. DATE STARTED: 9/25/10	11. DATE COMPLETED: 9/25/10
12. OVERBURDEN THICKNESS: >5' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA	
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA	
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	SVOCs	EXPLOSIVES	HEX CR	NO %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	SCSS-055

ENG FORM 5056-R. AUG 94 (Proponent: CECW-EG)

HTRW DRILLING LOG

HOLE NUMBER: SCsb-055

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: [illegible]

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	1	dry to moist light brown silty clay w/organics	0.0 ppm	NA	NA	NA	NO SAMPLE COLLECTED AT 0-1' INTERVAL
	2	light brown silty clay, loose, dry (1-3')	0.0 ppm		SCsb-055		SCsb-055 via composite SVS surface MI for 1-5' interval
	3	SAME	0.0 ppm				
	4	moist, loose to dense ~~brown~~ (gray) brown silty clay and gray clay mixed. (4-5')	0.0 ppm				
	5	SAME	0.0 ppm				

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCsb-055

ENG FORM 5056A-R. AUG 94 (Proponent: CECW-EG)

Sample # SCsb-055m-0001-SO @ 1205

HTRW DRILLING LOG

DISTRICT	HOLE NUMBER
	SCSS-056

1. COMPANY NAME	2. DRILL CONTRACTOR	SHEET	SHEET
The Shaw Group - Shaw E&I	Frontz Drilling	1 OF	2

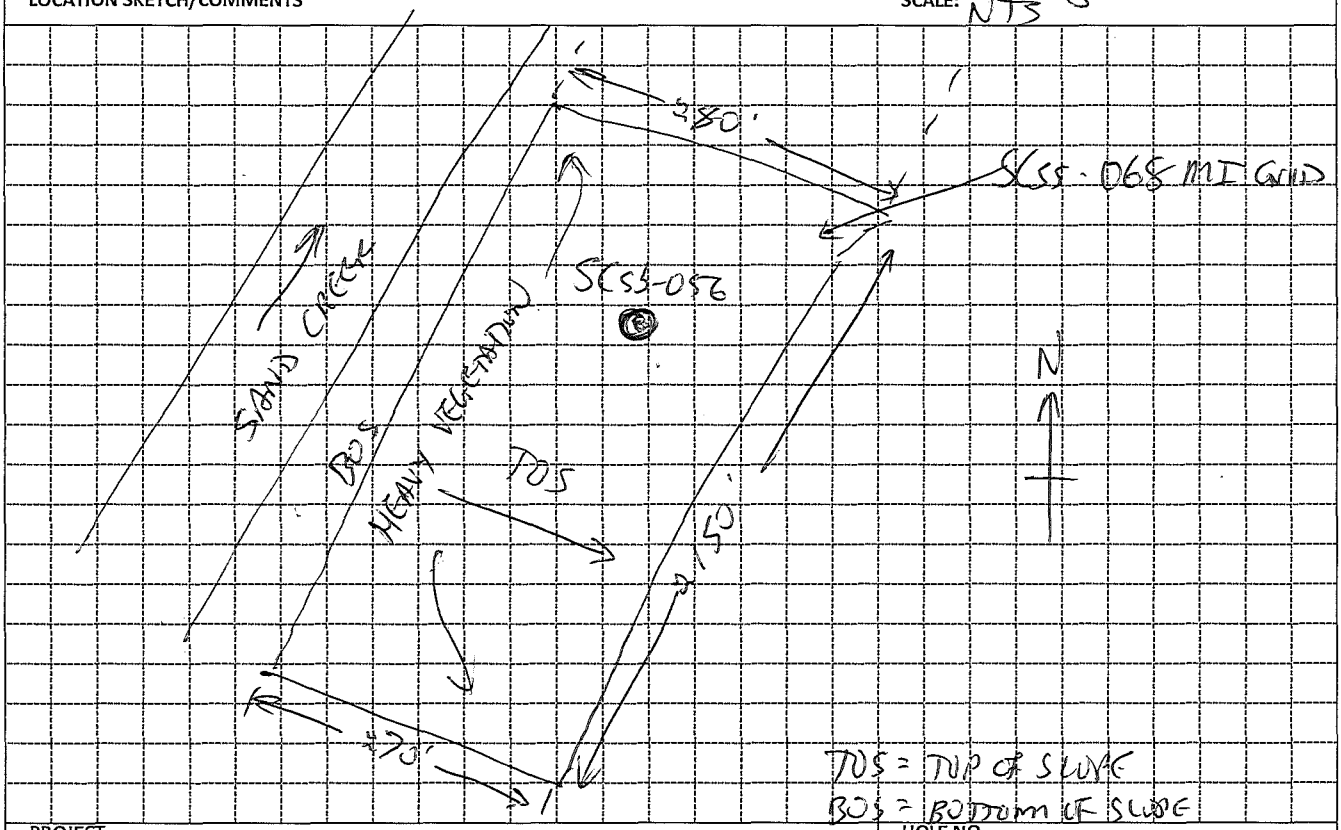
3. PROJECT	4. LOCATION
RVAAP - MI Sampling (Ravenna A/E: 133616)	Ravenna, Ohio
5. NAME OF DRILLER: JOE RASNACK, KYLE HAVENS, DAVID CRISPO	6. MANUFACTURER'S DESIGNATION OF DRILL: AMS HAND AUGER
7. SIZE AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 3" HAND AUGER	8. HOLE LOCATION: SCSS-056
	9. SURFACE ELEVATION: 961'
	10. DATE STARTED: 9/25/10 — 11. DATE COMPLETED: 9/25/10
12. OVERBURDEN THICKNESS: > 5' (MAX DEPTH)	15. DEPTH OF GROUNDWATER ENCOUNTERED: NA
13. DEPTH DRILLED INTO ROCK: NA	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: NA
14. TOTAL DEPTH OF HOLE: 5'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): NA

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. OTAL NUMBER OF CORE BOXES
NA			

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
		✓	EXPLOSIVES	SVOCs	NA	100 %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	NA	GROUT	

LOCATION SKETCH/COMMENTS — SCALE: NTS



PROJECT	HOLE NO.
RVAAP - MI Sampling (Ravenna A/E: 133616)	

HTRW DRILLING LOG

HOLE NUMBER: SCSb-056

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

INSPECTOR: [illegible]

SHEET 2 OF 2

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIAL (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)
	0	light brown, silty clay w/ organics, dry, loose	0.0 ppm	NA	NA	NA	No sample collected at 0-1' interval
	1	dry, light brown, silty clay, loose to dense (1-3')	0.0 ppm		SCSb-056		SCSb-056 via composite sub-surface MI for 1-5' interval
	2		0.0 ppm				
	3	dry, dense light gray clay mixed w/ light brown loose silty clay	0.0 ppm				
	4	dry dense gray and brown clay	0.0 ppm				
	5						

PROJECT: RVAAP - MI Sampling (Ravenna A/E: 133616)

HOLE NO. SCSb-056

ENG FORM 5056A-R. AUG 94

(Proponent: CECW-EG)

Sample #: SCSb-056m-0001-SO @ 1120

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Chains of Custody

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Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

Folder #: 81543
Company: SHAW E&I INC
Project: RAVAAP IRP
Logged By: JLS PM: ET

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater **SW** - surface water **WW** - wastewater **DW** - drinking water
S - soil/sediment **SL** - sludge **A** - air **M** - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.21.10	1100	S	grab	SCsb-043m-0001-SO	N	X	X	X											1		850257
09.21.10	1105	S	grab	SCsb-043m-0002-SO	N	X	X	X											1		850302
09.21.10	1115	S	grab	SCsb-043m-003-SO	N	X	X	X											1		850303
09.21.10	1120	S	grab	SCsb-043m-0004-SO	N	X	X	X											1		850304
09.21.10	1135	S	grab	SCsb-043m-0005-SO	N	X	X	X											1		850305
09.21.10	1330	S	grab	SCsb-042m-0001-SO	N	X	X	X											1		850306
~~09.21.10~~	~~1335~~	S	~~grab~~	~~SCsb-042m-0002-SO~~	N	~~X~~	~~X~~	X											1		850307
09.21.10	1345	S	grab	~~SCsb-042m-0003-SO~~	~~N~~	~~X~~	~~X~~	X											1		850308
09.21.10	1350	S	grab	SCsb-042m-0004-SO	N	X	X	X											1		850309
09.21.10	1400	S	grab	SCsb-042m-0005-SO	N	X	X	X											1		850310
09.21.10	1425	S	grab	SCsb-041m-0001-SO	N	X	X	X											1		850311
09.21.10	1435	S	grab	SCsb-041m-0002-SO	N	X	X	X											3	X	850312

Relinquished By: [signature] Date/Time 09.22.10 1845
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/23/10 1320

Lab Use Only
Ice Present (Yes) No
Temperature 4.5
Cooler # 7 coolers

9/23/10 1105 PNL

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
81543

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						ANALYSES REQUESTED (Fill in Spaces with Bottles per Test)															
09.21.10	1440	S	grab	SCsb-041m-0003-SO	N	X	X	X													850313
09.21.10	1450	S	grab	SCsb-041m-0004-SO	N	X	X	X													850314
09.21.10	1455	S	grab	SCsb-041m-0005-SO	N	X	X	X													850315
09.21.10	1525	S	grab	SCsb-040m-0001-SO	N	X	X	X													850316
09.21.10	1535	S	grab	SCsb-040m-0002-SO	N	X	X	X													850317
09.21.10	1540	S	grab	SCsb-040m-0003-SO	N	X	X	X													850318
09.21.10	1545	S	grab	SCsb-040m-0004-SO	N	X	X	X													850319
09.21.10	1550	S	grab	SCsb-040m-0005-SO	N	X	X	X													850320
09.21.10	1600	S	grab	SCsb-039m-0001-SO	N	X	X	X													850321
09.21.10	1610	S	grab	SCsb-039m-0002-SO	N	X	X	X													850322
09.21.10	1615	S	grab	SCsb-039m-0003-SO	N	X	X	X													850323
09.21.10	1625	S	grab	SCsb-039m-0004-SO	N	X	X	X													850324

Relinquished By: [signature] Date/Time 09.22.10/1745
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/23/10 1320

Lab Use Only
Ice Present (Yes) No
Temperature 4.5
Cooler # 7 Coolers

9/23/10 1105 PMC

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
81543

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Matrix:
GW – groundwater **SW** - surface water **WW** - wastewater **DW** - drinking water
S - soil/sediment **SL** - sludge **A** - air **M** - misc/waste

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.21.10	1630	S	grab	SCsb-039m-0005-SO	N	X	X	X											1		850325
09.21.10	1535	S	grab	SCsb-082m-0002-SO	N	X	X	X											1		850326
09.21.10	1345	S	grab	SCsb-083m-0003-SO	N	X	X	X											1		850327
09.21.10	1345	S	grab	SCsb-042d-0003-SO	N					X									3		850408
09.21.10	1535	S	grab	SCsb-040d-0002-SO	N					X									3		850418
09.21.10	1610	S	grab	SCss-067m-0001-SO	N	X	X	X											1		850425
~~09.21.10~~	~~1200~~	S	grab	~~SCss-068m-0001-SO~~	~~N~~	X	X	X											1		850426
~~09.21.10~~	~~1500~~	S	grab	~~SCss-068d-0001-SO~~	~~N~~					X									3		850442
09.21.10	1315	S	grab	SCss-086m-0001-SO	N	X	X	X											1		850446
09.21.10	1505	S	grab	SCss-086d-0001-SO	N					X									3		850458
09.21.10	1640	GW	grab	SCqc-001-0001-TB	N					X									3		850464
09.21.10	1640	GW	grab	SCqc-001-0001-ER	N	X	X	X											1		850471

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Relinquished By: Brian P. McCabe
Date/Time: 09.22.10/1745

Received by:
Date/Time

Received By:
Date/Time

Received for Laboratory by:
Date/Time: 9/23/10 1320

Lab Use Only
Ice Present (Yes) No
Temperature 2.4.5
Cooler # 4 coolers

9/23/10 1105 PMC

Page 6059

Rev. 4/2010

CHAIN OF CUSTODY

Page 1 of 1

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
8543

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Matrix:
GW – groundwater **SW** - surface water **WW** - wastewater **DW** - drinking water
S - soil/sediment **SL** - sludge **A** - air **M** - misc/waste

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.22.10	1005	S	grab	SCss-066m-0001-SO	N	X	X	X	X												85487
09.22.10	1330	S	grab	SCsb-036m-0001-SO	N	X	X	X	X												85488
09.22.10	1630	S	grab	SCss-062m-0001-SO	N	X	X	X	X												85489
09.22.10	1350	S	grab	SCss-064m-0001-SO	N	X	X	X	X												85490

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Relinquished By:	Date/Time	Received By:	Date/Time	*Lab Use Only*
	9.22.10/1715			Ice Present (Yes) No
Received by:	Date/Time	Received for Laboratory by:	Date/Time	Temperature 14.5
			9/23/10 1330	Cooler # 7 coolers

9/23/10 1105 AM

Page 6060

Rev. 4/2010

CHAIN OF CUSTODY

Page 1 of 4

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 81575
Company: SHAW E&I INC
Project: RAVAAP IRP
Logged By: JLS PM: ET

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____
PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	ANALYSES REQUESTED: TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.22.10	1125	S	grab	SCss-065m-0001-SO	N	X	X	X													851475
09.22.10	1510	S	grab	SCss-063m-0001-SO	N	X	X	X													851476
09.22.10	1005	S	grab	SCss-066m-0001-SO	N	X	X	X	X		No Sample recv'd				see coc 81543 etk 9-28-10						851477
09.22.10	1105	S	grab	SCsb-035m-0001-SO	N	X	X	X													851478
09.22.10	1110	S	grab	SCsb-035m-0002-SO	N	X	X	X													851479
09.22.10	1115	S	grab	SCsb-035m-0003-SO	N	X	X	X													851480
09.22.10	1120	S	grab	SCsb-035m-0004-SO	N	X	X	X													851481
09.22.10	1125	S	grab	SCsb-035m-0005-SO	N	X	X	X													851482
09.22.10	1305	S	grab	SCsb-036m-0001-SO	N	X	X	X	X		No Sample recd				see doc 81543						851483
09.22.10	1310	S	grab	SCsb-036m-0002-SO	N	X	X	X							etk 9-28-10						851484
09.22.10	1315	S	grab	SCsb-036m-0003-SO	N	X	X	X													851485
09.22.10	1320	S	grab	SCsb-036m-0004-SO	N	X	X	X													851486
09.22.10	1325	S	grab	SCsb-036m-0005-SO	N	X	X	X													851487

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
Eric P. McCall	09.23.10/1710			Ice Present (Yes) No
Received by:	Date/Time	Received for Laboratory by:	Date/Time 9/24/10 1445	Temperature 2.3
				Cooler # 5 Coolers

9/24/10 1040 PMC

Page 9162

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
81575

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						ANALYSES REQUESTED (Fill in Spaces with Bottles per Test)															
09.22.10	1030	S	grab	SCsb-037m-0001-SO	N	X	X	X											1		851488
09.22.10	1030	S	grab	SCsb-037d-0001-SO	N					X									3		851495
09.22.10	1030	S	grab	SCsb-080d-0001-SO	N					X									3		851497
~~09.22.10~~	~~1030~~	~~S~~	~~grab~~	~~SCsb-037m-0001-SO~~	N	X	X	X			send to RTI per client								1		
09.22.10	1030	S	grab	SCsb-080m-0001-SO	N	X	X	X											1		851498
09.22.10	1045	S	grab	SCsb-037m-0002-SO	N	X	X	X											1		851502
09.22.10	1050	S	grab	SCsb-037m-0003-SO	N	X	X	X											1		851503
09.22.10	1055	S	grab	SCsb-037m-0004-SO	N	X	X	X											1		851504
09.22.10	1100	S	grab	SCsb-037m-0005-SO	N	X	X	X											1		851505
09.22.10	1015	S	grab	SCsb-038m-0001-SO	N	X	X	X											3	X	851506
09.22.10	1110	S	grab	SCsb-038m-0002-SO	N	X	X	X											1		851507
09.22.10	1115	S	grab	SCsb-038m-0003-SO	N	X	X	X											1		851508
09.22.10	1120	S	grab	SCsb-038m-0004-SO	N	X	X	X											1		851509

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Relinquished By: [signature] Date/Time 09.23.10/1710
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/24/10 1040

Lab Use Only
Ice Present (Yes) No
Temperature 4.3
Cooler # 5 coolers

9/24/10 1040 PM

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here: 81575

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed: _____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.22.10	1125	S	grab	SCsb-038m-0005-SO	N	X	X	X		two bags recid + send to RTI									1		851510
09.22.10	1125	S	grab	SCsb-038d-0004-SO	N					X									3		851512
09.22.10	1125	S	grab	SCsb-081m-~~0004~~ 0005-SO fs per client	N	X	X												3		851513
09.22.10	1545	S	grab	DA1sb-056m-0001-SO	N	X	X												1		851514
09.22.10	1550	S	grab	DA1sb-056m-0002-SO	N	X	X												1		851515
09.22.10	1555	S	grab	DA1sb-056m-0003-SO	N	X	X												1		851516
09.22.10	1600	S	grab	DA1sb-056m-0004-SO	N	X	X												1		851517
~~09.22.10~~	~~1605~~	~~S~~	~~grab~~	~~DA1sb-055m-0001-SO~~	~~N~~	~~X~~	~~X~~												1		851518
09.22.10	1610	S	grab	DA1sb-~~054m~~ 055m-0002-SO fs per client	N	X	X												1		851519
09.22.10	1615	S	grab	DA1sb-055m-0003-SO	N	X	X												1		851520
09.22.10	0800	~~S~~ TB	grab	SCqc-002-0001-TB	N					X									1		851521
09.22.10	1715	~~S~~ GW	grab	SCqc-002-0001-ER	N	X	X	X											1		851524
09.23.10	0915	S	grab	SCss-059m-0001-SO	N	X	X	X											1		851525

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	09.23.10/1710		
Received by:	Date/Time	Received for Laboratory by: [signature]	Date/Time 9/24/10 1445

Lab Use Only
Ice Present (Yes) No
Temperature <4.3
Cooler # 5 coolers

9/24/10 1040 PML

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By: _____

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
81575

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.23.10	1020	S	grab	SCss-060m-0001-SO	N	X	X	X	X										1		851526
09.23.10	1140	S	grab	SCss-061m-0001-SO	N	X	X	X											1		851527
09.23.10	0915	S	grab	DA1sb-059m-0201-SO	N	X	X	X	X		X	X	X	X					1		851528
09.23.10	1400	S	grab	DA1sb-064m-0201-SO	N	X	X	X	X		X	X	X	X					1		851529
9-23-10		S	G	SCsb-081d-0005-SO see memo etk 9-28-10						X											852193

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
	09.23.10/1710			Ice Present (Yes) No
Received by:	Date/Time	Received for Laboratory by:	Date/Time	Temperature 2.4.3
			9/24/10 1445	Cooler # 5 coolers

9/24/10 1040 AMC

Page 9165

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP/A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 81583
Company: SHAW E&I INC
Project: RAVAAP IRP
Logged By: JLS PM: ET

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.23.10	1340	S	grab	SCss-058m-0001-SO	N	X	X	X		NOT included									1		
09.23.10	1445	S	grab	SCss-085m-0001-SO	N	X	X	X		NOT included									1		
09.23.10	0900	S	grab	DA1sb-057m-0201-SO	N	X	X												1		851823
09.23.10	0905	S	grab	DA1sb-057m-0202-SO	N	X	X												1		851859
09.23.10	0910	S	grab	DA1sb-057m-0203-SO	N	X	X												1		851860
09.23.10	0915	S	grab	DA1sb-057m-0204-SO	N	X	X												1		851861
09.23.10	0845	S	grab	DA1sb-058m-0201-SO	N	X	X												1		851862
09.23.10	0850	S	grab	DA1sb-058m-0202-SO	N	X	X												1		851863
09.23.10	0855	S	grab	DA1sb-058m-0203-SO	N	X	X												1		851864
09.23.10	0920	S	grab	DA1sb-059m-0202-SO	N	X	X												1		851865
09.23.10	0925	S	grab	DA1sb-059m-0203-SO	N	X	X												1		851866
09.23.10	0915	S	grab	DA1sb-059d-0201-SO	N					X									3		851867
09.23.10	0925	S	grab	DA1sb-081m-0203-SO	N	X	X												1		851868

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
[signature]	09.24.10/1640			Ice Present (Yes) No
Received by:	Date/Time	Received for Laboratory by:	Date/Time	Temperature 4.3°
		[signature]	9/27/10 1150	Cooler # 4 coolers

9/25/10 1035 & 9/27/10 1045

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I

Project Contact: David Crispo

Telephone: 617-834-5230

Project Name: RVAAP A/E

Project #: 133616

Location: RAVENNA, OH

Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here
81883

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.23.10	0930	S	grab	DA1sb-060m-0201-SO	N	X	X												1		851869
09.23.10	0935	S	grab	DA1sb-060m-0202-SO	N	X	X												1		851876
09.23.10	0940	S	grab	DA1sb-060m-0203-SO	N	X	X												1		851871
09.23.10	0945	S	grab	DA1sb-060m-0204-SO	N	X	X												1		851872
09.23.10	1030	S	grab	DA1sb-061m-0201-SO	N	X	X												1		851873
09.23.10	1035	S	grab	DA1sb-061m-0202-SO	N	X	X												1		851874
09.23.10	1040	S	grab	DA1sb-061m-0203-SO	N	X	X												1		851875
09.23.10	1045	S	grab	DA1sb-061m-0204-SO	N	X	X												1		851876
09.23.10	1325	S	grab	DA1sb-062m-0201-SO	N	X	X												1		851877
09.23.10	1330	S	grab	DA1sb-062m-0202-SO	N	X	X												1		851878
09.23.10	1335	S	grab	DA1sb-062m-0203-SO	N	X	X												1		851879
09.23.10	1340	S	grab	DA1sb-062m-0204-SO	N	X	X												1		851880
09.23.10	1345	S	grab	DA1sb-063m-0201-SO	N	X	X							X					1	X	851881

Relinquished By: Brian P McCall
Date/Time 09.24.10/1040
Received by:
Date/Time

Received By:
Date/Time
Received for Laboratory by:
Date/Time 9/27/10 1152

Lab Use Only
Ice Present Yes No
Temperature _____
Cooler # _____

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
81565

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	ANALYSES REQUESTED: TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.23.10	1345	S	grab	DA1sb-063m-0201-MS	N	X	X							X					1	X	851881
09.23.10	1345	S	grab	DA1sb-063m-0201-MD	N	X	X							X					1	X	851881
09.23.10	1350	S	grab	DA1sb-063m-0202-SO	N	X	X							X					1		851882
09.23.10	1350	S	grab	DA1sb-082m-0202-SO	N	X	X							X					1		851883
09.23.10	1355	S	grab	DA1sb-063m-0203-SO	N	X	X							X					1		851884
09.23.10	1400	S	grab	DA1sb-064d-0201-SO	N					X									3		851887
09.23.10	1405	S	grab	DA1sb-064m-0202-SO	N	X	X							X					1		851888
09.23.10	1410	S	grab	DA1sb-064m-0203-SO	N	X	X							X					1		851889
09.23.10	1415	S	grab	DA1sb-065m-0201-SO	N	X	X												1		851890
09.23.10	1420	S	grab	DA1sb-065m-0202-SO	N	X	X												1		851891
09.23.10	1420	S	grab	DA1sb-083m-0202-SO	N	X	X												1		851892
09.23.10	1425	S	grab	DA1sb-065m-0203-SO	N	X	X												1		851893
09.23.10	1430	S	grab	DA1sb-066m-0201-SO	N	X	X							X					1		851894

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
Brian P. McCall	09.24.10 / 1640			Ice Present Yes No
Received by:	Date/Time	Received for Laboratory by:	Date/Time	Temperature _____
		GLS	9/27/10 1152	Cooler # _____

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:
81583

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater **SW** - surface water **WW** - wastewater **DW** - drinking water
S - soil/sediment **SL** - sludge **A** - air **M** - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # *Lab use only*
						Fill in Spaces with Bottles per Test															
09.23.10	1435	S	grab	DA1sb-066m-0202-SO	N	X	X							X					1		851895
09.23.10	1440	S	grab	DA1sb-066m-0203-SO	N	X	X							X					1		851896
09.23.10	1445	S	grab	DA1sb-066m-0204-SO	N	X	X							X					1		851897
09.23.10	1635	GW	grab	SCqc-003-0001-ER	N	X	X	X											5		851908
09.23.10	0800	GW	grab	SCqc-003-0001-TB	N					X									1		851909

Relinquished By:	Date/Time	Received By:	Date/Time	*Lab Use Only*
[signature]	09.24.10/1640			Ice Present Yes No
Received by:	Date/Time	Received for Laboratory by: [signature]	Date/Time 9/27/10 1152	Temperature _____
				Cooler # _____

Rev. 4/2010

CHAIN OF CUSTODY

Page 1 of 2 (BPM)

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

Folder #: 81670
Company: SHAW E&I INC
Project: RVAAP IRP
Logged By: JLS PM: ET

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

rogram:
SM RCRA SDWA NPDES
olid Waste Other _____

O # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.28.10	1420	S	grab	SCsd-070m-0001-SD	N	X	X	X	X		X	X	X	X					1		854000
09.28.10	1325	S	grab	SCsd-071m-0001-SD	N	X	X	X	X		X	X	X	X					1		854001
09.28.10	1340	S	grab	SCsd-071d-0001-SD	N					X									1		854002
09.25.10	1000	S	grab	SCsb-045m-0001-SO	N	X	X	X		X ETC									1		854003
09.28.10	1530	GW	grab	SCqc-004-0001-ER	N	X	X	X	X		X	X	X	X					14		854005
09.28.10	0800	GW	grab	SCqc-004-0001-TB	N					X									3		854007
09.29.10	1545	GW	grab	SCqc-005-0001-ER	N	X	X	X	X		X	X	X	X	– missing *				14		
09.29.10	0800	GW	grab	SCqc-005-0001-TB	N					X									3		854008
09.29.10	0905	S	grab	SCsb-046m-0001-SO	N	X	X	X	X										1		854009
09.29.10	1015	S	grab	SCsb-047m-0001-SO	N	X	X	X											1		854010
09.29.10	0925	S	grab	SCsb-048m-0001-SO	N	X	X	X	X		X	X	X	X					1		854011
09.29.10	0940	S	grab	SCsb-048d-0001-SO	N					X									3		854012

Relinquished By: [signature] Date/Time 09.29.10 / 1715
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: Date/Time 9/30/10 1141

Lab Use Only
Ice Present (Yes) No
Temperature 2.6, 1.9, 2.9
Cooler # 3785, 3635, 3583

* ETC was notified by client sample would be included in shipment 10/1. JS 9/30/10 1150

CT Laboratories Terms and Conditions

Rev. 4/2010

CHAIN OF CUSTODY

Page 2 of 2

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

8167

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.29.10	0930	S	grab	SCsb-084m-0001-SO	N	X	X	X	X		X	X	X	X					1		854013
09.29.10	0945	S	grab	SCsb-084d-0001-SO	N					X									3		854014
09.29.10	1025	S	grab	SCsb-049m-0001-SO	N	X	X	X											1		854015
09.29.10	1110	S	grab	SCsb-050m-0001-SO	N	X	X	X											1		854016
09.29.10	1130	S	grab	SCsb-051m-0001-SO	N	X	X	X	X										1		854017
09.29.10	1135	S	grab	SCsb-051m-0001-MS	N	X	X	X											1		854017
09.29.10	1140	S	grab	SCsb-051m-0001-MD	N	X	X	X											1		854017
09.29.10	1155	S	grab	SCsb-052m-0001-SO	N	X	X	X											1		854018
09.29.10	1240	S	grab	SCsb-053m-0001-SO	N	X	X	X											1		854019
09.29.10	1235	S	grab	SCsb-054m-0001-SO	N	X	X	X													854020

Relinquished By: [signature] Date/Time 09.29.10/1715
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/30/10 1141

Lab Use Only
Ice Present (Yes) No
Temperature 2.6, 1.9, 2.9
Cooler # 3785, 3638, 3333

9/30/10 1050 [signature]

CT Laboratories Terms and Conditions

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 81613
Company: SHAW E&I INC
Project: RAVAAP IRP
Logged By: JLS PM: ET

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.24.10	1405	S	grab	DA1sb-067d-0201-SO	N					X											852283
09.24.10	1410	S	grab	DA1sb-067d-0202-SO	N					X											852284
09.24.10	1415	S	grab	DA1sb-067d-0203-SO	N					X											852285
09.24.10	1420	S	grab	DA1sb-067d-0204-SO	N					X											852286
09.24.10	0855	S	grab	DA1sb-068d-0201-SO	N					X											852287
09.24.10	0900	S	grab	DA1sb-068d-0202-SO	N					X											852288
09.24.10	0905	S	grab	DA1sb-068d-0203-SO	N					X											852289
09.24.10	0910	S	grab	DA1sb-068d-0204-SO	N					X											852290
09.24.10	0915	S	grab	DA1sb-069d-0201-SO	N					X											852291
09.24.10	0920	S	grab	DA1sb-069d-0202-SO	N					X											852292
09.24.10	0925	S	grab	DA1sb-069d-0203-SO	N					X											852293
09.24.10	0930	S	grab	DA1sb-070d-0201-SO	N					X											852294
09.24.10	0935	S	grab	DA1sb-070d-0202-SO	N					X											852295

Relinquished By: [signature] Date/Time 09.25.10/1630
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/28/10 1155

Lab Use Only
Ice Present (Yes) No
Temperature ≤5.1°
Cooler # 3662, 3645, 3772, 3794, NONE
ETK, 9-28-10, 1045

Rev. 4/2010

CHAIN OF CUSTODY

Page 2 of 5

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.24.10	0940	S	grab	DA1sb-070d-0203-SO	N					X											852296
09.24.10	0930	S	grab	DA1sb-070d-0201-MS	N					X											852294
09.24.10	0930	S	grab	DA1sb-070d-0201-MD	N					X											852295
09.24.10	0855	S	grab	DA1sb-084d-0201-SO	N					X											852297
09.24.10	0945	S	grab	DA1sb-085d-0204-SO	N					X											852298
09.24.10	0800	S	grab	DA1qc-001-0001-TB	N					X											852299
09.24.10	0800	S	grab	DA1qc-002-0001-TB	N					X											852300
09.24.10	1350	S	grab	DA1sb-071d-0201-SO	N					X											852301
09.24.10	1300	S	grab	SCss-057d-0001-SO	N					X											852302
09.24.10	1305	S	grab	SCss-057d-0001-MS	N					X											852303
09.24.10	1310	S	grab	SCss-057d-0001-MD	N					X											852304
09.23.10	1340	S	grab	SCss-058m-0001-SO	N	X	X	X													852322
09.23.10	1445	S	grab	SCss-085m-0001-SO	N	X	X	X													852334

Relinquished By: Date/Time 09.25.10/1630
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: Date/Time 9/28/10 1045

Lab Use Only
Ice Present (Yes) No
Temperature ≤5.1°
Cooler # 3662, 3645, 3772, 3741, NONE
ETK, 9-28-10, 1045

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed: _____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.24.10	1105	S	grab	SCss-057m-0001-SO	N	X	X	X	X		X	X	X	X							852338
09.24.10	1135	S	grab	SCss-057m-0001-MS	N	X	X	X			X	X	X	X							852338
09.24.10	1240	S	grab	SCss-057m-0001-MD	N	X	X	X			X	X	X	X							852338
09.24.10	1525	S	grab	SCss-044m-0001-SO	N	X	X	X													852362
09.24.10	1405	S	grab	DA1sb-067m-0201-SO	N	X	X														852369
09.24.10	1410	S	grab	DA1sb-067m-0202-SO	N	X	X		X												852370
09.24.10	1415	S	grab	DA1sb-067m-0203-SO	N	X	X														852371
09.24.10	1420	S	grab	DA1sb-067m-0204-SO	N	X	X														852372
09.24.10	0855	S	grab	DA1sb-068m-0201-SO	N	X	X	X			X	X	X	X							852373
09.24.10	0900	S	grab	DA1sb-068m-0202-SO	N	X	X							X							852374
09.24.10	0905	S	grab	DA1sb-068m-0203-SO	N	X	X							X							852375
09.24.10	0910	S	grab	DA1sb-068m-0204-SO	N	X	X							X							852376
09.24.10	0915	S	grab	DA1sb-069m-0201-SO	N	X	X	X			X	X	X	X							852377

Relinquished By:	Date/Time	Received By:	Date/Time	Lab Use Only
[signature]	09.25.10/1630			Ice Present Yes No
Received by:	Date/Time	Received for Laboratory by: [signature]	Date/Time 9/28/10	Temperature ≤ 5.1°
				Cooler # 3662, 3645, 3772, 3794, NONE
				ETK, 9-28-10, 1045

Rev. 4/2010

CHAIN OF CUSTODY

Page 4 of 5

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions*

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.24.10	0920	S	grab	DA1sb-069m-0202-SO	N	X	X							X							852378
09.24.10	0925	S	grab	DA1sb-069m-0203-SO	N	X	X							X							852379
09.24.10	0930	S	grab	DA1sb-070m-0201-SO	N	X	X							X							852380
09.24.10	0935	S	grab	DA1sb-070m-0202-SO	N	X	X							X							852381
09.24.10	0940	S	grab	DA1sb-070m-0203-SO	N	X	X	X			X	X	X	X							852382
09.24.10	0945	S	grab	DA1sb-070m-0204-SO	N	X	X							X	Missing						852383
09.24.10	0930	S	grab	DA1sb-070m-0201-MS	N	X	X							X							852380
09.24.10	0930	S	grab	DA1sb-070m-0201-MD	N	X	X							X							852380
09.24.10	1350	S	grab	DA1sb-071m-0201-SO	N	X	X	X		X	X	X	X	X							852384
09.24.10	1355	S	grab	DA1sb-071m-0202-SO	N	X	X														852385
09.24.10	1400	S	grab	DA1sb-071m-0203-SO	N	X	X														852386
09.24.10	1330	S	grab	DA1sb-072m-0201-SO	N	X	X	X													852387
09.24.10	1335	S	grab	DA1sb-072m-0202-SO	N	X	X														852388

Relinquished By: [signature] Date/Time 09.25.10/1630
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/28/10 1105

Lab Use Only
Ice Present (Yes) No
Temperature 5.1°
Cooler # 3762, 3645, 3772, 3794, NONE
ETK, 9-28-10, 1045

Page 7907

Rev. 4/2010

CHAIN OF CUSTODY

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES
1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Lab Use Only
Place Header Sticker Here:

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

**Client Special Instructions*

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						ANALYSES REQUESTED															
						Fill in Spaces with Bottles per Test															
09.24.10	1340	S	grab	DA1sb-072m-0203-SO	N	X	X														852389
09.24.10	1345	S	grab	DA1sb-072m-0204-SO	N	X	X														852390
09.24.10	0855	S	grab	DA1sb-084m-0201-SO	N	X	X	X			X	X	X	X							852391
09.24.10	0945	S	grab	DA1sb-085m-0204-SO	N	X	X							X							852392
09.24.10	1345	S	grab	DA1sb-086m-0204-SO	N	X	X														852393
09.25.10		S	grab	SCsb-055m-0001-SO	N	X	X	X													852394
09.25.10		S	grab	SCsb-056m-0001-SO	N	X	X	X	X												852395

Relinquished By: [signature] Date/Time 09.25.10/1630
Received by: Date/Time

Received By: Date/Time
Received for Laboratory by: [signature] Date/Time 9/28/10 1045

Lab Use Only
Ice Present (Yes) No
Temperature ≤ 5.1°
Cooler # 3662, 3645, 3772, 3794, NONE
ETK, 9-28-10, 1045

Rev. 4/2010

CHAIN OF CUSTODY

Page 1 of 1

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617-834-5230
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 81718
Company: SHAW E&I INC
Project: RVAAP IRP
Logged By: JLS PM: ET

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO # 621620

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

ANALYSES REQUESTED

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants	FP, RCN, RS, pH				Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
09.29.10	1545	GW	grab	SCqc-005-0001-ER	N	X	X	X		X	X	X	X	X							884738
09.29.10	0800	GW	grab	SCqc-006-0001-TB	N					X											884739
09.30.10	1200	GW	grab	RVAAP-001-IDW-DL	N	X	X	X		X				X	X						884740
09.30.10	1230	S	grab	RVAAP-001-IDW-SO	N	X	X	X		X				X	X						884741

8-10-1-10 RCRA LIST
RCRA LIST
8-10-1-10 RCRA LIST

Relinquished By:	Date/Time	Received By:	Date/Time
[signature]	09.30.10/1320		
Received by:	Date/Time	Received for Laboratory by: [signature]	Date/Time 10/1/10 1142

Lab Use Only
Ice Present Yes No
Temperature 3.7, 2.9
Cooler # 3608, 3653
10/1/10 0930 [signature]

CT Laboratories Terms and Conditions

Rev. 4/2010

CHAIN OF CUSTODY

Page 1 of 1

Company: SHAW E & I
Project Contact: David Crispo
Telephone: 617.589.8146
Project Name: RVAAP A/E
Project #: 133616
Location: RAVENNA, OH
Sampled By:

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
608-356-2760 Fax 608-356-2766
www.ctlaboratories.com

Folder #: 82400
Company: SHAW E&I INC
Project: RVAAP IRP
Logged By: JLS PM: ET

Program:
QSM RCRA SDWA NPDES
Solid Waste Other _____

PO #

Report To: David Crispo
EMAIL: david.crispo@shawgrp.com
Company: SHAW E & I
Address: Randolph, MA

Invoice To:*
EMAIL:
Company:
Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

Matrix:
GW – groundwater SW - surface water WW - wastewater DW - drinking water
S - soil/sediment SL - sludge A - air M - misc/waste

Turnaround Time
Normal RUSH*
Date Needed:
_____
Rush analysis requires prior CT Laboratories' approval
Surcharges:
24 hr 200%
2-3 days 100%
4-9 days 50%

Collection Date	Collection Time	Matrix	Grab/ Comp	Sample ID Description	Filtered? Y/N	TAL Metals	Explosives	SVOCs	Hex Chromium	VOCs	Pesticides	PCBs	Cyanide	Propellants					Total # Containers	Designated MS/MSD	CT Lab ID # (Lab use only)
						Fill in Spaces with Bottles per Test															
11.09.10	1128	S	grab	SCss-072m-0001-SO	N	X	X	X											1		869557
11.09.10	1410	S	grab	SCss-073m-0001-SO	N	X	X	X											1		869558
11.09.10	1500	S	grab	SCss-087m-0001-SO	N	X	X	X											1		869559
11.09.10	1532	S	grab	SCss-074m-0001-SO	N	X	X	X											1		869560
11.09.10	1048	S	grab	SCss-075m-0001-SO	N	X	X	X											1		869561
11.09.10	1000	S	grab	SCss-076m-0001-SO	N	X	X	X											1		869562
11.09.10	1630	GW	grab	SCqc-006-0001-ER	N	X	X	X		X	X	X	X	X					13		869563
11.09.10	0800	GW	grab	SCqc-007-0001-TB	N					X									3		869564

Relinquished By:	Date/Time	Received By:	Date/Time
Bi P. McCoy	11.09.10 / 1700		
Received by:	Date/Time	Received for Laboratory by:	Date/Time
			11/10/10 0928

Lab Use Only
Ice Present (Yes) No
Temperature 2.6°C + 3.9°C
Cooler # 3610 + 3794

11/10/10 MMD 1130

Page 4072

Appendix B
Quality Assurance Summary Report

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Acronyms and Abbreviations

AOC	Area of Concern
CERCLA	Comprehensive, Environmental Responsibility, Compensation and Liability Act
CFR	Code of Federal Regulations
DOD	Department of Defense
ELAP	Environmental Laboratory Accreditation Program
FCR	Field Change Request
FSAP	Facility-Wide Sampling and Analysis Plan
FSP	Field Sampling Plan
FWQAPP	Quality Assurance Project Plan
LCG	Louisville Chemistry Guideline
M&TE	measuring and testing equipment
NCR	Noncomformance Report
NELAC	National Environmental Laboratory Accreditation Conference
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
QA	quality assurance
QC	quality control
QCSR	Quality Control Summary Report
QSM	Quality Systems Manual
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
Shaw	Shaw Environmental & Infrastructure, Inc.
SOW	Scope of Work
SSHP	Site Safety and Health Plan
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

B1 PROJECT QUALITY ASSURANCE SUMMARY

This Project *Quality Assurance Summary Report*; hereafter, referred to as the *QASR*, has been prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) to meet the quality assurance/quality control (QA/QC) objectives for the Phase I Remedial Investigation (RI) activities at the RVAAP-34 Sand Creek Disposal Road Landfill at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. These objectives were established in accordance with the *Scope of Work for Environmental Services at RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area 1, and RVAAP-28 Mustard Agent Burial Site* and the *Sampling and Analysis Plan Addendum No.1* (hereafter referred to as "*Addendum*"). The *Addendum* supplements the *Facility-Wide Sampling and Analysis Plan* (*FSAP*) *for Environmental Investigations at the RVAAP* (SAIC, 2001). The *FSAP* provides the base documentation (i.e., technical and investigative protocols) for conducting a RI under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at the RVAAP. Field activities at the Sand Creek Disposal Road Landfill Area of Concern (AOC) were conducted in two mobilizations that occurred in October and November, 2010, respectively and included RI sampling activities for the collection of environmental media from the following matrices: surface soil, subsurface soil and sediment.

B1.1 Field Quality Control

This section outlines the implementation of procedures and practices by Shaw to ensure project QC objectives were achieved.

B1.1.1 Readiness Review/Pre-Mobilization

Shaw coordinated pre-mobilization actions to ensure the following elements of the proposed field activities were implemented prior to mobilization the field: 1) project documents and procedures were approved, controlled and properly distributed; 2) assigned personnel were trained for their intended activities; 3) mobilization and site logistics were established; 4) laboratories were notified as to when sample shipment would commence and were able to meet turn-around requirements; 5) subcontractors were properly notified to mobilize, submitted the required certifications, and were ready to begin work; and 6) QC systems were in place.

B1.1.2 Procedures

Standard operating methods for field activities performed during the RI are incorporated into the governing documents for the project. The FSAP (SAIC, 2001) describes the overall approach and methodologies to be used for projects at the RVAAP, and the Addendum (Shaw, 2010) details project-specific requirements for field implementation. The United States Army Corps of Engineers (USACE), Louisville District and the Ohio Environmental Protection Agency (Ohio EPA) reviewed and approved these documents prior to implementation of RI

field activities. Clarifications and/or planned deviations from either plan in the described methods of implementation are typically documented as field change requests (FCRs); however, no FCRs were submitted for this RI effort. Any variances from the approved plans were documented as Nonconformance Reports (NCRs). There were no variances identified or FCRs submitted during the implementation of the RI at the Sand Creek Disposal Road Landfill AOC.

B1.1.3 Training

All field personnel were required to attend a safety orientation meeting prior to working at any project site associated with the RVAAP project. The safety orientation training was documented on the Site Safety Health Plan (SSHP) Acknowledgement Form and included the following topics:

- Names of personnel responsible for site safety;
- Responsibilities for accident prevention and maintaining safe and healthful work environments;
- Procedures for reporting and correcting unsafe conditions or practices;
- Safety and health hazards on site and the means to control/eliminate those hazards;
- Personal protection equipment use and care;
- Morning safety and preparatory meeting procedures;
- Review of pertinent sections including emergency response procedures as outlined in the Emergency Response Plan and Emergency Response Training;
- Responsibilities for reporting all accidents and illnesses;
- Provisions for medical care and facilities and the names of cardiopulmonary resuscitation and first-aid trained personnel assigned to the project;
- Fire prevention;
- Housekeeping;
- Hazard Communication Program, includes discussion of Material Safety Data Sheets for hazardous chemicals used on site;
- Review of applicable Activity Hazard Analyses;
- Standard operating procedures, safety rules, and safe work practices for the project; and

- Location of safety equipment (e.g., fire extinguishers, first-aid kits, eyewash stations).

All site personnel working in regulated areas at this project were required to meet the minimum Occupational Safety and Health Administration (OSHA) training requirements as specified in 29 CFR 1926.65 and 29 CFR 1910.120. Copies of the OSHA-required training and medical records were provided to the RVAAP Facility Manager prior to commencing field activities and were maintained on-site by Shaw as well during field activities.

B1.1.4 Equipment Calibration

Several types of measuring and testing equipment (M&TE) were used during the field investigation that included the following:

- Schonstedt Model GA-52Cx magnetometer;
- Photoionization detector (MiniRAE 3000); and
- Global Positioning System (Trimble GeoXH Handheld)

These M&TE consisted of both Shaw-owned and rented units from a reputable provider. Only equipment having verifiable traceability to nationally recognized standards was used in the field and was maintained in the project file. Last and next calibration recall dates were recorded and maintained for each instrument used in the instrumentation log book. Instruments were calibrated daily by the M&TE Coordinator (or designee) according to the manufacturer's instructions and frequency. Daily calibration activities and results, as well as source information for all calibration standards and reagents were documented in the logbooks dedicated to that particular piece of equipment.

Equipment that did not calibrate within manufacturer’s specifications or operate properly in the field was taken out of service and was replaced promptly. Replacement equipment was placed into service upon calibration.

B1.1.5 Quality Control Samples

Field QC samples collected for this project included trip blanks, equipment rinsate blanks, source water (potable and deionized), and field duplicates, as specified in the Addendum (Shaw, 2010). Field QA split samples were also collected and sent to a USACE QA laboratory for independent analysis and evaluation of analytical results by the contracted laboratory. The Shaw Field Operations Manager was responsible for implementing the QA program in the field. **Appendix C** of this Phase I RI report presents the data validation report that evaluates data quality and analytical performance with respect to field QC results.

B1.1.6 Field Records

Field data, observations, activities, and information were recorded on daily activity logs and sampling forms, and bound in 3-ring binders (i.e., logbooks). Each field team possessed a binder with applicable sampling forms and activity logs. The use of structured logbooks ensured that all necessary data were entered consistently. Logbook entries were checked for accuracy and completeness by independent reviewers. Field records were collected upon completion of the project and likewise maintained by the Shaw Field Operations Manager. Other records included equipment/material certifications and invoices, and air-bill forms.

B1.2 Analytical Laboratory Quality Assurance

Shaw subcontracted CT Laboratories, Inc. of Baraboo, Wisconsin to perform chemical analysis of samples collected during this RI. CT Laboratories has current Environmental Laboratory Accreditation Program (ELAP) and National Environmental Laboratory Accreditation Conference (NELAC) accreditations and/or approvals. CT Laboratories has Navy certification approvals to meet the Department of Defense (DoD) Quality Systems Manual (QSM) Version 4.1 (DoD, 2009) requirements. QA split samples were collected and submitted to an independent USACE, Louisville District QA laboratory (Severn Trent Laboratories located in Canton, Ohio). Primary analytical direction for these projects will be obtained from the identified USEPA publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2007) and the *DoD QSM* (DoD, 2009). The *Louisville Chemistry Guideline* (*LCG*), Version 5 (USACE, 2002) was used as a guidance document for data review and data validation.

B1.2.1 Readiness Review

Laboratory QA/QC activities were initiated during the readiness review. The readiness review ensured that: 1) governing documents and approved analytical methods were controlled and properly distributed; 2) CT laboratories was notified as to when sample shipment would commence and were able to meet turn-around requirements; 3) logistical coordination was established between the laboratory and the field team; and 4) the laboratory QA program was consistent and compatible with the project requirements.

B1.2.2 Procedures

Prior to initiation of analytical support for this RI, CT Laboratories and Shaw reviewed and negotiated a contract based on a comprehensive laboratory Statement of Work (SOW). The laboratory SOW detailed project-specific requirements including the following:

- Parameters to be measured:
- Analytical methods;
  - Adherence to USEPA SW-846 protocols; and

  - DoD QSM for Environmental Laboratories, Version 4.1 requirements;
- Project quantitation goals (sensitivity); and
- Data deliverables requirements.

All laboratory comments and questions were resolved before analytical work proceeded.

B1.2.3 Laboratory Quality Control

To document laboratory data quality and to measure the quality of the analytical process, laboratory QC samples (e.g., method blanks, laboratory control samples, laboratory duplicates, and matrix spike/matrix spike duplicates) and data verification/validation were employed. The results of laboratory QC are discussed in the Project Data Validation Report in **Appendix C** of the Phase I RI. Analytical results of laboratory QC samples are included in **Appendix D** of the Phase I RI and form the basis of the data validation process.

B1.2.4 Laboratory Documentation

CT Laboratories maintains comprehensive information regarding the entire analytical process. The laboratory delivered summary data packages and electronic deliverables to Shaw consistent with those identified in the USEPA SW-846 and DoD QSM 4.1 protocols for validation and verification. Laboratory QC sample analyses were cross-referenced to the appropriate environmental field sample analyses in the laboratory deliverables.

B1.2.5 Data Verification/Validation

Shaw subjected analytical data generated during this project to a rigorous process of data verification, as specified in the *Facility-Wide Quality Assurance Project Plan* (FWQAPP) (SAIC, 2001) and the Addendum (Shaw, 2009). For verification of data, criteria were established against which the analytical results were compared and from which a judgment was rendered regarding the acceptability and qualification of the data. Upon receipt of data packages from the laboratory, the information was subjected to a systematic examination following standardized checklists and procedures to ensure content, presentation, administrative validity, and technical validity (**Appendix C** of the Phase I RI). Data deficiencies or formal laboratory related nonconformances are typically documented through an NCR process, as required; however, no NCRs were issued to CT Laboratories for this project.

Following data verification, the Shaw Project Chemist performed 100 percent data validation of all field samples, a comprehensive validation of the QA split sample dataset, and a comparison of primary sample, field duplicate sample, and field QA split sample information.

B1.3 Quality Assurance Documentation

Primary methods for documenting QA during the RI process at the RVAAP include the completion of FCRs requiring USACE and Ohio EPA concurrence and NCRs generated in accordance with Shaw QA procedures. There were no FCRs or NCRs generated during the implementation of this RI.

B1.4 References

Science Applications International Corporation (SAIC), 2001. *Final Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. March 2001.

Shaw Environmental & Infrastructure, Inc. (Shaw). *Final Sampling and Analysis Plan Addendum No. 1 for Environmental Services at RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site, Ravenna Army Ammunition Plant, Ravenna, Ohio*. February, 2010.

U.S. Department of Defense (DoD), 2009. *DoD Quality Systems Manual for Environmental Laboratories*, Version 4.1, Environmental Data Quality Workgroup. April 22, 2009.

U.S. Army Corps of Engineers (USACE), 2002. *Louisville Chemistry Guideline,* Louisville District, Environmental Engineering Branch, Revision 5. June 2002.

U.S. Environmental Protection Agency (USEPA), 2007. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, publication SW-846, Revision 6. February 2007.

Appendix C
Data Validation Results and Usability Assessment

(Note: Data submitted on compact disc.)

Shaw Data Validation Report

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List of Attachments

Attachment 1 Data Validation Checklists
Attachment 2 Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

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Acronyms and Abbreviations

%D	percent difference
BFB	bromofluorobenzene
CCB	calibration blank
CCC	calibration check compound
CCV	continuing calibration verification
DDD	dichloro-diphenyl-dichloroethane
DDT	dichloro-diphenyl-trichloroethane
DL	detection limit
DOD	U.S. Department of Defense
DUP	duplicate sample
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatography/mass spectrometry
ICB	initial calibration blank
ICP	inductively coupled plasma
ICV	initial calibration verification
ISM	incremental sampling method
LCG	Louisville Chemistry Guideline
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
PDS	postdigestion spike
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RF	response factor
RI	remedial investigation
RL	reporting limit
RPD	relative percent difference
RSD	relative standard deviation
RVAAP	Ravenna Army Ammunition Plant
SDG	sample data group
Shaw	Shaw Environmental & Infrastructure, Inc.
SPCC	system performance check compound
SVOC	semivolatile organic compound
U.S.	United States
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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1.0 INTRODUCTION

This Data Validation Report presents the results of an analytical data review and verification conducted by Shaw Environmental & Infrastructure, Inc. (Shaw) in support of Phase I Remedial Investigation (RI) field activities for the area of concern RVAAP-34 Sand Creek Disposal Road Landfill (herein, referred to as the "Sand Creek Site" or "the Site") located at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. Shaw subcontracted CT Laboratories, Inc. of Baraboo, Wisconsin to perform chemical analysis of samples collected during this RI. CT Laboratories has current Environmental Laboratory Accreditation Program and National Environmental Laboratory Accreditation Conference accreditations and/or approvals. CT Laboratories has Navy certification approvals to meet the United States (U.S.) Department of Defense (DOD) *Quality Systems Manual* (QSM), Version 4.1 (DOD, 2009) (hereafter referred to as DOD QSM 4.1) requirements. Primary analytical direction for this project was obtained from the identified U.S. Environmental Protection Agency (EPA) publication SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2007) and the DOD QSM 4.1 (DOD, 2009). The *Louisville Chemistry Guideline* (LCG), Version 5 (USACE, 2002) was used as a guidance document for data review and data validation.

The RI field sampling event was conducted at the Sand Creek Site between September 21, 2010 and November 9, 2010. In all, Shaw collected a total of 28 surface samples using the incremental sampling method (ISM), 78 subsurface samples using modified ISM, and 3 ISM sediment samples. The SW-846 chemical analytical procedures were followed for analyses of target analyte list metals, hexavalent chromium, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosives, propellants (nitrocellulose, nitroguanidine, and nitroglycerine), and cyanide for the samples collected for the RI event. **Table C-1** summarizes the samples collected, data type, associated sample data group (SDG), and the parameters analyzed.

1.1 Data Review and Validation Steps

The following steps are involved in the data review, verification, and validation process:

- Step 1—Laboratory Data Review
  - The laboratory reviews its data before releasing data packages to Shaw. This review verifies that project-specific reporting requirements were satisfied.

Table C-1
Sample Summary Table for Remedial Investigation Samples Collected at Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicates	USACE QA Split Samples	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
Surface Soil														
SCss-057M-0001-SO	9/24/10	0–1	81670	---	---	X	X	X	X	X		X	X	X
SCss-057D-0001-SO	9/24/10	0–1	81670	---	---						X			
SCss-058M-0001-SO	9/23/10	0–1	81670	SCss-085M-0001-SO	SCss-058M-0001-QA	X	X		X					
SCss-059M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X					
SCss-060M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X				X	
SCss-061M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X					
SCss-062M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X				X	
SCss-063M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X					
SCss-064M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X				X	
SCss-065M-0001-SO	9/23/10	0–1	81578	---	---	X	X		X					
SCss-066M-0001-SO	9/24/10	0–1	81578	---	---	X	X		X				X	
SCss-067M-0001-SO	9/21/10	0–1	81578	---	---	X	X		X					

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicates	USACE QA Split Samples	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCss-068M-0001-SO	9/21/10	0–1	81578	SCss-086M-0001-SO	SCss-068M-0001-QA	X	X		X					
SCss-068D-0001-SO	9/21/10	0–1	81578	SCss-086D-0001-SO	SCss-068D-0001-QA						X			
SCss-069M-0001-SO	9/24/10	0–1	81578	---	---	X	X		X					
SCss-068M-0001-SO	9/21/10	0–1	81578	SCss-086M-0001-SO	SCss-068M-0001-QA	X	X		X					
SCss-072M-0001-SO	11/9/10	0–1	82400-1	---	---	X	X		X					
SCss-073M-0001-SO	11/9/10	0–1	82400-1	SCss-087M-0001-SO	SCss-073M-0001-QA	X	X		X					
SCss-074M-0001-SO	11/9/10	0–1	82400-1	---	---	X	X		X					
SCss-075M-0001-SO	11/9/10	0–1	82400-1	---	---	X	X		X					
SCss-076M-0001-SO	11/9/10	0–1	82400-1	---	---	X	X	X	X	X		X	X	X
Subsurface Soil														
SCsb-035M-0001-SO	9/22/10	1–5	81578	---	---	X	X		X					
SCsb-035M-0002-SO	9/22/10	5–9	81578	---	---	X	X		X					
SCsb-035M-0003-SO	9/22/10	9–13	81578	---	---	X	X		X					

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicate	USACE QA Spit Sample	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCsb-035M-0004-SO	9/22/10	13–17	81578	---	---	X	X		X					
SCsb-035M-0005-SO	9/22/10	17–20	81578	---	---	X	X		X					
SCsb-036M-0001-SO	9/22/10	1–5	81578	---	---	X	X		X				X	
SCsb-036M-0002-SO	9/22/10	5–9	81578	---	---	X	X		X					
SCsb-036M-0003-SO	9/22/10	9–13	81578	---	---	X	X		X					
SCsb-036M-0004-SO	9/22/10	13–17	81578	---	---	X	X		X					
SCsb-036M-0005-SO	9/22/10	17–20	81578	---	---	X	X		X					
SCsb-037D-0001-SO	9/22/10	1–5	81578	SCsb-080D-0001-SO	---	X					X			
SCsb-037M-0001-SO	9/22/10	1–5	81578	SCsb-080M-0001-SO	SCsb-037M-0001-QA[1]	X	X	X	X	X		X	X	X
SCsb-037M-0002-SO	9/22/10	5–9	81578	---	---	X	X		X					
SCsb-037M-0003-SO	9/22/10	9–13	81578	---	---	X	X		X					
SCsb-037M-0004-SO	9/22/10	13–17	81578	---	---	X	X		X					
SCsb-037M-0005-SO	9/22/10	17–20	81578	---	---	X	X		X					

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicate	USACE QA Spit Sample	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCsb-038M-0001-SO	9/22/10	1–5	81578	---	---	X	X		X					
SCsb-038M-0002-SO	9/22/10	5–9	81578	---	---	X	X		X					
SCsb-038M-0003-SO	9/22/10	9–13	81578	---	---	X	X		X					
SCsb-038M-0004-SO	9/22/10	13–17	81578	---	---	X	X		X					
SCsb-038M-0005-SO	9/22/10	17–20	81578	SCsb-081M-0005-SO	SCsb-038M-0005-QA	X	X		X					
SCsb-038D-0005-SO	9/22/10	17–20	81578	SCsb-081M-0005-SO	---						X			
SCsb-039M-0001-SO	9/21/10	1–5	81578	---	---	X	X		X					
SCsb-039M-0002-SO	9/21/10	5–9	81578	---	---	X	X		X					
SCsb-039M-0003-SO	9/21/10	9–13	81578	---	---	X	X		X					
SCsb-039M-0005-SO	9/21/10	17–20	81578	---	---	X	X	X	X	X		X	X	X
SCsb-040M-0001-SO	9/21/10	1–5	81578	---	---	X	X		X					
SCsb-040M-0002-SO	9/21/10	5–9	81578	SCsb-082M-0002-SO	SCsb-040M-0001-QA[1]	X	X	X	X	X		X	X	X
SCsb-040D-0002-SO	9/21/10	5–9	81578	---	---						X			

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicate	USACE QA Spit Sample	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCsb-040M-0003-SO	9/21/10	9–13	81578	---	---	X	X		X					
SCsb-040M-0004-SO	9/21/10	13–17	81578	---	---	X	X		X					
SCsb-040M-0005-SO	9/21/10	17–20	81578	---	---	X	X		X					
SCsb-041M-0001-SO	9/21/10	1–5	81578	---	---	X	X		X					
SCsb-040M-0003-SO	9/21/10	9–13	81578	---	---	X	X		X					
SCsb-040M-0004-SO	9/21/10	13–17	81578	---	---	X	X		X					
SCsb-040M-0005-SO	9/21/10	17–20	81578	---	---	X	X		X					
SCsb-041M-0001-SO	9/21/10	1–5	81578	---	---	X	X		X					
SCsb-041M-0002-SO	9/21/10	5–9	81578	---	---	X	X		X					
SCsb-041M-0003-SO	9/21/10	9–13	81578	---	---	X	X		X					
SCsb-041M-0004-SO	9/21/10	13–17	81578	---	---	X	X		X					
SCsb-041M-0005-SO	9/21/10	17–20	81578	---	---	X	X		X					
SCsb-042M-0001-SO	9/21/10	1–5	81578	---	---	X	X		X					

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicate	USACE QA Spit Sample	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCsb-042M-0002-SO	9/21/10	5 - 9	81578	---	---	X	X		X					
SCsb-042M-0003-SO	9/21/10	9–13	81578	SCsb-083M-0003-SO	SCsb-042M-0003-QA[1]	X	X	X	X	X		X	X	X
SCsb-042D-0003-SO	9/21/10	9 -1 3	81578	---	---						X			
SCsb-042M-0004-SO	9/21/10	13–17	81578	---	---	X	X		X					
SCsb-042M-0005-SO	9/21/10	17–20	81578	---	---	X	X		X					
SCsb-043M-0001-SO	9/21/10	1–5	81578	---	---	X	X		X					
SCsb-043M-0002-SO	9/21/10	5–9	81578	---	---	X	X		X					
SCsb-043M-0003-SO	9/21/10	9–13	81578	---	---	X	X		X					
SCsb-043M-0004-SO	9/21/10	13–17	81578	---	---	X	X		X					
SCsb-043M-0005-SO	9/21/10	17–20	81578	---	---	X	X		X					
SCsb-044M-0001-SO	9/24/10	1–5	81670	---	---	X	X		X					
SCsb-045M-0001-SO	9/25/10	1–5	81670	---	---	X	X		X					

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicate	USACE QA Spit Sample	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCsb-046M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X				X	
SCsb-047M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-048M-0001-SO	9/29/10	1–5	81670	SCsb-084M-0001-SO	SCsb-048M-0001-QA	X	X	X	X	X		X	X	X
SCsb-048D-0001-SO	9/29/10	1–5	81670	SCsb-084D-0001-SO	---						X			
SCsb-049M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-050M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-051M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X				X	
SCsb-046M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X				X	
SCsb-047M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-048M-0001-SO	9/29/10	1–5	81670	SCsb-084M-0001-SO	SCsb-048M-0001-QA	X	X	X	X	X		X	X	X
SCsb-048D-0001-SO	9/29/10	1–5	81670	SCsb-084D-0001-SO	---						X			
SCsb-049M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

Sample Location ID	Date	Depth (feet bgs)	Laboratory SDG	Field Duplicate	USACE QA Spit Sample	Metals	Explosives	Propellants	SVOCs	Pesticides	VOCs	PCBs	Hexavalent Chromium	Total Cyanide
SCsb-050M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-051M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X				X	
SCsb-052M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-053M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-054M-0001-SO	9/29/10	1–5	81670	---	---	X	X		X					
SCsb-055M-0001-SO	9/25/10	1–5	81670	---	---	X	X		X					
Sediment														
SCsd-070M-0001-SD	9/28/10	0–0.5	81670	---	---	X	X	X	X	X		X	X	X
SCsd-071M-0001-SD	9/28/10	0–0.5	81670	---	---	X	X	X	X	X		X	X	X
SCsd-071D-0001-SD	9/28/10	0–0.5	81670	---	---						X			

Table C-1 (continued)
Sample Summary Table for Remedial Investigation Samples Collected as Sand Creek Disposal Road Landfill

[1] denotes the associated QA sample was submitted for metals, explosives, and SVOCs analyses only.
--- denotes not sampled.
bgs denotes below ground surface.
ID denotes identification.
PCB denotes polychlorinated biphenyl.
QA denotes quality assurance.
SDG denotes sample data group.
SVOC denotes semivolatile organic compound.
USACE denotes U.S. Army Corps of Engineers.
VOC denotes volatile organic compound.

- Step 2—Data Validation by Shaw
  - Shaw performs a detailed validation process as described in Section 1.2. Shaw also reviews all the analytical data packages for completeness, consistency, and compliance with the project quality assurance (QA) requirements presented in the RVAAP *Final Facility-Wide Sampling and Analysis Plan* (SAIC, 2001) and the project-specific *Final Quality Assurance Project Plan Addendum No.1* (Shaw, 2009). Shaw assigns data qualifiers in accordance with DOD QSM 4.1.

1.2 Data Validation Process

Shaw completed Step 2 (Data Validation) of the data review/validation process. The purpose of data validation was to evaluate the completeness, consistency, and compliance of data packages with quality objectives stated in SW-846, as well as the DOD QSM 4.1. In addition, data qualifiers were assigned based on data validation findings. The validation process reviewed the data elements listed below:

- Holding Times (VOCs, SVOCs, pesticides, PCBs, explosives, and metals)—Holding times were verified by comparing sampling dates on the chain-of-custody form with the dates of analysis and/or extraction on the analytical data sheet. The sample record documents were examined to determine if the samples had been properly preserved.
- Gas Chromatography/Mass Spectrometry (GC/MS) Tune Check (VOCs and SVOCs)—Tuning and performance criteria were reviewed to ensure that mass resolution, analyte identification, and to some extent, instrument sensitivity were within limits specified in the method, DOD QSM 4.1 and LCG. Conformance to DOD QSM 4.1 was determined using standard compounds [bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine for SVOCs]. The criteria provided in the LCG had to be met in all circumstances. The evaluation process involved the following steps:
  a. Verify that the mass calibration was correct by reviewing the raw data.
  b. Verify the data presented on each GC/MS tuning and mass calibration were compared with each mass listing submitted.
  c. Verify that a Mass Calibration Form was completed for each 12-hour period in which samples were analyzed.
  d. Verify that the laboratory made no transcription errors.
  e. Verify that the appropriate number of significant figures was reported.

f. Verify that analytical calculations were error free. For example, the percent mass of m/z 443 relative to the mass of m/z 442 was calculated using the following equation:

$$\%\ \text{abundance} = \frac{\text{relative abundance of m/z 443}}{\text{relative abundance of m/z 442}} \times 100$$

- Initial and Continuing Calibrations (VOCs, SVOCs, pesticides, PCBs, and explosives)—DOD QSM 4.1 requirements for satisfactory instrument calibration were established to verify that the instrument was capable of producing acceptable quantitative data prior to sample analysis. The evaluation process involved the following:

  – VOCs and SVOCs

  a. Verify that all response factors (RFs) and their mean were calculated accurately and the RFs of the system performance check compounds (SPCCs) met the method criteria requirement.

  b. Verify that relative standard deviations (RSDs) were calculated accurately and %RSDs of the calibration check compounds (CCCs) during initial calibration met the method requirements.

  c. Verify that percent differences (%Ds) of the CCCs during continuing calibration verifications (CCVs) were within the method requirements.

  – Pesticides, PCBs (Aroclor-1016 and -1260), and explosives

  a. Verify that the correlation coefficients were >0.995.

  b. Check the calculation of %RSD, and verify that all analytical method criteria were met.

The continuing calibration demonstrated the satisfactory maintenance of the instrument on a day-to-day basis. The evaluation process involved the following:

a. Verify the average RF.

b. Verify the %Ds.

1.2.1 DOD QSM 4.1 Requirements

Validation of the data by CT Laboratories and Shaw was based on revisions to the DOD QSM 4.1 which differs greatly from the previous versions of this document. Incorporation of the limit of detection (LOD) and limit of quantitation (LOQ) as the standards for validation has created new definitions for validation flagging that did not previously exist. The greatest

impact of these revised flagging standards particularly impacts the validation process for inorganics as can be seen in Section 2.7, Metals. Terminology of the LOD and LOQ and applicable requirements necessary for data validation based on the DOD QSM 4.1 are presented in this section.

- LOD—An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte specific and matrix specific and may be laboratory dependent.
- LOD (Clarification)—The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99 percent). At the LOD, the false negative rate (Type II error) is 1 percent.
- Determination and Verification of LOD (Requirement)—A laboratory shall establish a detection limit (DL) using a scientifically valid and documented procedure for each suite of the analyte matrix method, including surrogates. The DL shall be used to determine the LOD for each analyte and matrix as well as for all preparatory and cleanup methods routinely used on samples as follows:
  - After each DL determination, the laboratory must immediately establish the LOD by spiking a quality system matrix at approximately 2 to 3 times the DL (for a single-analyte standard) or 1 to 4 times the DL (for a multianalyte standard). This spike concentration establishes the LOD. It is specific to each combination of analyte, matrix, method (including sample preparation), and instrument configuration. The LOD must be verified quarterly. The following requirements apply to the initial DL/LOD determinations and to the quarterly LOD verifications.
  - The apparent signal-to-noise ratio at the LOD must be at least 3, and the results must meet all method requirements for analyte identification (i.e., ion abundance, second-column confirmation, or pattern recognition.) For data systems that do not provide a measure of noise, the signal produced by the validation sample must produce a result that is at least three standard deviations greater than the mean method blank (MB) concentrations.
  - If a laboratory uses multiple instruments for a given method, the LOD must be verified on each.
  - If the LOD validation fails, then the laboratory must repeat the DL determination and LOD validation at a higher concentration or perform and pass two consecutive LOD validations at a higher concentration and set the LOD at the higher concentration.

– The laboratory shall maintain documentation for all DL determinations and LOD validations.

- LOQ—The minimum levels, concentrations, or quantities of a target variable (i.e., target analyte) that can be reported with a specified degree of confidence.
- LOQ (Clarification)—The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DOD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.
- Establishment and Validation of LOQ (Requirement)—For DOD projects, the LOQ must be set within the calibration range prior to sample analysis. At a minimum, the LOQ must be verified quarterly. The laboratory procedure for establishing the LOQ must empirically demonstrate precision and bias at the LOQ. The LOQ and associated precision and bias must meet client requirements and must be reported. If the method is modified, precision and bias at the new LOQ must be demonstrated and reported.

1.2.2 Data Reduction

The data reduction process consisted of the following procedures:

- Initial Calibration (Metals)—Ensure initial calibrations demonstrated that the instrument was capable of acceptable performance at the beginning of an analytical run. The evaluation process involved the following:
  a. Verify that the instrument was calibrated daily and each time the instrument was set up.
  b. Verify that at least three standards and a blank were used to generate initial calibration.
  c. Verify that the correlation coefficients were >0.995.
- CCV—Ensure CCV documented that the initial calibrations were still valid. The evaluation process involved the following:
  a. Verify that CCVs were conducted after every 10 samples.
  b. Verify that a CCV was conducted at the end of the analytical sequence.
  c. Verify that the percent recoveries (%Rs) for the CCVs were within 90 to 110 percent.
- Instrument Performance (SVOCs and Pesticides)—Pesticide data packages were evaluated to verify that the total percentage breakdown of both dichloro-diphenyl-trichloroethane (DDT) and Endrin did not exceed 15 percent. The SVOC package,

however, was evaluated to verify that the total percentage breakdown of DDT did not exceed 20 percent.

- Initial Calibration Verification (ICV)—Initial calibration verifications were reviewed to verify that an ICV was prepared from a second source and that the recoveries were within acceptable ranges.
- Interelement Check Standard (Metals)—The laboratory's interelement and background correction factors were evaluated by recalculation of one or more recoveries from the raw data and verifying that the recalculated values agreed with the laboratory report. The following points were established:
  a. No interference was observed in the Interelement Check Standard A analysis.
  b. Eighty to 120 percent was observed for the Interelement Check Standard B analysis.
- Blanks (VOCs, SVOCs, Pesticides, PCBs, and Explosives)—Blank analytical results were assessed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applied to any blank associated with the samples. The evaluation process involved the following:
  a. Prepare a MB for each preparatory batch. No target analyte was detected >1/2 RL and >1/10 the amount measured in any sample or >1/10 the regulatory limit, whichever was greater.
  b. Review the results of all associated blanks, the summary sheet, and raw data (chromatograms and quantitation reports).
  c. Verify that the MB analysis had been reported per matrix, per concentration level, for each instrument used to analyze samples, and for each extraction batch.
- Blanks (Metals)—Blank analytical results were assessed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applied to any blank associated with the samples. If a problem with any blank existed, all data associated with the sample batch were evaluated to determine whether or not there was an inherent variability in the data for the sample batch or if the problem was an isolated occurrence not affecting other data. A MB was prepared for each preparatory batch. No target analyte was detected >1/2 RL and >1/10 the amount measured in any sample or >1/10 the regulatory limit, whichever was greater.
- Blank Contamination Qualification—The validator will use the 5x or 10x rule for qualifying positive hits for analytes in the samples that also appear in the MB.

a. "Noncommon" Laboratory Contaminants—The 5x rule is used for "noncommon" laboratory contaminants. If sample analyte concentrations are within 5 times the levels detected in the associated MB, the sample data are considered impacted, and the value reported is qualified as nondetect at the reported concentration. Associated sample detections that are reported as estimated concentrations below the RL will be qualified as nondetects at the RL. Detections that are greater than 5 times the levels in the MB should be considered analytes detected in the sample and are reported without qualification.

b. “Common" Laboratory Contaminants—The 10x rule is employed when the contaminants are considered to be "common" laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone, chloromethane, phthalate compounds, silver, and lead). If sample analyte concentrations are within 10 times the levels detected in the associated MB, the sample data are considered impacted, and the value reported is qualified as nondetect at the reported concentration. Associated sample detections that are reported as estimated concentrations below the RL will be qualified as nondetects at the RL. Detections that are greater than 10 times the levels in the MB should be considered analytes detected in the sample and are reported without qualification.

- Laboratory Control Sample (LCS)—The LCS monitored overall performance of all steps in the analytical process, including sample preparation. The evaluation included the following:

  a. Review the summary form, and verify that the results were within the control limits.

  b. Check the raw data to verify recoveries reported on the summary form.

- Internal Standard (VOCs and SVOCs)—Internal standard performance was evaluated to determine whether the GC/MS sensitivity and response was stable during every run. The evaluation involved the following:

  a. Check raw data (i.e., chromatograms, quantitation lists, etc.) to verify that recoveries reported on the internal standard area summary report were within acceptable limits.

  b. Verify that all retention times and internal standard areas were acceptable.

- Surrogate Recovery (VOCs, SVOCs, Pesticides, PCBs, and Explosives)—Surrogate recovery data were reviewed for conformance to DOD QSM 4.1 specifications. The evaluation involved the following:

a. Check raw data to verify the recoveries reported on the surrogate recovery summary form.

b. Determine whether any surrogate was out of specification.

c. Determine whether the laboratory took appropriate corrective action when surrogate recoveries were outside of specification (i.e., evidence of repurging, reinjection, or reextraction).

d. Verify that blanks did not exhibit surrogates outside the criteria.

- Matrix Spike (MS) and Matrix Spike Duplicate (MSD) (VOCs, SVOCs, Pesticides, PCBs, and Explosives)—MS/MSD analytical results were reviewed for conformance to DOD QSM 4.1 specifications. The evaluation process involved the following:

  a. Inspect MS/MSD results.

  b. Verify transcriptions from raw data.

  c. Verify calculations.

- MS (Metals)—The MS analytical results were reviewed for conformance to DOD QSM 4.1 specifications. The MS recovery was verified by the following:

  a. Review the MS recovery summary form to verify that the results were within specified limits.

  b. Check the data, and recalculate at least one %R using the following equation:

$$\%R = \frac{(SSR - SR)}{SA} \times 100$$

Where: SSR = spiked sample result
SR = sample result
SA = spike added

- Matrix Duplicate (Metals)—Matrix duplicate analytical results were reviewed for conformance to DOD QSM 4.1 specifications. The evaluation process involved the following:

  a. Review the summary form, and verify that the results fall within the control limits.

  b. Check the raw data, and recalculate one or more relative percent differences (RPDs) using the following equation:

$$RPD = \frac{|S - D|}{|S+D|/2} \times 100$$

Where: S = first sample value (original)
D = second sample value (duplicate)

c. Verify that the field blank was not used for duplicate analysis.

- Inductively Coupled Plasma (ICP) Serial Dilution (Metals)—Serial dilution data were reviewed to determine whether significant physical or chemical interferences existed due to the sample matrix.

1.3 Documentation

Shaw has prepared validation checklists for methods addressed in the DOD QSM 4.1 (VOCs, SVOCs, pesticides/PCBs, explosives, and metals). The checklists and format has been reviewed and approved by the USACE Project Chemist. The validation checklists are presented in **Attachment 1**.

2.0 DATA VALIDATION RESULTS

The data validation process described in Section 1.0 was completed for all analytical data provided by CT Laboratories. The Shaw reviewer was the Shaw Project Chemist, Maqsud Rahman, PhD, a qualified individual. The data validation process ensured the following:

- Data generation and reduction were conducted in a technically correct manner in accordance with the methods used.
- Data were reported in the proper units and with the correct number of significant figures.
- Calculations were verified by a valid calculation program, a spot-check verified calculation program, or 100-percent check of all hand calibrations.
- All variances from an accepted method and the rationale for the variations were documented and approved.
- Data were reviewed for transcription errors.
- Analytical data documentation was completed (i.e., analysis data file or data package) and included sample preparation/extraction records, analysis sequence list, raw data, calculations or calculation records, calibration data or records, quality control (QC) measurement results, and test results summary.
- QC measurement results are within established program specification limits, or if not, the data are appropriately qualified.
- Analytical sample holding times were met or exceptions are documented.
- All samples received were in acceptable condition.

Attachment 1 presents the data validation documentation for all environmental and QC samples collected at the Sand Creek Site. A summary of the sample data qualifications for the RI sample results that includes the laboratory and validation qualifiers and reason codes is presented in **Attachment 2**. The following subsections summarize significant findings from the data validation process.

2.1 Data Qualifiers

Analytical results were reported by the laboratory in electronic format and issued to Shaw on compact disc. Data validation was performed to ensure all requested data were received and complete. Data use qualifiers were assigned to each result based on the laboratory QA review

and validation criteria. Validation qualifiers used are presented in **Tables C-2** through **C-5** for the analyses performed.

Table C-2 summarizes the validation qualifiers for VOC and SVOC analyses by EPA SW-846 Methods 8260B and 8270C, respectively. Both methods utilize GC/MS.

Table C-2
Validation Qualifiers for VOC EPA Method 8260B and SVOC EPA Method 8270C

Flag	Flagging Criteria
J	NOT fulfilling any of the following: CCV RF criteria for SPCCs CCV % difference/drift for all analytes and surrogates Internal standard validation criteria LCS recovery Surrogate recovery Any of the following MS recovery outside allowable limit MSD recovery outside allowable limit Sample result between DL and LOQ
B	Method blank contamination
U	Nondetects
N	Nontarget analyte
Flagging not appropriate	NOT fulfilling any of the following: Tuning criteria DDT breakdown requirement Normal responses for benzidine and pentachlorophenol Initial calibration requirements Second source/ICV requirements Relative retention time requirements

CCV denotes continuing calibration verification.
DDT denotes dichloro-diphenyl-trichloroethane.
DL denotes detection limit.
EPA denotes U.S. Environmental Protection Agency.
ICV denotes initial calibration verification.
LCS denotes laboratory control sample.
LOQ denotes limit of quantitation.
MS denotes matrix spike.
MSD denotes matrix spike duplicate.
RF denotes response factor.
SPCC denotes system performance check compound.
SVOC denotes semivolatile organic compound.
VOC denotes volatile organic compound.

Table C-3 summarizes the validation qualifiers for organochlorine pesticides and PCBs by EPA SW-846 Methods 8081B and 8082, respectively. Both methods utilize GC.

Table C-3
Validation Qualifiers for Organochlorine Pesticide EPA Method 8081B and PCB EPA Method 8082

Flag	Flagging Criteria
J	NOT fulfilling any of the following: CCV requirement LCS recovery/recoveries Surrogate recovery/recoveries Any of the following: Results between primary and secondary column RPD $\leq$ 40 percent MS recovery/recoveries outside allowable limit MSD recovery/recoveries outside allowable limit Sample result between DL and LOQ
B	Method blank contamination
U	Nondetects
N	Nontarget analyte
Flagging not appropriate	NOT fulfilling any of the following: DDT/Endrin breakdown requirement Initial calibration requirements ICV requirements

CCV denotes continuing calibration verification.
DDT denotes dichloro-diphenyl-trichloroethane.
DL denotes detection limit.
EPA denotes U.S. Environmental Protection Agency.
ICV denotes initial calibration verification.
LCS denotes laboratory control sample.
LOQ denotes limit of quantitation.
MS denotes matrix spike.
MSD denote matrix spike duplicate.
PCB denotes polychlorinated biphenyl.
RPD denotes relative percent difference.

Table C-4 summarizes the validation qualifiers for nitroaromatics, nitramines, and nitrate esters by EPA SW-846 Method 8330B. This method utilizes high performance liquid chromatography.

Table C-4
Validation Qualifiers for Explosives (Nitroaromatics, Nitramines, and Nitrate Esters) EPA Method 8330B

Flag	Flagging Criteria
J	NOT fulfilling any of the following: CCV requirements LCS recovery/recoveries Any of the following: Results between primary and secondary column RPD $\leq$ 40 percent MS recovery/recoveries outside allowable limit MSD recovery/recoveries outside allowable limit Sample result between DL and LOQ Soil sample triplicate RSD $\leq$ 20 percent
B	Method blank contamination
U	Nondetects
N	Nontarget analyte
Flagging not appropriate	NOT fulfilling any of the following: DDT/Endrin breakdown requirement Initial calibration requirements ICV requirements

CCV denotes continuing calibration verification.
DDT denotes dichloro-diphenyl-trichloroethane.
DL denotes detection limit.
EPA denotes U.S. Environmental Protection Agency.
ICV denotes initial calibration verification.
LCS denotes laboratory control sample.
LOQ denotes limit of qunatitation.
RPD denotes relative percent difference.
RSD denotes relative standard deviation.

Table C-5 summarizes the validation qualifiers for metals by EPA SW-846 Method 6010C. This method utilizes ICP–atomic emission spectrometry.

Table C-5
Validation Qualifiers for Metals EPA Method 6010C

Flag	Flagging Criteria
J	NOT fulfilling any of the following: CCV requirement Interference check standard/solution requirement LCS recovery/recoveries Any of the following: MS recovery/recoveries outside allowable limit MSD recovery/recoveries outside allowable limit Sample result between DL and LOQ Postdigestion spike recovery outside the allowable limit. Graphite furnace recovery test (when applicable) not fulfilling the requirement
B	Method blank contamination
U	Nondetects
N	Nontarget analyte
Flagging not appropriate	NOT fulfilling any of the following: Low-level calibration check standard Initial calibration requirements ICV requirements

CCV denotes continuing calibration verification.
DL denotes detection limit.
EPA denotes U.S. Environmental Protection Agency.
ICV denotes initial calibration verification.
LCS denotes laboratory control sample.
LOQ denotes limit of quantitation.
MS denotes matrix spike.
MSD denotes matrix spike duplicate.

2.2 Volatile Organic Compounds

The data validation indicated that the SDGs were complete (i.e., all required data elements were reported) and all analyses were in compliance with EPA SW-846 Method 8260B and DOD QSM 4.1 requirements with the following exceptions:

- SDG 81613—The MB was reported with a high surrogate recovery for toluene-d8. However, all other QC criteria were within the control limits, and no flagging was done.
- SDG 81543—The result of the sample SCsb-042D-0003-SO was reported a surrogate recovery for 4-BFB of 122 percent which was just outside the allowable

limit of 85–120 percent. Since the recovery was high and no analyte was detected in the sample, no flagging was necessary.

- SDG 82400—Acetone was detected in the MB, but was not detected in the sample. Subsequently, no flagging was necessary.

The CCV standard analyzed on November 12, 2010, had a low recovery (%D of -27 percent) of bromomethane that was outside the allowable limit of 20 percent. The compound was quantified with a "J" flag on the following samples—equipment rinsate sample SCqc-006-0001-ER and trip blank sample SCqc-007-0001-TB.

2.3 Semivolatile Organic Compounds

Validation of the SVOC data indicated that the SDGs were complete (i.e., all required data elements were reported) and all analyses were in compliance with EPA SW-846 Method 8270C and DOD QSM 4.1 with the following exceptions:

- SDG 81613
  - CCV 1CCV24 analyzed on October 9, 2010, had recoveries outside of specified criteria for 2,4-dinitrophenol (31.6 percent high) and benzoic acid (30.1 percent high).
  - CCV 2CCV27 analyzed on October 12, 2010, had recoveries outside of specified criteria for 3,3'-dichlorobenzidine (27.4 percent high) and benzoic acid (38.1 percent high). These compounds were not detected in the associated samples, so they were not qualified.
  - CCV 2CCV30 analyzed on October 19, 2010, had a recovery outside of specified criteria for benzoic acid (32.6 percent high). The compound was not detected in the associated sample.
  - CCV 2CCV32 analyzed on October 20, 2010, had a recovery outside of specified criteria for benzoic acid (23.0 percent high). This compound was not detected in the associated samples. Thus, flagging was not necessary.
  - Sample SCss-044M-0001-SO (852362) had a low surrogate recovery for 2,4,6-tribromophenol. This low surrogate recovery was confirmed by reanalysis and was qualified with a "J" flag in the sample.
  - Sample SCss-069M-0001-SO (854682) had low surrogate recoveries for surrogates 2-fluorophenol, phenol-d5, and 2-fluorobiphenyl. These low surrogate recoveries were greater than 10 percent and were confirmed by reanalysis and were qualified with a "J" flag in the samples.

– The response of the last internal standard (perylene-d12) was low (less than 50 percent of the response in the midpoint of the associated initial calibration) for the following samples: SCsb-045M-0001 (854003), SCsb-046M-0001-SO (854009), SCsb-047M-0001-SO (854010), SCsb-048M-0001-SO (854011), (SCsb-084M-0001-SO (854013), SCsb-049M-0001-SO (854015), SCsb-050M-0001-SO (854016), SCsb-051M-0001-SO (854017), SCsb-052M-0001-SO (854018), SCsb-053M-0001-SO (854019), SCsb-054M-0001-SO (854020), and SCss-069M-0001-SO (854682) due to sample matrix. The compound results calculated using this internal standard in these samples were qualified with a "J" flag.

– LCS 851609 had a high recovery of 3,3'-dichlorobenzidine. The recovery was confirmed by repeat analysis. This compound was qualified with a "J" in the associated samples. The MS and the MSD for sample 851910 (sample from another SDG) had all recoveries and RPDs within the QC limits. All surrogate recoveries were within the QC limits.

– LCS 855463 had all recoveries within the QC limits. The MS for sample SCSQ-004-0001-SO (854005) had the recovery of 3,3'-dichlorobenzidine outside the QC limits. This compound was qualified with a "J" in the parent sample. The RPDs were high for the following compounds: 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, 4-nitroaniline, 4-nitrophenol, and pentachlorophenol. These compounds were not qualified in the parent samples as they were not detected, and the recoveries were within the QC limits.

– LCS 860448 had all recoveries within the QC limits. The MS and/or the MSD for sample SCsb-041M-0002-SO (850312) had recoveries outside the QC limits for the following compounds: 2,4,5-trichlorophenol, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, and pentachlorophenol. The recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. All RPDs were within the QC limits.

– LCS 858563 had all recoveries within the QC limits. The MS and/or the MSD for sample SCqc-001-0001-ER (854741) had recoveries outside the QC limits for the following compounds: benzyl alcohol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-chlorophenol, nitrobenzene, bis(2-chloroethoxy)methane, bis(2-chloroethyl)ether, hexachlorobutadiene, hexachlorocyclopentadiene, and hexachloroethane. The recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. The RPDs were high for the following compounds: benzyl alcohol, 1,2,4-trichlorobenzene, 1,2-

dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 2-nitrophenol, nitrobenzene, bis(2-chloroethyl)ether, 3,3'-dichlorobenzidine, 3-nitroaniline, hexachlorobutadiene, naphthalene, and hexachloroethane. The compounds with low recoveries and high RPDs were qualified with a "J" in the parent sample.

- LCS 861019 had all recoveries within the QC limits. The MS and/or the MSD for sample SCss-057M-0001-SO (852338) had recoveries outside the QC limits for the following compounds: benzyl alcohol, hexachlorocyclopentadiene, 4-chloroaniline, 3,3'-dichlorobenzidine, 4,6-dinitro-2-methylphenol, and pentachlorophenol. The recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. The RPD was high for pentachlorophenol. This compound was qualified with a "J" in the parent sample.

- SDG 82400

  - CCV 1CCV40 analyzed on November 18, 2010, had a high recovery for hexachloropropene (24.1 percent). This compound was not detected in samples, and the data were not qualified.

  - The parent sample (analytical run 71972) for the MS and the MSD was from another SDG and had low recoveries for 4-chloroaniline. This was confirmed by reanalysis, and the compound was qualified with a "J" flag in the parent sample. The RPD was high for 3'3'-dichlorobenzidine. This compound was not detected in the parent sample, and the data were not qualified. All surrogate recoveries were within the acceptable limits.

- SDG 81543

  - CCV 1CCV14 analyzed on October 5, 2010, had a recovery outside of specified criteria for 3,3'-dichlorobenzidine (27.6 percent low). This compound was qualified with a "J" in the associated samples.

  - CCV 2CCV30 analyzed on October 19, 2010, had a recovery outside of specified criteria for benzoic acid (32.6 percent high). Samples SCss-059M-0001 (851525), SCss-060M-001-SO (851526), and SCss-001M-0001-SO (851527) which had detects for benzoic acid were reanalyzed on October 25, 2010, with a CCV (1CCV26) that passed for all compounds.

  - LCS 853893 had all recoveries within the QC limits. The MS and/or the MSD for sample SCsb-041M-002-SO (850312) had recoveries outside the QC limits for the following compounds: 2,4,5-trichlorophenol, 2-nitrophenol, 4,6-dinitro-2-methylphenol, pentachlorophenol, and hexachlorocyclopentadiene. The

recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. The RPDs were high for 3,3'-dichlorobenzidine and 4-chloroaniline. These compounds were not qualified in the parent sample as they were not detected and had passing recoveries.

- Samples SCsb-043M-0005-SO (850305) and SCsb-041M-0002-SO (850312) had low surrogate recoveries for 2-fluorophenol and 2,4,6-tribromophenol. The low surrogate recoveries were confirmed by reanalysis and were qualified with a "J" flag.
- LCS 854888 had all recoveries within the QC limits. The MS and/or the MSD for sample SCSB-039-0002-SO (850322) had recoveries outside the QC limits for the following compounds: 2,4,5-trichlorophenol, 2-nitrophenol, 4,6-dinitro-2-methylphenol, pentachlorophenol, and hexachlorocyclopentadiene. The recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. All RPDs were within the QC limits.
- Sample SCsb-035M-0005-SO (851482) had a low surrogate recovery for 2,4,6-tribromophenol. This low surrogate recovery was confirmed by reanalysis and was qualified with a "J" flag.
- LCS 855277 had all recoveries within the QC limits. The MS and/or the MSD for sample 851506 had recoveries outside the QC limits for the following compounds: 3,3'-dichlorobenzidine, 3-nitroaniline, 4-chloroaniline, and hexachlorocyclopentadiene. The recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. The RPD was high for benzoic acid. This compound was not qualified in the parent sample as it was not detected and had passing recoveries.
- Samples SCsb-036M-0003-SO (851485) SCsb-080M-0001-SO (851498), SCsb-037M-0004-SO (851504), SCsb-038M-0002-SO (851507), and SCsb-038M-003 (851508) had low surrogate recoveries for 2,4,6-tribromophenol. These low surrogate recoveries were confirmed by reanalyses and were qualified with a "J" flag in the samples.
- CCV 2CCV30 analyzed on October 19, 2010, had a recovery outside of specified criteria for benzoic acid (32.6 percent high). Samples SCss-059M-0001-SO (851525), SCss-060M-0001-SO (851526), and SCss-061M-0001-SO (851527) which had detects for benzoic acid were reanalyzed on October 25, 2010, with a CCV (1CCV26) that passed for all compounds.
- LCS 860448 had all recoveries within the QC limits. The MS and/or the MSD for sample SCsb-041M-0002-SO (850312) had recoveries outside the QC limits

for the following compounds: 2,4,5-trichlorophenol, 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, and pentachlorophenol. The recoveries were confirmed by reanalysis, and parent sample results for these compounds were qualified with a "J" flag. All RPDs were within the QC limits.

- Sample SCsb-039M-0001-SO (850321) had a low surrogate recovery for 2,4,6-tribromophenol. This low surrogate recovery was confirmed by reanalyses and qualified with a "J" flag in the sample.

2.4 Polychlorinated Biphenyls

Validation of PCB data indicated that the SDGs were complete (i.e., all required data elements were reported) and all analyses were in compliance with EPA SW-846 Method 8082 and DOD QSM 4.1 requirements. No QC outliers are reported.

2.5 Pesticides

Validation of pesticide data indicated that the SDGs were complete (i.e., all required data elements were reported) and all analyses were in compliance with EPA SW-846 Method 8081A and DOD QSM 4.1 requirements with the following exceptions:

- SDG 81613
  - The MB 852473 analyzed on October 20, 2010, had a 4,4'-DDT detected at 0.02 micrograms per liter (μg/L). The compound was not detected in the associated samples. No flagging was necessary.
  - CCV 053 analyzed on October 21, 2010 had high responses of toxaphene/chlordane for the following peaks: channel A chlordane #3, toxaphene #1, #2, #3, and #4, and the surrogate decachlorobiphenyl; channel B chlordane #2, #3, and #5, toxaphene #4 and #5 and the surrogate decachlorobiphenyl. However, the total chlordane and toxaphene results were within the QC limits. Furthermore, these compounds were not detected in the associated samples.
  - LCS 855458 analyzed on October 21, 2010, had 118 percent recovery of endosulfan and was outside the allowable range of 50–110 percent. This compound was not detected in the associated samples.
  - The MS and MSD on sample SCqc-005-0001-ER had high recoveries of 138 percent and 130 percent for gamma-chlordane and were outside the allowable range of 60–125 percent. The recoveries were confirmed by reanalysis. The compound was qualified with "J" in the parent sample.

– The MB 852916 analyzed on November 9, 2010, had a 2,4,5,6-tetrachloro-m-xylene (a surrogate) recovery of 67.7 percent that was just below the allowable range of 70–125 percent. The low recovery was confirmed by repeat analysis. The recovery of the second surrogate (decachlorobiphenyl) was within the acceptable limit.

– Ending toxaphene/chlordane (CCV 06 analyzed on November 10, 2010) had a low response of surrogate decachlorobiphenyl. Toxaphene and technical chlordane were not detected in the associated samples.

– The following compounds were "J" qualified because the concentration differ more than 40 percent between channel A and channel B:

Laboratory Sample Number	Sample Description	Compound
852377	SCss-057M-0001-SO	Heptachlor 4,4'-DDD
854000	SCsd-070M-0001-SD	Heptachlor 4,4'-DDT Methoxychlor Alpha-chlordane Beta-BHC Delta-BHC Endosulfan sulfate Gamma-chlordane
854010	SCsd-071M-000-SD	4,4'-DDT Methoxychlor 4,4'-DDD

DDD denotes dichloro-diphenyl-dichloroethane.
DDT denotes dichloro-diphenyl-trichloroethane.

– The MS recovery on sample SCss-057-000-SO had a recovery of 57 percent for endosulfan sulfate and was outside the allowable range of 60–135 percent. This compound was qualified with "J" in the parent compound.

2.6 Explosives

Data validation for explosives indicated that the SDGs were complete (i.e., all required data elements were reported) and all analyses were performed following EPA SW-846 Method 8330 and DOD QSM 4.1 requirements. No QC outliers were identified for SDGs 81643 and 82400. The validation of explosives data in the SDG 81613 consist of the following findings:

- SDG 81613
  - The sample SCqc-004-0001-ER had a recovery of 145 percent 1,2-dinitrobenzene (the surrogate) which was above the allowable range of 70–130 percent. In the confirmation analysis, the surrogate was within the normal range. This was due to interference with the surrogate analysis by sample matrix on the primary column. The interfering contaminant elutes at a different time on the confirmation column. There were a number of miscellaneous peaks and baseline disturbances in all the samples on both column analyses.
  - The sample SCqc-005-001-ER had a recovery of 141 percent of the surrogate 1,2-dinitrobenzene which was above the allowable range of 70–130 percent. In the confirmation column analysis, the surrogate was within the normal limit. It was confirmed in the confirmation analysis that there were several extra peaks. Thus, the high surrogate recovery was due to matrix interference. No analytes were detected in the sample.
  - The sample SCsb-056M-0001-SO had no hits, but had a high recovery of the surrogate 1,2-dinitrobenzene of 130 percent (allowable range 75–127 percent). The sample was reanalyzed on the confirmation column, and the surrogate recovery was within the acceptable range. However, there were several extra peaks that appear in the confirmation column, mostly towards the end.

2.7 Metals

Data validation of metals indicated that the SDGs were complete (i.e., all required data elements were reported) and all analyses were performed following EPA SW-846 Method 6010C and DOD QSM 4.1 requirements with the following exceptions:

- SDG 81613
  - Barium was detected above the LOD in the initial calibration blank (ICB) 860519, but the affected sample results were greater than 5 times the amount present in the blank, so the samples were not reanalyzed. The sample results in the element were not qualified.
  - Magnesium was detected above the LOD, and aluminum, barium, calcium, and iron were detected above the ½ reporting limit (RL) in the MB (858603). The results for these elements in the associated samples were all greater than 5 times the MB results. Subsequently, the sample data were not qualified.
  - Barium was detected above the LOD in three calibration blanks (CCBs) 860524, 860528, and 860530. However, the sample results were greater than 5

times the amount present in the blanks. Subsequently, the sample results were not reanalyzed. The sample results for barium were not qualified.

- Aluminum and barium were detected above the LOD in CCB 860532. However, the sample results were greater than 5 times the amount present in this blank. Subsequently, the samples were not reanalyzed. The sample results for aluminum and barium were not qualified.
- Serial dilution 860525 failed (>10 percent RPD) for silver, aluminum, arsenic, barium, calcium, cadmium, cobalt, chromium, copper, magnesium, manganese, nickel, lead, thallium, and zinc. Arsenic, cadmium, and thallium were not applicable to the serial dilution test because the parent sample SCss-057M-0001-SO (852338) results for these elements were not greater than 50 times the LOQ. A postdigestion spike (PDS) (860526) was analyzed on this sample. The elements with failing PDS recoveries were qualified with a "J" flag in the parent sample.
- The MS and/or MSD for sample 850322 failed for silver, chromium, antimony, and iron. These MSs were also analyzed at two different dilutions. The first PDS (860526) analyzed had acceptable recoveries for silver, chromium, and iron. Those elements with acceptable recoveries were reported without qualification in the parent sample. The elements with failing PDS recoveries and applicable serial dilution test failures were qualified with a "J" flag in the parent sample.
- The duplicate sample (DUP) results for sample 852338 were not applicable for thallium and antimony because their results were not greater than 5 times the LOQ in the parent sample. A MSD was analyzed to demonstrate precision.
- The DUP result for sample 852338 failed the RPD limit for arsenic. The parent sample result for this element was qualified "J."
- Barium and magnesium were detected above the LOD in CCB 863787, but the sample results were greater than 5 times the amount present in this blank for these elements. Subsequently, the samples were not reanalyzed. The sample results for these two elements were not qualified.
- Serial dilution 861686 failed (>10 percent RPD) for sodium and potassium. Sodium and potassium were not applicable to the serial dilution test because the parent sample (852338) results for these elements were not greater than 50 times the LOQ. There was a PDS (861687) analyzed on this sample with acceptable results for these elements.

- The MS and MSD for sample 852338 failed for potassium and sodium, but the PDS (861687) had acceptable recoveries for these elements. The parent sample result was reported without qualification.
- Aluminum and magnesium were detected above the ICB 863231. However, the affected sample result was greater than 5 times the amounts present in this blank; subsequently, the sample was not reanalyzed. The sample result for these elements was not qualified.
- Serial dilution 863235 failed (>10 percent RPD) for arsenic, beryllium, calcium, cadmium, cobalt, chromium, copper, magnesium, nickel, lead, thallium, vanadium, and zinc. Arsenic, cadmium, beryllium, and thallium were not applicable to serial dilutions tests because the parent sample (852380) results for these elements were not greater than 50 times the LOQ. A PDS (862236) was analyzed on this sample. The elements with failing PDS recoveries that were qualified with as "J" flag in the parent sample were cadmium, chromium, cobalt, copper, manganese, nickel, thallium, vanadium, and zinc.
- The MS and/or MSD for sample 852380 failed for arsenic, cadmium, cobalt, chromium, nickel, thallium, vanadium, zinc, selenium, antimony, iron, silver, aluminum, and manganese. The MSs were also analyzed at a dilution. The PDS had acceptable recoveries for arsenic, antimony, silver, and aluminum. Those elements with acceptable recoveries were reported without qualification in the parent sample. The elements with failing PDS recoveries and applicable serial dilution test failures were qualified with a "J" flag in the parent sample.
- Thallium was detected above the LOD in the MB 860784. The results for this element in the associated samples were greater than 5 times the results in the MB that were not qualified in the MB result. Samples that have thallium results were less than 5 times the MB result and were qualified as nondetects.
- Barium and thallium were detected above the LOD in CCB 863238. However, the sample results were greater than 5 times the amount present in this blank for these elements, so the samples were not reanalyzed. The sample results for these two elements were not qualified.
- Barium was detected above the LOD in CCB 863240. However, the sample results were greater than 5 times the amount present in this blank for this element. Subsequently, the sample was not reanalyzed. The sample results for this element was not qualified.

- Thallium was detected above the LOD in CCB 863242, but the sample results were greater than 5 times the amount present in this blank for this element. Subsequently, the sample was not reanalyzed. The sample results for this element were not qualified. Serial dilution 864142 failed (>10 percent RPD) for sodium and potassium, but was not applicable because the sample results were not greater than 50 times the LOQ for these elements. A PDS (864143) was analyzed and had acceptable recoveries for these elements.
- The MS/MSD for sample 852380 failed for sodium and potassium. A PDS (864143) had acceptable recoveries for sodium and potassium. These elements were reported without qualification in the parent sample.
- Aluminum was detected above LOD in ICB 863250 that was analyzed prior to the sample analysis, and barium was detected above the LOD in CCB 864257. There were no affected sample results bracketed by these calibrations.
- Thallium was detected above the LOD in CCB 863259. However, the sample results were 5 times the amount present in this blank for this element, so the samples were not reanalyzed. The results for this element were qualified with a "B" flag.
- Aluminum, barium, calcium, chromium, iron, magnesium, and nickel were detected above the LOD in ICB 863780, but the sample results were greater than 5 times the amount present in this blank for these elements, so the sample were not reanalyzed. The sample result for these seven elements was not qualified.
- Zinc was detected above the LOD, and aluminum, barium, calcium, iron, magnesium, and manganese were detected above $^1/_2$ of the RL in the MB 860786. The results for these elements in the associated samples were all greater than 5 times the MB results. Subsequently, the sample data were not qualified.
- Aluminum, magnesium, barium, calcium, chromium, and nickel were detected above the LOD in ICB 864085 that was analyzed prior to the sample analysis. There were no affected sample results bracketed by this ICB.
- Barium and iron were detected above the LOD in CCB 86091, but the sample results were greater than 5 times the amount present in this blank for these elements, so the samples were not reanalyzed. The sample results for these elements were not qualified.

- Serial dilution 864092 failed (>10 percent RPD) for beryllium, thallium, and zinc. Arsenic was not applicable to the serial dilution test because the parent sample (854017) result for this element was not greater than 50 times the LOQ. A PDS (8641014) was analyzed on this sample. The elements with failing PDS recoveries were qualified with "J" flag in the parent sample.
- The MSA and/or MSD for sample 854017 failed for thallium, zinc, nickel, magnesium, iron, copper, chromium, lead, aluminum, antimony, cadmium, and cobalt. These MSs were analyzed at a dilution. The PDS had acceptable recoveries for chromium, lead, aluminum, antimony, cadmium, and cobalt. Those elements with acceptable recoveries were reported without qualification in the parent sample. The elements with failing PDS recoveries and applicable serial dilution test failures were qualified with a "J" flag in the parent sample.
- The DUP results for sample 854017 were not applicable for antimony, cadmium, and selenium because their results were not greater than 5 times the LOQ for these elements in the parent sample. A MSD was analyzed to demonstrate the precision. The MSD exceeded the PRD criteria for cadmium and antimony. The parent sample results were qualified with a "J" flag when the difference between the original and duplicate results were greater than plus/minus RL.
- Barium, aluminum, magnesium, and iron were detected above the LOD in CCB 864094, but the sample results were greater than 5 times the amount present in the blank for these elements, so the sample were not reanalyzed. The sample results for these four elements were not qualified.
- Serial dilution 862216 failed (>10 percent RPD) for potassium, but was not applicable because the sample result was not greater than 50 times the LOQ for potassium.
- Barium was detected above ½ of the RL in the MB (864350). The result for this element in the associated sample was greater than 5 times the MB result. Subsequently, the sample data were not qualified because of MB contamination.

- SDG 81643
  - Barium and cadmium were detected above the LOD in ICB 855219 that was analyzed prior to the sample analysis, and barium, cadmium, magnesium, selenium, and zinc were detected above the LOD in CCB 857525. Only preparatory batch QC samples were bracketed by this CCB; therefore, they were reported without qualification.

- Vanadium was detected above the LOD, and aluminum, barium, cadmium, iron, and zinc were detected above ½ of the RL in the MB (853784). The results for these elements in the associated samples were all greater than 5 times the MB sample results; therefore, the sample data were not qualified.

- Barium, calcium, cadmium, magnesium, and zinc were detected above the LOD in CCB 857126, but the sample results were greater than 5 times the amount present in this blank, so the samples were not reanalyzed again. The sample results for these five elements were not qualified.

- Serial dilution 857129 failed (>10 percent RPD) for arsenic, cobalt, copper, magnesium, nickel, lead, antimony, vanadium, and zinc, and serial dilutions 857639 and 857688 failed for iron and aluminum, respectively. Arsenic and antimony were not applicable to the serial dilution test because the parent sample SCsb-041M-00-2-SO (850312) results for these elements were not greater than 50 times the LOQ. Three PDSs (857130, 857640, and 857650) were analyzed on this sample.

- The MS and/or MSD for sample SCsb-041M-00-2-SO (850312) failed for cadmium, chromium, cobalt, copper, magnesium, nickel, lead, antimony, vanadium, zinc, selenium, manganese, thallium, iron, and aluminum. These MSs were also analyzed at two different dilutions. The first PDS (846847) analyzed had acceptable recoveries for cadmium, lead, selenium, and antimony. The second PDS (857650) analyzed had acceptable recoveries for aluminum, cobalt, copper, magnesium, nickel, vanadium, and zinc. The third PDS (875640) analyzed had acceptable recoveries for iron, manganese, and thallium.

- The first serial dilution (857129) analyzed had an acceptable result for chromium. These elements were reported without qualification in the parent sample. Aluminum, barium, calcium, cadmium, magnesium, and zinc were detected above the LOD in CCB 857132, but the sample results were greater than 5 times the amount present in this blank, so the samples were not reanalyzed again. The sample results for these six elements were not qualified.

- Aluminum, barium, beryllium, calcium, cadmium, cobalt, magnesium, nickel, selenium, vanadium, and zinc were detected above the LOD in CCB 857134, but the sample results were greater than 5 times the amount present in this blank for aluminum, barium, beryllium, calcium, cadmium, cobalt, magnesium, nickel, vanadium, and zinc and less than the LOD for selenium, so the samples were not reanalyzed again. Selenium was qualified as nondetect (“U”). The remaining sample results for the rest of elements were not qualified.

- Magnesium and zinc were detected above the LOD in the CCB 857689, but only analytical QC (PDS 857650) was affected by this blank, and the sample results were greater than 5 times the amounts present in this blank, so this sample was not reanalyzed. The PDS results for these two elements were reported without qualification.
- Magnesium, vanadium, and zinc were detected above the LOD in CCB 857691, but only analytical QC (PDS 857650) was affected by this blank, and the sample results were greater than 5 times the amounts present in this blank, so this sample was not reanalyzed. The PDS results for these three elements were reported without qualification.
- Iron was detected above the LOD in two CCBs (857691 and 857693), but the sample results were greater than 5 times the amount present in these blanks, so the samples were not reanalyzed. The sample results for this element were not qualified.
- Serial dilution 855939 failed (>10 percent RPD) for potassium. A PDS (855940) was analyzed and had an acceptable result.
- The MS and MSD for sample 850312 failed for potassium. PDS (855940) had an acceptable recovery for potassium. This element was reported without qualification in the parent sample (analytical run 70642).
- Silver, barium, iron, and selenium were detected above the LOD in the ICB 856560, but the sample results were greater than 5 times the amount present in this blank for silver, barium, and selenium, so the samples were not reanalyzed again. The sample results for these three elements were not qualified with a "B." Only preparatory batch QC samples were bracketed by this ICB for iron; therefore, they were reported without qualification.
- Silver was detected above the LOD in three CCBs (856567, 856569, and 856572), but sample results were less than 5 times the concentration in the blank and were not reanalyzed. They were reported as nondetects.
- Serial dilution 856564 failed (>10 percent RPD) for aluminum, barium, beryllium, calcium, cobalt, chromium, copper, magnesium, manganese, nickel, lead, vanadium, and zinc, and serial dilution 859401 respectively failed for iron and thallium. Beryllium and thallium were not applicable to the serial dilution test because the parent sample (850322) results for these elements were not greater than 50 times the LOQ. Two PDSs (856565 and 859402) were analyzed on this sample.

- The MS and/or MSD for sample 850322 failed for aluminum, cobalt, copper, manganese, nickel, vanadium, zinc, cadmium, selenium, antimony, iron, and thallium. These MSs were also analyzed at two different dilutions. The first PDS (856565) analyzed had acceptable recoveries for aluminum, barium, beryllium, calcium, chromium, magnesium, manganese, nickel, lead, vanadium, cadmium, selenium, and antimony. Those elements with acceptable recoveries were reported without qualification in the parent sample. The elements with failing recoveries were qualified with a "J" flag in the parent sample.
- Serial dilution 856752 failed (>10 percent RPD) for potassium, but was not applicable because the sample result was not greater than 50 times the LOQ. A PDS (857202) was analyzed and had an acceptable result.
- The MS for sample 850322 failed for potassium. PDS (857202) had an acceptable recovery for potassium. This element was reported without qualification in the parent sample.
- Selenium was detected above the LOD, and barium, calcium, magnesium, and vanadium were detected above ½ of the RL in the MB (855985). The results for barium, calcium, magnesium, and vanadium in the associated samples were all greater than 5 times the MBS results; therefore, the sample data were not qualified. The results for selenium were less than 5 times the MB contamination. Selenium results less than the LOD were not qualified as nondetects ("U" qualified).
- Serial dilution 860049 failed (>10 percent RPD) for barium, beryllium, calcium, cobalt, chromium, copper, magnesium, nickel, lead, thallium, vanadium, and zinc. Beryllium and thallium were not applicable to the serial dilution test because the parent sample (851518) results for these elements were not greater than 50 times the LOQ. Three PDS (860050, 863292, and 863449) were analyzed on this sample.
- The MS and/or MSD for sample 51518 (sample from another SDG) failed for cobalt, chromium, copper, magnesium, thallium, zinc, cadmium, iron, manganese, selenium, aluminum, and antimony. The first PDS (860050) analyzed had an acceptable recovery for antimony. The second PDS (863292) analyzed had acceptable recoveries for magnesium and thallium. The third PDS (863449) analyzed had acceptable recoveries for cadmium, cobalt, chromium, copper, and zinc. The serial dilution (860049) analyzed had an acceptable result for aluminum, iron, and manganese. These elements were reported without qualification in the parent sample.

- Calcium had a failing PDS recovery on sample 851518. The serial dilution test failed for this element. Although the MS and MSD recoveries met the acceptance criteria, this element was qualified with a "J" flag in the parent sample.
- Aluminum and vanadium were detected above the LOD in CCB 860052, but the affected sample result was greater than 5 times the amount present in this blank, so the sample was not reanalyzed. The sample result for these elements was not qualified.
- Aluminum, iron, magnesium, and vanadium were detected above the LOD in ICB 862490, but the sample results were greater than 5 times the amount present in this blank for these elements, so the samples were not reanalyzed. The sample results for these four elements were not qualified.
- Barium was detected above CCB 62497, but the affected sample results were greater than 5 times the amount present in this blank, so the samples were not reanalyzed. The sample results for this element were not qualified.
- Barium and thallium were detected above the LOD in CCB 864030. Only a QC sample (PDS 863292) was bracketed by this CCB; therefore, it was reported without qualification.
- Thallium was detected above the LOD in CCB 863188, but the samples on this run were not affected by this blank contamination.

- SDG 82400
  - Aluminum, magnesium, nickel, and vanadium were detected above the LOD in CCB 871909 that was analyzed prior to the sample analysis. No affected sample results were bracketed by this CCB.
  - Arsenic and barium were detected above the LOD in CCB 871914. The affected sample (869563) was reported without qualification for arsenic because it was less than the LOD. The sample was reanalyzed for barium.
  - Barium and vanadium were detected above the LOD in CCB 871917. The affected sample (869563) was reported without qualification for vanadium because it was less than the LOD. The sample was reanalyzed for barium.
  - Vanadium was detected above the LOD in the MB (870444). The result for this element in the associated sample was less than the LOD. The sample data were not qualified because of the MB contamination.

- Barium and magnesium were detected above the LOD in CCB 874885. The associated sample results were greater than 5 times the amount present in the blank, and the samples were not reanalyzed. The sample results for these two elements were not qualified. The CCV 875742 failed high for cadmium, copper, and thallium, while CCV 875744 failed for silver, cadmium, copper, antimony, thallium, and cobalt. The associated sample (871039) was reanalyzed for these elements.
- Barium, chromium, and manganese were detected above the LOD in CCB 874261. The associated sample results were greater than 5 times the amount present in the blank, and the samples were not reanalyzed. The sample results for these three elements were not qualified.
- Barium, chromium, aluminum, and manganese were detected above the LOD in CCB 874263. The associated sample results were greater than 5 times the amount present in the blank, and the samples were not reanalyzed. The sample results for these four elements were not qualified.
- Barium, vanadium, and manganese were detected above the LOD in CCB 874898. No samples were associated with this blank.
- Selenium and vanadium were detected above the LOD in CCB 875743. No samples were associated with this blank.
- Vanadium was detected above the LOD in CCB 874905. No samples were associated with this blank.
- Silver was detected above the LOD, and aluminum, barium, calcium, iron, magnesium, and manganese were detected above ½ the RL in the MB (872318). The associated sample results for aluminum, barium, calcium, iron, magnesium, and manganese were all greater than 5 times the MB results. The sample data were not qualified for the MB contamination for these elements. The associated sample results less than 5 times the MB contamination for silver were reported as nondetect ("U" qualifier).
- The MS, MSD, and/or PDS for sample 871026 (from another SDG) failed for magnesium, manganese, and vanadium. The serial dilution test was applicable for these elements and had acceptable results. These elements were reported without qualification in the parent sample.

2.8 Completeness and Usability

Usable data are data that pass individual scrutiny during the validation process and are accepted for unrestricted acceptance for use in data evaluation, risk assessment, or equal

similar type usage. The completeness of field and laboratory generated analytical data was assessed using the following formula:

$$\%\ \text{Completeness} = \frac{[(\text{usable samples}) \times (\text{total analytes})] - \text{unusable analytes} - [(\text{unusable samples}) \times (\text{total analytes})]}{[(\text{total samples}) \times (\text{total analytes})]}$$

Since no data were rejected, 100 percent of the data is considered valid which achieves the completeness criteria presented in Table 3-1 of the Facility-Wide Sampling and Analysis Plan (SAIC, 2001). Therefore, the completeness and usability criteria for the data collected for the Sand Creek Disposal Road Landfill RI have been satisfied.

3.0 REFERENCES

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U.S. Department of Defense (DOD), 2009. *DOD Quality Systems Manual for Environmental Laboratories,* Version 4.1, Environmental Data Quality Workgroup, April 22, 2009.

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Attachment 1
Data Validation Checklists

DATA VALIDATION USING DoD QSM 4.1
US ARMY CORPS OF ENGINEERS
RAVENNA ARMY AMMUNITION PLANT
NITROAROMATICS AND NITRAMINE ANALYSIS
CHECKLIST

Project Name: Ravenna Army Ammunition Plant, Sand Creek Disposal Road Landfill

Laboratory: CT Laboratories

Report No.: 81613, 81543, 82400

Analytical Method: SW-846-8330B **Matrix:** soil, sediment, water

Analyte: Nitroaromatics and Nitromine **SDGs:** 81613, 81543, 82400

SAMPLE PREPARATION

	Yes	No
1. Analytical Capability		
Was analytical capability demonstrated?	[x]	[ ]
2. Limit of Detection (LOD)		
Were LODs determined and verified?	[x]	[ ]
3. Limit of Quantitation (LOQ)		
a) Were LOQs determined and verified?	[x]	[ ]
b) Were the samples dried to a constant weight?	[x]	[ ]
c) Were the dates, times and ambient temperatures recorded on a daily basis?	[x]	[ ]
d) Were the samples sieved and ground?	[x]	[ ]
4. Soil Grinding Blank		
a) Was a grinding blank processed in-between samples?	[x]	[ ]
b) Were any target analyte present at >1/2 of the RL?		
5. Soil Subsampling Process	[x]	[ ]
a) Was any subsampling process followed?		
6. Soil Sample Triplicate		
a) Was a triplicate analysis performed?	[ ]	[ ]
b) Was the RSD ≤20%?		
7. Aqueous Sample Preparation (when applicable)		
Was a SPE performed?		

SAMPLE ANALYSIS

8. Sample Holding Time		
Were samples analyzed within holding times?	[x]	[ ]
9. Initial Calibration		
a) Did the initial calibration consist of five or more standards?	[x]	[ ]
b) Was the lowest standard concentration at or below the RL?	[x]	[ ]
c) Was the apparent signal to noise ratio at the RL at least 5:1?	[x]	[ ]
d) Was r ≥0.995 (if using linear regression)?	[x]	[ ]
e) Was the RSD ≤15 (if using internal standardization)?	[x]	[ ]

	Yes	No
f) Was the lowest standard reanalyzed after the generation of the calibration curve?	[x]	[ ]
10. Initial Calibration Verification (ICV)		
a) Was the ICV run immediately following the ICAL?	[x]	[ ]
b) Was the ICV made of a 2nd source?	[x]	[ ]
c) Was the mid-level (2nd source) recovery within 80-120%?	[x]	[ ]
11. Continuing Calibration Verification (CCV)/Mid-Point Calibration		
a) Was a CCV conducted prior to sample analysis?	[x]	[ ]
b) Was a CCV conducted after every ten samples or every 12 hours?	[x]	[ ]
c) Was a CCV conducted after the last sample of the day?	[x]	[ ]
d) Did the CCV meet the minimum requirements (D ≤20%)?	[x]	[ ]
12. Method Blank		
a) Was a method blank present in every preparatory batch?	[x]	[ ]
b) Were target analytes detected >1/2 the RL and >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater)?	[ ]	[x]
c) Did the method blank fail the project-specific objectives (>1/2 the RL or > the RL)?	[ ]	[x]
13. Laboratory Control Sample		
a) Was an LCS present in every preparatory batch?	[x]	[ ]
b) Did the LCS contain all analytes to be reported?	[x]	[ ]
c) LCS: Were the percent recoveries for LCS within the limits? (Enter out of control recoveries only)	[x]	[ ]

Identification of LCS Standard

Spiked Compound	LCS %R	Acceptable Range (%)
	.	
	.	

14. Matrix Spike/Matrix Spike Duplicate		
a) MS/MSD: were the percent recoveries within limits? (Enter out of control recoveries only)	[x]	[ ]
b) Were the RPDs within control limits?	[x]	[ ]

Identification of Original Sample Used for QC

Spiked compound	MS %R	MSD%R	%RPD	RPD Control Limits
.				

15. Confirmation Analysis		
a) Was the RPD <40% between the two column results?	[ ]	[x]

	Yes	No
16. Analyte Detection		
a) Were results reported between the DL and the LOQ?	[ ]	[x]
b) Were results reported between the DL and the LOQ flagged as estimated?	[ ]	[ ]

Comments (attach additional sheets if necessary):

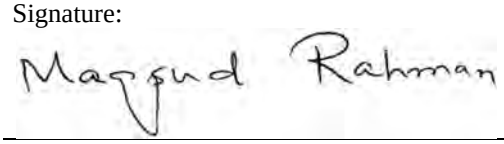
No surrogate recovery criteria are provided in the DoD QSM 4.1for method 8330B. CT Laboratories surrogate limits have been used.

Validated/Reviewed by:

Name: Maqsud Rahman

Date: April 18, 2011

Signature:



Overall Assessment of the Data Package:

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DATA VALIDATION USING DoD QSM 4.1
US ARMY CORPS OF ENGINEERS
RAVENNA ARMY AMMUNITION PLANT
ICP METALS ANALYSIS BY 6010B
CHECKLIST

Project Name: **Ravenna Army Ammunition Plant, Sand Creek Disposal Road Landfill**

Laboratory: CT Laboratories **Sampling Date:** Multiple

Report No.: 81613, 81543, 82400

Analytical Method: SW-846-6010B **Matrix:** soil, sediment, water

Analyte: Metals **SDGs:** 81613, 81543, 82400

	Yes	No
SAMPLE PREPARATION		
1. Analytical Capability Was analytical capability demonstrated?	[x]	[ ]
2. Limit of Detection (LOD) Were LODs determined and verified?	[x]	[ ]
3. Limit of Quantitation (LOQ) Were LOQs determined and verified?	[x]	[ ]
4. Instrument Detection Limit (IDL) study Was an IDL study performed?	[x]	[ ]
SAMPLE ANALYSIS		
5. Sample Holding Time Were samples analyzed within holding times?	[x]	[ ]
6. Initial Calibration Did the initial calibration consist of:		
a) One high calibration standard and a blank?	[x]	[ ]
b) More than one standard and a blank?	[x]	[ ]

	Yes	No
7. Low Level Calibration Check Standard (daily after 1 point ICAL)		
Was the percentage "D" ≤20%?	[x]	[ ]
8. Initial Calibration Verification (ICV)		
a) Was it analyzed after each ICAL and the beginning of each analytical run?	[x]	[ ]
b) Was the mid-level (2nd source) within 90-110?	[x]	[ ]
9. Linear Dynamic Range or High Level Check Standard (every 6 months)		
Was recovery within 90-110?	[x]	[ ]
10. Interelement Check Standard (ICS)		
a) Was ICS-A (interferents only) conducted at the beginning of the analytical sequence?	[x]	[ ]
b) Were concentrations (absolute values) of all non-spiked analytes <LOD?	[x]	[ ]
c) Was ICS-B (interferents and target analytes) within QC limits (80-120)?	[x]	[ ]
11. Continuing Calibration Blank (CCB)		
a) Was a CCB conducted at least every 10 samples?	[x]	[ ]
b) Was a CCB conducted at the end of the analytical sequence?	[x]	[ ]
c) Were all analyte concentrations >LOD?	[x]	[ ]
12. Continuing Calibration Verification (CCV)		
a) Was a CCV conducted at least every 10 samples?	[x]	[ ]
b) Was a CCV conducted at the end of the analytical sequence?	[x]	[ ]
c) Were recoveries between 90-110%?	[x]	[ ]
13. Sample Quality Control		
a) Method Blanks		
1) Was a method blank present in every preparatory batch?	[x]	[ ]
2) Were target analytes detected >1/2 RL, and >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater?	See validation report	
b) Laboratory Control Sample (LCS)		
1) Was an LCS present in every preparatory batch?	[x]	[ ]
2) Did the LCS contain all analytes to be reported?	[x]	[ ]
3) Were percent recoveries for the LCS within the limits? (Enter out of control recoveries only)	[x]	[ ]

Identification of LCS Standard

Spiked Compound	LCS %R	LCSD %R	%RPD
	.		
	.		

c) Matrix Spike (MS)		
Were the percent recoveries within limits? (Enter out of control recoveries only)	[ ]	[x]

Allowable range: Silver 75-120%, Rest 80-120%

Original Sample	Batch.	Spiked Element	%R
SCSB-041M-0002-SO	34852	Antimony	24
SCSB-041M-0002-SO	34852	Cobalt	12
SCSB-041M-0002-SO	34852	Copper	69
SCSB-041M-0002-SO	34852	Nickel	72
SCSB-041M-0002-SO	34852	Vanadium	79
SCSB-041M-0002-SO	34852	Zinc	74
SCSB-041M-0002-SO	34852	Manganese	14
SCSB-041M-0002-SO	34852	Thallium	74
SCSB-041M-0002-SO	34852	Potassium	76
SCSB-039M-0002-SO	34898	Aluminum	5500
SCSB-039M-0002-SO	34898	Antimony	-3
SCSB-039M-0002-SO	34898	Cadmium	78
SCSB-039M-0002-SO	34898	Cobalt	50
SCSB-039M-0002-SO	34898	Manganese	1908
SCSB-039M-0002-SO	34898	Selenium	71
SCSB-039M-0002-SO	34898	Vanadium	68
SCSB-039M-0002-SO	34898	Zinc	71
SCSB-039M-0002-SO	34898	Thallium	70
SCSB-039M-0002-SO	34898	Potassium	78
SCSB-038M-0001-SO	34910	Aluminum	125
SCSB-038M-0001-SO	34910	Antimony	-1
SCSB-038M-0001-SO	34910	Cadmium	56
SCSB-038M-0001-SO	34910	Chromium	-63
SCSB-038M-0001-SO	34910	Cobalt	63
SCSB-038M-0001-SO	34910	Copper	46
SCSB-038M-0001-SO	34910	Nickel	74
SCSB-038M-0001-SO	34910	Selenium	71
SCSB-038M-0001-SO	34910	Thallium	56
SCSB-038M-0001-SO	34910	Vanadium	75
SCSB-038M-0001-SO	34910	Zinc	74
SCSB-057M-0001-SO	35054	Antimony	26
SCSB-057M-0001-SO	35054	Chromium	59
SCSB-057M-0001-SO	35054	Potassium	67
SCSB-057M-0001-SO	35054	Sodium	72
SCSB-057M-0001-SO	35055	Mercury	-1099

	Yes	No
a) *Matrix Spike Duplicate (MSD)*		
Were the percent recoveries within limits? (Enter out of control recoveries only)	[ ]	[x]

Allowable range: Silver 75-120%, Rest 80-120%

Original Sample	Batch.	Spiked Element	%R
SCSB-041M-0002-SO	34852	Antimony	23
SCSB-041M-0002-SO	34852	Cadmium	12
SCSB-041M-0002-SO	34852	Chromium	57
SCSB-041M-0002-SO	34852	Cobalt	10
SCSB-041M-0002-SO	34852	Copper	63
SCSB-041M-0002-SO	34852	Zinc	74
SCSB-041M-0002-SO	34852	Lead	72
SCSB-041M-0002-SO	34852	Magnesium	75
SCSB-041M-0002-SO	34852	Nickel	67
SCSB-041M-0002-SO	34852	Selenium	78
SCSB-041M-0002-SO	34852	Vanadium	74
SCSB-041M-0002-SO	34852	Zinc	68
SCSB-041M-0002-SO	34852	Iron	57
SCSB-041M-0002-SO	34852	Manganese	1908
SCSB-041M-0002-SO	34852	Iron	57
SCSB-041M-0002-SO	34852	Manganese	10
SCSB-041M-0002-SO	34852	Thallium	73
SCSB-041M-0002-SO	34852	Aluminum	37
SCSB-041M-0002-SO	34852	Potassium	78
SCSB-039M-0001-SO	34898	Aluminum	5200
SCSB-039M-0001-SO	34898	Antimony	-3
SCSB-039M-0001-SO	34898	Cadmium	78
SCSB-039M-0001-SO	34898	Cobalt	50
SCSB-039M-0001-SO	34898	Copper	70
SCSB-039M-0001-SO	34898	Manganese	1908
SCSB-039M-0001-SO	34898	Nickel	78
SCSB-039M-0001-SO	34898	Selenium	70
SCSB-039M-0001-SO	34898	Vanadium	66
SCSB-039M-0001-SO	34898	Zinc	67
SCSB-039M-0001-SO	34898	Thallium	75
SCSB-039M-0001-SO	34898	Iron	136
SCSB-038M-0001-SO	34910	Antimony	0
SCSB-038M-0001-SO	34910	arsenic	-7
SCSB-038M-0001-SO	34910	Cadmium	0
SCSB-038M-0001-SO	34910	Chromium	-54
SCSS-038M-0001-SO	34910	Cobalt	-87
SCSS-038M-0001-SO	34910	Copper	-154
SCSS-038M-0001-SO	34910	Iron	72
SCSS-038M-0001-SO	34910	Lead	-44
SCSS-038M-0001-SO	34910	Nickel	-98
SCSS-038M-0001-SO	34910	Thallium	2
SCSS-038M-0001-SO	34910	Zinc	-270

	Yes	No
b) *Matrix Spike Duplicate (MSD) or Sample Duplicate (SD)* Were the relative percent differences (RPDs) within the acceptable limit? (Enter out of control recoveries only)	[ ]	[x]

Identification of Original Sample Used for QC

Analyte	Original Sample	Duplicate Sample	RPD
Selenium	73.2	4.8	175
Thallium	60.0	4.1	174

	Yes	No
14. Dilution Test		
a) Was a 5-fold serial dilution conducted (one per preparatory batch)?		
b) Was there an agreement between diluted and undiluted results (<10%)?	[x]	[ ]
	[ ]	[ ]
15. Post Digestion Spike Addition		
a) Was a post-digestion spike addition necessary?		
b) Were recoveries within acceptable limits?	[x]	[ ]
	[ ]	[x]
16. Method of Standard Addition (MSA)		
a) Was MSA performed on samples when matrix interference is confirmed?		
	[ ] N/A	[ ]
17. Analyte Detection		
a) Were any results between the DL and the LOQ?		
b) Were any results between the DL and LOQ J flagged?	[x]	[ ]
	[x]	[ ]
18. Sample Analysis		
a) Were samples with analyte concentrations higher than the calibration range (E), diluted and re-analyzed?		
	[x]	[ ]

Comments (attach additional sheets if necessary):

a) All calibrations criteria were completely fulfilled.

b) There has been a number instances when matrix interference was observed.

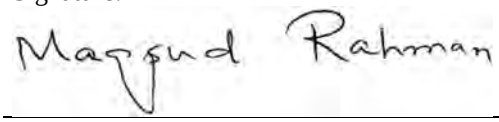
c) The data appears to contain a large amount of blank contamination from various metals; however, in actuality, the data has not be impacted. The "B" qualifiers were included due to lab mix-up of the MDLs and LODs when the data was qualified in the lab.

d) Details of matrix interferences and contamination are described in the data verification report.

Validated/Reviewed by:

Name: Maqsud Rahman Date: April 18, 2011

Signature:



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DATA VALIDATION USING DoD QSM 4.1
US ARMY CORPS OF ENGINEERS
RAVENNA ARMY AMMUNITION PLANT
POLYCHLORINATED BIPHENYL (PCB) ANALYSIS
CHECKLIST

Project Name: Ravenna Army Ammunition Plant, Sand Creek Disposal Road Landfill

Laboratory: CT Laboratories

Report No.: 81613, 81543, 82400

Analytical Method: SW-846 -8082 **Matrix:** soil, sediment, water

Analyte: PCBs **SDGs:** 81613, 81543, 82400

	Yes	No
SAMPLE PREPARATION		
1. Analytical Capability Was analytical capability demonstrated?	[x]	[ ]
2. Limit of Detection (LOD) Were LODs determined and verified?	[x]	[ ]
3. Limit of Quantitation (LOQ) Were LOQs determined and verified?	[x]	[ ]
SAMPLE ANALYSIS		
4. Sample Holding Time		
a) Were samples extracted within holding times?	[x]	[ ]
b) Were samples analyzed within holding times?	[x]	[ ]
5. DDT Breakdown Was DDT Breakdown < 15%?	[x]	[ ]
6. Initial Calibration:		
a) Did the initial calibration consist of five or more standards?	[x]	[ ]
b) Did the initial calibration meet any of the three acceptance criteria:		
Option 1 - RSD for each analyte $\leq$ 20%?	[x]	[ ]
Option 2 - Linear least square regression r $\geq$ 0.995%?		
Option 3 - Non-linear regression coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be used for second order, 7 points shall be used for third order)?		

	Yes	No
7. Retention Time Window Were retention time window positions established for each analyte and surrogate?	[x]	[ ]
8. Initial Calibration Verification (ICV):		
a) Was an ICV run immediately after each ICAL?	[x]	[ ]
b) Is the mid-level (2nd source) within $\pm$ 20% of the true value?	[x]	[ ]
9. Continuing Calibration Verification (CCV): Was a CCV conducted at least every 10 samples and at the end of the analytical sequence?	[x]	[ ]
10. Sample Quality Control		
a) Method Blanks		
1) Was a method blank present for each preparatory batch?	[x]	[ ]
2) Were target analytes detected >1/2 RL, and >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater?	[ ]	[ ]
3) Did the method blank fail project-specific objectives (>1/2 the RL or > the RL)?	[ ]	[x]
a) *Laboratory Control Sample (LCS)*		
1) Was an LCS included in each preparatory batch?	[x]	[ ]
2) Did the LCS contain all arochlors to be reported?	[x]	[ ]
3) Were the percent recoveries for LCS within the limits? (Enter out of control recoveries only)	[x]	[ ]

Identification of LCS Standard

Spiked Compound	LCS %R	LCSD %R	%RPD
	.		
	.		

	Yes	No
b) Matrix Spike/Matrix Spike Duplicate (MS/MSD)		
1) Were the percent recoveries within limits? (Enter out of control recoveries only)	[x]	[ ]
2) Were the RPD within limits?	[x]	[ ]

Identification of Original Sample Used for QC

Spiked compound	MS %R	MSD%R	%RPD
.			

	Yes	No
c) System Monitoring Compounds (Surrogates)		
Are surrogate recoveries within QC limits?	[x]	[ ]
(Enter out of control recoveries only)		

Sample ID	%R

11. Analyte Detection

a)	Were results reported between the DL and the LOQ?	[ ]	[x]
b)	Were results reported between the DL and the LOQ J flagged?	[ ]	[ ]

Comments (attach additional sheets if necessary):

No QC outlier to report.

Validated/Reviewed by:

Name: Maqsud Rahman

Date: April 18, 2011

Signature:

Maqsud Rahman

Overall Assessment of the Data Package:

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DATA VALIDATION USING DoD QSM 4.1
US ARMY CORPS OF ENGINEERS
RAVENNA ARMY AMMUNITION PLANT
PESTICIDE ANALYSIS
CHECKLIST

Project Name: Ravenna Army Ammunition Plant, Sand Creek Disposal Road Landfill

Laboratory: CT Laboratories **Sampling Date:** Various

Report No.: 81613, 81643, 82400

Analytical Method: SW-846, 8081A **Matrix:** soil, sediment, water

Analyte: Pesticides **SDGs:** 81613, 81643, 82400

	Yes	No
SAMPLE PREPARATION		
1. Analytical Capability Was analytical capability demonstrated?	[x]	[ ]
2. Limit of Detection (LOD) Were LODs determined and verified?	[x]	[ ]
3. Limit of Quantitation (LOQ) Were LOQs determined and verified?	[x]	[ ]
SAMPLE ANALYSIS		
4. Sample Holding Time a) Were samples extracted within holding times?	[x]	[ ]
b) Were samples analyzed within holding times?	[x]	[ ]
5. Sample Holding Time c) Were samples extracted within holding times? Were samples analyzed within holding times?		
6. DDT Breakdown Was DDT Breakdown < 15%	[x]	[ ]
7. Initial Calibration: a) Did the initial calibration consist of five or more standards?	[x]	[ ]
b) Did the initial calibration meet any of the three acceptance criteria:		
Option 1 - RSD for each analyte ≤ 20%?	[x]	[ ]
Option 2 - Linear least square regression r ≥ 0.995%?		
Option 3 - Non-linear regression coefficient of determination (COD) r^2 ≥ 0.99 (6 points shall be used for second order, 7 points shall be used for third order)?		
8. Retention Time Window Were retention time window positions established for each analyte and surrogate?	[x]	[ ]

	Yes	No
9. Initial Calibration Verification (ICV): Is the mid-level (2nd source) within ± 20% of the true value?	[x]	[ ]
10. Continuing Calibration Verification (CCV): Was a CCV conducted at least every 10 samples and at the end of the analytical sequence?	[x]	[ ]

11. Sample Quality Control:

a) *Method Blanks*
Were target analytes detected >1/2 RL, and >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater? [x]See comments [ ]

b) *Common Contaminants*
Were any analytes present >RL? [ ] [ ]

.

c) *Laboratory Control Sample (LCS)*
Were the percent recoveries for LCS within the limits? [ ] [x]
(Enter out of control recoveries only)

Identification of LCS Standard

Spiked Compound	LCS %R	LCSD %R	%RPD
LCS 855458/Endosulfan	118 (50-110)		

d) *Matrix Spike/Matrix Spike Duplicate (MS/MSD)*
Were the percent recoveries within limits? [ ] [x]
(Enter out of control recoveries only)

Parent Sample	Compound	MS %R	MSD%R	%RPD
SCqc-005-0001-ER	Gamma-Chlordane	138 (60-125)	130 (60-125)	

e) *System Monitoring Compounds (Surrogates)*
Are surrogate recoveries within QC limits? [ ] [x]
(Enter out of control recoveries only)

Sample ID	Surrogate	%R	Allowable
Method Blank 853916/	2,4,5,6-tetrachloro-m-xylene	67	70-125

12. Results reported between the DL and the LOQ?	[x]	[ ]
13. Results between Channel A and Channel B over 40%?	[x]	[ ]

Sample Description	Compound
SCss-057M-0001-SO	Heptachlor, 4,4'-DDD
SCsd-070M-0001-SD	Heptachlor, Methoxychlor, 4,4'-DDT, Alpha-chlordane, Beta-BHC, Delta-BHC, Endosulfan sulfate, Endosulfan sulfate, Gamma-chlordane
SCsd-071M-0001-SD	4,4'-DDT, Methoxychlor, 4,4'-DDD

Comments (attach additional sheets if necessary):

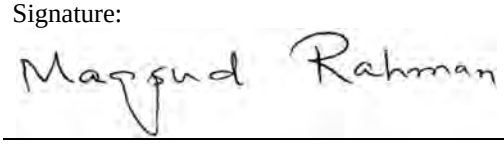
(a) CCV 053 on October 21 (Toxaphene/chlordane) had a high response for the following peaks: Channel A Chlordane #3, Toxaphene #1, #2, #3, #4, and the surrogate decachlorobiphenyl. Channel B: Chlordane #2, #3, #5, Toxaphene #4, #5, and the surrogate decachlorodiphenyl. However, the total chlordane and toxaphene Results were within the QC limits. Furthermore, these compounds were not detected in the associated samples.

(b) Ending CCV 06 analyzed on November 10, 2010 had a low response of surrogate decachlorbiphenyl. Toxaphene and technical chlordane were not detected in the associated samples.

Validated/Reviewed by:

Name: Maqsud Rahman Date: April 18, 2011

Signature:



Overall Assessment of the Data Package:

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DATA VALIDATION USING DoD QSM 4.1
US ARMY CORPS OF ENGINEERS
RAVENNA ARMY AMMUNITION PLANT
SEMIVOLATILE ORGANIC ANALYSIS
CHECKLIST

Project Name: **Ravenna Army Ammunition Plant, Sand Creek Disposal Road Landfill**

Laboratory: CT Laboratories **Sampling Date:** Multiple

Report No.: 81613, 82400, 81543

Analytical Method: SW-846-8270C **Matrix:** soil, sediment, water

Analyte: SVOCs

	Yes	No
SAMPLE PREPARATION		
1. Analytical Capability Was analytical capability demonstrated?	[x]	[ ]
2. Limit of Detection (LOD) Were LODs determined and verified?	[x]	[ ]
3. Limit of Quantitation (LOQ) Were LOQs determined and verified?	[x]	[ ]
SAMPLE ANALYSIS		
4. Sample Holding Time		
a) Were samples extracted within holding times?	[x]	[ ]
b) Were samples analyzed within holding times?	[x]	[ ]
5. Instrument Tuning Was the DFTPP tune performed at the beginning of each 12-hour period during which samples were analyzed?	[x]	[ ]
6. Ion Mass Assignments Was mass assignment based on m/z 198?	[x]	[ ]
7. Ion Abundance Indicate if DFTPP ions abundance relative to m/z 198 base peak met the ions abundance criteria:		

m/z	Acceptance Criteria		
51	30.0 - 60.0 %	[x]	[ ]
68	< 2% of mass 69	[x]	[ ]
70	< 2% of mass 69	[x]	[ ]
127	40-60%	[x]	[ ]
197	< 1%	[x]	[ ]
198	100%, Base peak	[x]	[ ]
199	5-9%	[x]	[ ]
275	5.0 - 9.0%	[x]	[ ]
365	> 1%	[x]	[ ]
441	present but < mass 443	[x]	[ ]

		Yes	No
442	> 40%	[x]	[ ]
443	17-23% of mass 442	[x]	[ ]

8. DDT Breakdown
   Was DDT Breakdown ≤ 20% [x] [ ]

9. Initial Calibration
   a) Did the initial calibration consist of five or more standards? [x] [ ]
   (If the calibration curve consisted of 5-standards, check validity of the calibration model)

   b) Did the following System Performance Check Compounds (SPCC) meet the minimum mean response factor (RF)?

	RF		
N-nitroso-di-n-propylamine	0.05	[x]	[ ]
Hexachlorocyclopentadiene	0.05	[x]	[ ]
2,4-dinitrophenol	0.05		[ ]
4-nitrophenol	0.05	[x]	[ ]
		[x]	

   c) Did the RSD meet the criteria ≤ 30% for the following individual Calibration Check Compound (CCC)?

Base/Neutral Fraction		
Acenaphthene	[x]	[ ]
1,4-Dichlorobenzene	[x]	[ ]
Hexachlorobutadiene	[x]	[ ]
Diphenylamine	[x]	[ ]
Di-n-octylphthalate	[x]	[ ]
Fluoranthene	[x]	[ ]
Benzo(a)pyrene	[x]	[ ]
Acid Fraction		
4-Chloro-3-methylphenol	[x]	[ ]
2,4-Dichlorophenol	[x]	[ ]
2-Nitrophenol	[x]	[ ]
Phenol	[x]	[ ]
Pentachlorophenol	[x]	[ ]
2,4,6-Trichlorophenol	[x]	[ ]

   d) In addition, has met one of the following options:
      1) RSD for each analyte ≤ 15% [x] [ ]
      2) Linear least square regression r ≥ 0.995
      3) Non-linear regression-coefficient r^2 ≥ 0.99

10. Retention Time Window
    Were retention time window position established for each analyte and surrogate? [x] [ ]

11. Evaluation of relative retention time
    Was RRT of each target analyte within ± 0.06 RRT units [x] [ ]

12. Initial Calibration Verification (ICV)
    a) Was an ICV run immediately after each ICAL? [x] [ ]

		Yes	No
b)	Is the mid-level (2nd source) within ± 20% of the true value?	[x]	[ ]

13. Continuing Calibration Verification (CCV)

a)	Was CCV conducted every 12 hours?	[x]	[ ]
b)	Did any of SPCC meet the minimum RF values?	[x]	[ ]

	RF		
N-nitroso-di-n-propylamine	0.05	[x]	[ ]
Hexachlorocyclopentadiene	0.05	[x]	[ ]
2,4-dinitrophenol	0.05	[x]	[ ]
4-nitrophenol	0.05	[x]	[ ]

c) Did the CCC meet the minimum requirements (D ≤ 20%) for the followings?

Base/Neutral Fraction		
Acenaphthene	[x]	[ ]
1,4-Dichlorobenzene	[x]	[ ]
Hexachlorobutadiene	[x]	[ ]
Diphenylamine	[x]	[ ]
Di-n-octylphthalate	[x]	[ ]
Fluoranthene	[x]	[ ]
Benzo(a)pyrene	[x]	[ ]

Acid Fraction		
4-Chloro-3-methylphenol	[x]	[ ]
2,4-Dichlorophenol	[x]	[ ]
2-Nitrophenol	[x]	[ ]
Phenol	[x]	[ ]
Pentachlorophenol	[x]	[ ]
2,4,6-Trichlorophenol	[x]	[ ]

d)	Primary Evaluation Was Drift or D ≤ 20% calculated from the initial calibration?	[ ]See comments	[x]

14. Internal Standard Verification

a)	Were retention times ± 30 seconds from the retention time of the mid- point standard in the ICAL?	[x]	[ ]
b)	Were EICP areas within -50% to + 100% of the ICAL mid-point standard?	[ ]	[x]

15. Sample Quality Control

a)	Method Blanks		
	1) Was a method blank present for each preparatory batch?	[x]	[ ]
	2) Were target analytes detected >1/2 RL, and >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater?	[ ]	[x]
	3) Did the method blank fail project-specific objectives (>1/2 the RL or > the RL)?	[ ]	[x]
b)	Common Contaminants Were any analytes present >RL?	[ ]	[x]

.

	Yes	No
c) LCS		
1) Was an LCS included in each preparatory batch?	[x]	[ ]
2) Did the LCS contain all analytes to be reported?	[x]	[ ]
3) Were the percent recoveries for LCS within the limits? (Enter out of control recoveries only)	[x]	[ ]

Identification of LCS Standard

Spiked Compound	LCS %R	LCSD %R	%RPD

d) MS/MSD		
1) Were the percent recoveries within limits? (Enter out of control recoveries only)	[ ]	[x]
2) Were the RPD within limits?	[ ]	[x]

Sample ID	Spiked compound	MS %R	MSD%R	%RPD
SCSB-039M-0002-SO	2,4,5-Trichlorophenol	39 (50-110)	39 (50-110)	1
SCSB-039M-0002-SO	2-Nitrophenol	24 (40-110)	24 (40-110)	1
SCSB-039M-0002-SO	4,6-Dinitro-2-methylphenol	14 (30-135)	13 (30-135)	3

e) System Monitoring Compounds (Surrogates)		
Are surrogate recoveries within QC limits? (Enter out of control recoveries only)	[ ]	[x]

	%R					
	S1	**S2**	**S3**	**S4**	**S5**	**S6**
Sample ID	(35-125)	(45-105)	(35-105)	(35-100)	(30-125)	(40-100)
SCss-069M-0001-SO 854362	29					
SCsb-043M-0005-SO 850305	27		33			
SCsb-041M-0002-SO 850312	30		34			
SCsb-035M-0005-SO 851482	34					
SCsb-036M-0003-SO 851485				31		
SCsb-080M-0001-SO 851498	14		0			
SCsb-037M-0004-SO 851504	22					
SCsb-038M-0002-SO 851507	15					
SCsb-038M-0003-SO 851508	16					
SCsb-039M-0001-SO 850321	30					

NOTE: S1=2,4,6-Tribromophenol, S2=2-Fluorobiphenyl, S3=2-Fluorophenol, S4=Nitrobenzene-d5, S5=p-Terphenyl-d14 S6: Phenol-d5

	Yes	No
16. Analyte Detection		
a) Were results reported between the DL and the LOQ?	[x]	[ ]
b) Were results reported between the DL and the LOQ J flagged?	[x]	[ ]

Comments (attach additional sheets if necessary)

1. Several CCVs have exceeded allowable limit of 20% as shown below:

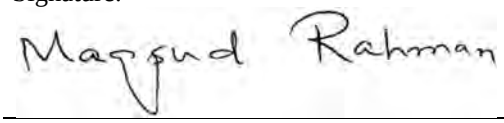
ID & date	Compound	%D	Actions
ICCV24, 10/9/10	2,4-dinitrophenol	31.6% high	Compounds not detected in samples, No qualifier
ICCV2 ,10/0/10	Benzoic acid	30.1% high	Compound not detected in samples, No qulaifier
2CCV27 , 10/9/10	3,3'-dichlorobenzidine	27.4%, high	Compound not detected in samples, No qualifier
2CCV27, 10/9/10	Benzoic acid	38.1, high	Compound not detected in samples, No qualifier
2CCV30,10/19/10	Benzoic acid	32.6%,high	Compound not detected in samples, No qualifier
2CCV32,10/20/10	Benzoic acid	23%,high	Compound not detected in samples, No qualifier
1CCV40,11/18/10	Hexachloropropene	24.1%,high	Compound not detected in samples, No qualifier
1CCV14,10/5/10	3,3'-dichlorobenzidine	27.6%,low	The compound was qualified "Q" in the associated samples.
2CCV30,10/19/10	Benzoic acid	32.6%, low	Samples SCSS-059M—0001-SO, SCSS-060M-001-SO and SCSS-001M-0001-SO which had detects for benzoic acid were re-analyzed on October 25, 2010 with a CCV (ICCV26) that passed for al compounds.

2. All other outliers (internal standard, MS/MSD) are described in the report

Validated/Reviewed by:

Name: Maqsud Rahman Date: April 18, 2011

Signature:



Overall Assessment of the Data Package:

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DATA VALIDATION USING DoD QSM 4.1
US ARMY CORPS OF ENGINEERS
RAVENNA ARMY AMMUNITION PLANT
VOLATILE ORGANIC ANALYSIS
CHECKLIST

Project Name: Ravenna Army Ammunition Plant, Sand Creek Disposal Road Landfill

Laboratory: CT Laboratories

Report No.: 81613, 82400, 81543

Analytical Method: SW-846-8260B **Matrix:** soil, sediment, water

Analyte: VOCs **Sample SDGs**; 81613, 81543, 82400

	Yes	No
SAMPLE PREPARATION		
1. Analytical Capability Was analytical capability demonstrated?	[x]	[ ]
2. Limit of Detection (LOD) Were LODs determined and verified?	[x]	[ ]
3. Limit of Quantitation (LOQ) Were LOQs determined and verified?	[x]	[ ]
SAMPLE ANALYSIS		
4. Sample Holding Time		
a) Were samples preserved?	[x]	[ ]
b) Were samples analyzed within holding times?	[x]	[ ]
5. Instrument Tuning: Was the BFB tune performed at the beginning of each 12-hour period during which samples were analyzed?	[x]	[ ]
6. Ion Mass Assignments: Was mass assignment based on m/z 95?	[x]	[ ]
7. Ion Abundance: Indicate if BFB ions abundance relative to m/z 95 base peak met the ions abundance criteria		

m/z	Acceptance Criteria		
50	15.0 - 40.0 %	[x]	[ ]
75	30.0 - 66.0 %	[x]	[ ]
95	100%, Base Peak	[x]	[ ]
96	5.0 - 9.0%	[x]	[ ]
173	<2.0% of m/z 174	[x]	[ ]
174	>50%	[x]	[ ]
175	5.0 - 9.0% of mass 174	[x]	[ ]
176	95.0 - 101.0% of m/z 174	[x]	[ ]
177	5.0 - 9.0% of m/z 176	[x]	[ ]

	Yes	No

Note: The relative ion abundance of m/g 95/96, m/z 174/176, and 176/177 are of critical importance. The relative ion abumndance of m/z 50 and 75 are of lower importance.

8. Initial Calibration:

a) Did the initial calibration consist of five or more standards? [x] [ ]

b) Did the following System Performance Check Compounds (SPCC) meet the minimum mean response factor (RF)?

	RF		
Chloromethane	0.1	[x]	[ ]
1,1-Dichloroethane	0.1	[x]	[ ]
Bromoform	0.1	[x]	[ ]
Chlorobenzene	0.3	[x]	[ ]
1,1,2,2-Tetrachloroethane	0.3	[x]	[ ]

c) Did the RSD meet the criteria ≤ 30% for the followings each individual Calibration Check Compound (CCC)?

1,1-Dichloroethene	[x]	[ ]
Chloroform	[x]	[ ]
1,2-Dichloropropane	[x]	[ ]
Toluene	[x]	[ ]
Ethylbenzene	[x]	[ ]
Vinyl chloride	[x]	[ ]

d) In addition, has met one of the following options: [x] [ ]
RSD for each analyte $\leq$ 15%
Linear least square regression r $\geq$ 0.995
Non-linear regression-coefficient $r^2 \geq 0.99$

9. Retention Time Window
Were retention time window positions established for each analyte and surrogate? [x] [ ]

10. Evaluation of relative retention time
Was RRT of each target analyte within $\pm$ 0.06 RRT units? [x] [ ]

11. Initial Calibration Verification (ICV):

a) Was an ICV run immediately after each ICAL? [x] [ ]

b) Is the mid-level (2nd source) within $\pm$ 20% of the true value? [x] [ ]

12. Continuing Calibration Verification (CCV):

a) Was CCV conducted every 12 hours? [x] [ ]

b) Did any of SPCC meet the minimum RF values?

	RF		
Chloromethane	0.1	[x]	[ ]
1,1-Dichloroethane	0.1	[x]	[ ]

		Yes	No
Bromoform	0.1	[x]	[ ]
Chlorobenzene	0.3	[x]	[ ]
1,1,2,2-Tetrachloroethane	0.3	[x]	[ ]

c) Did the CCC meet the minimum requirements (D ≤ 20%) for the followings?

1,1-Dichloroethene	[x]	[ ]
Chloroform	[x]	[ ]
1,2-Dichloropropane	[x]	[ ]
Toluene	[x]	[ ]
Ethylbenzene	[x]	[ ]
Vinyl chloride	[x]	[ ]

d) Primary Evaluation: Was Drift or D ≤ 20% calculated from the initial calibration? [ ] See comments [x]

13. Internal Standard Verification:

a) Were retention times ± 30 seconds from the retention time of the mid-point standard in the ICAL? [x] [ ]

b) Were EICP areas within -50% to + 100% of the ICAL mid-point standard? [x] [ ]

14. Sample Quality Control:

a) Method Blanks:

1) Was a method blank present for each preparatory batch? [x] [ ]

2) Were target analytes detected >1/2 RL, and >1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater? [ ] [x]

3) Did the method blank fail project-specific objectives (>1/2 the RL or > the RL)? [x] [ ]

b) Common Contaminants
Were any analytes present >RL? [x] [ ]

.

c) Laboratory Control Sample (LCS)

1) Was an LCS included in each preparatory batch? [x] [ ]

2) Did the LCS contain all analytes to be reported? [x] [ ]

3) Were the percent recoveries for LCS within the limits? (Enter out of control recoveries only) [x] [ ]

Identification of LCS Standard

Spiked Compound	LCS %R (80-130)	LCSD %R (80-130)	%RPD (20)
	.		
	.		

d) MS/MSD
Were the percent recoveries within limits? [ ] See comments [x]
(Enter out of control recoveries only)

Identification of Original Sample Used for QC

Spiked compound	MS %R	MSD%R	%RPD
	70-130%		
SCqc-006-0001-ER	132		

e) System Monitoring Compounds (Surrogates)
Are surrogate recoveries within QC limits? [ ] See comments [x]
(Enter out of control recoveries only)

Surrogate Recoveries

Sample ID	**%Recovery**			
	4-bromofluorobenzene			
	85-120%			
SCsb-042D-0003-SO	122%			
Method blank (856016)	121%			

15. Analyte Detection

a) Were results reported between the DL and the LOQ? [ ] [x]

b) Were results reported between the DL and the LOQ J flagged? [ ] [ ]

Comments (attach additional sheets if necessary):

SDG 81613: Method blank (856016) were reported with bromoflurobenzene (a surrogate) recovery of 121%. This was marginally outside the allowable limit of (75-120%). However, all other QC criteria were within the control Limits and no flagging was necessary.

SDG 81543: The result of the sample SCSB-042D-0003-SO were reported surrogate recovery for bromofluorobenzene of 122% which was just outside the allowable limit of 85-120%. Since the recovery was High and no analyte was detected in the sample, no flagging was necessary.

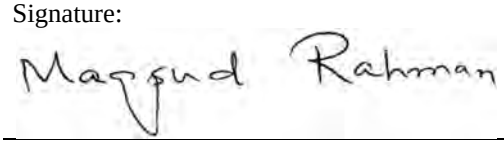
SDG 82400: (a) The matrix spike (MS) for sample SCQC-006-0001-ER had a high recovery for 1,1-dichloroethene. The compound was not detected in the sample and the data was not qualified.

(b) The continuing calibration verification standard analyzed on November 12, 2010 had a low recovery (%D of -27%) of bromomethane that was outside the allowable limit of 20%. The compound was qualified With a "Q" flag on the following samples: equipment blank

Validated/Reviewed by:

Name: Maqsud Rahman Date: April 18, 2011

Signature:



Overall Assessment of the Data Package:

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Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
Surface Soil Samples								
SCSS-057	SCSS-057M-0001-SO	1,2-Dichlorobenzene	0.028	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UM	UJ	MS/MSD	
	SCSS-057M-0001-SO	4,4'-DDD	0.0014	mg/kg	JP	J	DL-LOQ	P
	SCSS-057M-0001-SO	4,6-Dinitro-2-Methylphenol	0.280	mg/kg	UM	UJ	MS/MSD	
	SCSS-057M-0001-SO	4-Chloroaniline	0.040	mg/kg	UM	UJ	MS/MSD	
	SCSS-057M-0001-SO	Antimony	1.6	mg/kg	UMV	UJ	MS/MSD	
	SCSS-057M-0001-SO	Arsenic	8.3	mg/kg	JYV	J	DL-LOQ	MS/SD
	SCSS-057M-0001-SO	Benzo(a)anthracene	0.046	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Benzo(a)pyrene	0.045	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Benzo(b)fluoranthene	0.072	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Benzo(k)fluoranthene	0.042	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Benzyl Alcohol	0.085	mg/kg	UM	UJ	MS/MSD	
	SCSS-057M-0001-SO	Cadmium	0.41	mg/kg	JV	J	DL-LOQ	
	SCSS-057M-0001-SO	Chrysene	0.049	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Di-n-Butyl Phthalate	0.170	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Fluoranthene	0.078	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Heptachlor	0.0081	mg/kg	P	J	P	
	SCSS-057M-0001-SO	Hexachlorocyclopentadiene	0.053	mg/kg	UM	UJ	MS/MSD	
	SCSS-057M-0001-SO	Hexavalent Chromium	1.9	mg/kg	UM	UJ	MS/MSD	
	SCSS-057M-0001-SO	Isophorone	0.130	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-057	SCSS-057M-0001-SO	Lead	12.1	mg/kg	M	J	DL-LOQ	
	SCSS-057M-0001-SO	Methoxychlor	0.0016	mg/kg	JP	J	DL-LOQ	P
	SCSS-057M-0001-SO	Pentachlorophenol	0.240	mg/kg	UMY	UJ	MS/MSD	MS/SD
	SCSS-057M-0001-SO	Phenanthrene	0.033	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Pyrene	0.063	mg/kg	J	J	DL-LOQ	
	SCSS-057M-0001-SO	Selenium	1.4	mg/kg	UMV	UJ	MS/MSD	
	SCSS-057M-0001-SO	Thallium	3.2	mg/kg	M	J	MS/MSD	
SCSS-058	SCSS-058M-0001-SO	1,4-Dichlorobenzene	0.022	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	2-Methylnaphthalene	0.370	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Acenaphthene	0.043	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Acenaphthylene	0.160	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Anthracene	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Benzo(ghi)perylene	0.170	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Benzo(k)fluoranthene	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Carbazole	0.078	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Cyanide, Total	0.3	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Dibenzo(a,h)anthracene	0.075	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Dibenzofuran	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Di-n-Butyl Phthalate	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Fluorene	0.190	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Indeno(1,2,3-cd)pyrene	0.180	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-058	SCSS-058M-0001-SO	Isophorone	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Naphthalene	0.240	mg/kg	J	J	DL-LOQ	
	SCSS-058M-0001-SO	Selenium	0.83	mg/kg	JV	J	DL-LOQ	
	SCSS-058M-0001-SO	Silver	3.8	mg/kg		J	DL-LOQ	
SCSS-059	SCSS-059M-0001-SO	1,2-Dichlorobenzene	0.028	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	1,4-Dichlorobenzene	0.058	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	2-Methylnaphthalene	0.230	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Acenaphthylene	0.056	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Benzoic Acid	0.450	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Dibenzo(a,h)anthracene	0.170	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Dibenzofuran	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Di-n-Butyl Phthalate	0.180	mg/kg	J	J	DL-LOQ	
	SCSS-059M-0001-SO	Naphthalene	0.220	mg/kg	J	J	DL-LOQ	
SCSS-060	SCSS-060M-0001-SO	1,2-Dichlorobenzene	0.078	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	1,4-Dichlorobenzene	0.210	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	2-Methylnaphthalene	0.350	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Acenaphthene	0.340	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Acenaphthylene	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Benzoic Acid	0.410	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Dibenzo(a,h)anthracene	0.280	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-060	SCSS-060M-0001-SO	Dibenzofuran	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Naphthalene	0.320	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Pentachlorophenol	0.520	mg/kg	J	J	DL-LOQ	
	SCSS-060M-0001-SO	Silver	47.9	mg/kg	JV	J	DL-LOQ	
SCSS-061	SCSS-061M-0001-SO	1,2,4-Trichlorobenzene	0.00027	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	1,2-Dichlorobenzene	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	1,3-Dichlorobenzene	0.031	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	1,4-Dichlorobenzene	0.270	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Acenaphthene	0.074	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Acenaphthylene	0.087	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Anthracene	0.320	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Benzo(ghi)perylene	0.240	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Benzoic Acid	0.390	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Carbazole	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Dibenzo(a,h)anthracene	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Dibenzofuran	0.160	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Di-n-Butyl Phthalate	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Fluorene	0.079	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Indeno(1,2,3-cd)pyrene	0.270	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Naphthalene	0.310	mg/kg	J	J	DL-LOQ	
	SCSS-061M-0001-SO	Pentachlorophenol	0.400	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-062	SCSS-062M-0001-SO	1,2-Dichlorobenzene	0.041	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	1,4-Dichlorobenzene	0.041	mg/kg	J	J	DL-.LOQ	
	SCSS-062M-0001-SO	Anthracene	0.056	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Benzo(a)anthracene	0.180	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Benzo(a)pyrene	0.170	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Benzo(b)fluoranthene	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Benzo(ghi)perylene	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Benzo(k)fluoranthene	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Carbazole	0.045	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Chrysene	0.220	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Dibenzofuran	0.089	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Di-n-Butyl Phthalate	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Fluoranthene	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Indeno(1,2,3-cd)pyrene	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Isophorone	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Naphthalene	0.250	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Phenanthrene	0.290	mg/kg	J	J	DL-LOQ	
	SCSS-062M-0001-SO	Pyrene	0.280	mg/kg	J	J	DL-LOQ	
SCSS-063	SCSS-063M-0001-SO	1,2-Dichlorobenzene	0.050	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	1,4-Dichlorobenzene	0.047	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Acenaphthene	0.047	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-063	SCSS-063M-0001-SO	Acenaphthylene	0.033	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Anthracene	0.160	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Benzo(ghi)perylene	0.360	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Benzo(k)fluoranthene	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Carbazole	0.100	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Dibenzo(a,h)anthracene	0.097	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Dibenzofuran	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Di-n-Butyl Phthalate	0.220	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Fluorene	0.051	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Indeno(1,2,3-cd)pyrene	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Isophorone	0.200	mg/kg	J	J	DL-LOQ	
	SCSS-063M-0001-SO	Naphthalene	0.330	mg/kg	J	J	DL-LOQ	
SCSS-064	SCSS-064M-0001-SO	2-Methylnaphthalene	0.096	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Anthracene	0.026	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Benzo(a)anthracene	0.078	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Benzo(a)pyrene	0.078	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Benzo(b)fluoranthene	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Benzo(ghi)perylene	0.066	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Chrysene	0.100	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Dibenzofuran	0.027	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Di-n-Butyl Phthalate	0.120	mg/kg	J	J	DL-LOQ	

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Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-064	SCSS-064M-0001-SO	Fluoranthene	0.170	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Indeno(1,2,3-cd)pyrene	0.055	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Isophorone	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Naphthalene	0.063	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Phenanthrene	0.160	mg/kg	J	J	DL-LOQ	
	SCSS-064M-0001-SO	Pyrene	0.160	mg/kg	J	J	DL-LOQ	
SCSS-065	SCSS-065M-0001-SO	Acenaphthylene	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Anthracene	0.230	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Benzo(ghi)perylene	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Benzo(k)fluoranthene	0.290	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Benzoic Acid	0.570	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Carbazole	0.034	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Dibenzofuran	0.037	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Di-n-Butyl Phthalate	0.082	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Fluorene	0.059	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Indeno(1,2,3-cd)pyrene	0.340	mg/kg	J	J	DL-LOQ	
	SCSS-065M-0001-SO	Naphthalene	0.029	mg/kg	J	J	DL-LOQ	
SCSS-066	SCSS-066M-0001-SO	Fluoranthene	0.040	mg/kg	J	J	DL-LOQ	
	SCSS-066M-0001-SO	Isophorone	0.070	mg/kg	J	J	DL-LOQ	
	SCSS-066M-0001-SO	Pyrene	0.035	mg/kg	J	J	DL-LOQ	
SCSS-067	SCSS-067M-0001-SO	Di-n-Butyl Phthalate	0.093	mg/kg	J	J	DL-LOQ	

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Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-067	SCSS-067M-0001-SO	Selenium	0.18	mg/kg	J	J	DL-LOQ	
SCSS-068	SCSS-068M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.100	mg/kg	J	J	DL-LOQ	
	SCSS-068M-0001-SO	Di-n-Butyl Phthalate	0.088	mg/kg	J	J	DL-LOQ	
	SCSS-068M-0001-SO	Isophorone	0.051	mg/kg	J	J	DL-LOQ	
SCSS-069	SCSS-069M-0001-SO	2,4,6-Trinitrotoluene	0.0026	mg/kg	JP	J	DL-LOQ	P
	SCSS-069M-0001-SO	2-Methylnaphthalene	0.064	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Benzo(a)anthracene	0.062	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Benzo(a)pyrene	0.054	mg/kg	JS	J	DL-LOQ	
	SCSS-069M-0001-SO	Benzo(b)fluoranthene	0.120	mg/kg	JS	J	DL-LOQ	
	SCSS-069M-0001-SO	Benzo(k)fluoranthene	0.047	mg/kg	JS	J	DL-LOQ	
	SCSS-069M-0001-SO	Chrysene	0.061	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Di-n-Butyl Phthalate	0.150	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Fluoranthene	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Naphthalene	0.050	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Nickel	0.083	mg/kg	JV	J	DL-LOQ	
	SCSS-069M-0001-SO	Phenanthrene	0.093	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Pyrene	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-069M-0001-SO	Selenium	0.19	mg/kg	JV	J	DL-LOQ	
SCSS-072	SCSS-072M-0001-SO	Benzo(a)anthracene	0.027	mg/kg	J	J	DL-LOQ	
	SCSS-072M-0001-SO	Benzo(a)pyrene	0.026	mg/kg	J	J	DL-LOQ	
	SCSS-072M-0001-SO	Benzo(b)fluoranthene	0.039	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-072	SCSS-072M-0001-SO	Diethyl Phthalate	0.069	mg/kg	J	J	DL-LOQ	
	SCSS-072M-0001-SO	Di-n-Butyl Phthalate	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-072M-0001-SO	Fluoranthene	0.046	mg/kg	J	J	DL-LOQ	
	SCSS-072M-0001-SO	Pyrene	0.035	mg/kg	J	J	DL-LOQ	
SCSS-073	SCSS-073M-0001-SO	1,2-Dichlorobenzene	0.039	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	2-Methylnaphthalene	0.240	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Acenaphthene	0.035	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Acenaphthylene	0.029	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Anthracene	0.093	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Benzo(a)anthracene	0.370	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Benzo(a)pyrene	0.350	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Benzo(ghi)perylene	0.190	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Benzo(k)fluoranthene	0.200	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.190	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Carbazole	0.058	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Chrysene	0.400	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Dibenzo(a,h)anthracene	0.069	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Dibenzofuran	0.072	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Di-n-Butyl Phthalate	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Fluorene	0.033	mg/kg	J	J	DL-LOQ	
	SCSS-073M-0001-SO	Indeno(1,2,3-cd)pyrene	0.170	mg/kg	J	J	DL-LOQ	

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Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSs-073	SCSS-073M-0001-SO	Naphthalene	0.170	mg/kg	J	J	DL-LOQ	
SCSS-074	SCSS-074M-0001-SO	Acenaphthene	0.029	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Acenaphthylene	0.042	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Anthracene	0.070	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Benzo(a)anthracene	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Benzo(a)pyrene	0.310	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Benzo(ghi)perylene	0.150	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Benzo(k)fluoranthene	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.490	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Carbazole	0.057	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Chrysene	0.340	mg/kg	J	J	DL'LOQ	
	SCSS-074M-0001-SO	Dibenzo(a,h)anthracene	0.055	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Dibenzofuran	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Di-n-Butyl Phthalate	0.150	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Fluorene	0.031	mg/kg	J	J	DL-LOQ	
	SCSS-074M-0001-SO	Indeno(1,2,3-cd)pyrene	0.160	mg/kg	J	J	DL-LOQ	
SCSS-075	SCSS-075M-0001-SO	Benzo(a)anthracene	0.046	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Benzo(a)pyrene	0.034	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Benzo(b)fluoranthene	0.110	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Benzo(ghi)perylene	0.031	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Benzo(k)fluoranthene	0.035	mg/kg	J	J	DL-LOQ	

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Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-075	SCSS-075M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.910	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Chrysene	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Diethyl Phthalate	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Di-n-Butyl Phthalate	0.087	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Fluoranthene	0.300	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Indeno(1,2,3-cd)pyrene	0.025	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Phenanthrene	0.090	mg/kg	J	J	DL-LOQ	
	SCSS-075M-0001-SO	Pyrene	0.200	mg/kg	J	J	DL-LOQ	
SCSS-076	SCSS-076M-0001-SO	2-Methylnaphthalene	0.045	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Benzo(a)anthracene	0.052	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Benzo(a)pyrene	0.045	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Benzo(b)fluoranthene	0.077	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Benzo(k)fluoranthene	0.027	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.270	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Chrysene	0.051	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Fluoranthene	0.081	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Naphthalene	0.028	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Phenanthrene	0.050	mg/kg	J	J	DL-LOQ	
	SCSS-076M-0001-SO	Pyrene	0.072	mg/kg	J	J	DL-LOQ	
SCSS-058	SCSS-085M-0001-SO	1,4-Dichlorobenzene	0.019	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	2-Amino-4,6-Dinitrotoluene	0.00026	mg/kg	J	J	DL-LOQ	

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Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-058	SCSS-085M-0001-SO	2-Methylnaphthalene	0.320	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Acenaphthene	0.034	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Acenaphthylene	0.043	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Anthracene	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Benzo(a)anthracene	0.380	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Benzo(a)pyrene	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Benzo(ghi)perylene	0.120	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Benzo(k)fluoranthene	0.180	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Carbazole	0.069	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Chrysene	0.360	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Dibenzo(a,h)anthracene	0.050	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Dibenzofuran	0.086	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Di-n-Butyl Phthalate	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Fluorene	0.046	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Indeno(1,2,3-cd)pyrene	0.100	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Isophorone	0.079	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Naphthalene	0.200	mg/kg	J	J	DL-LOQ	
	SCSS-085M-0001-SO	Selenium	0.8	mg/kg	JV	J	DL-LOQ	
SCSs-068	SCSS-086M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-086M-0001-SO	Isophorone	0.140	mg/kg	J	J	DL-LOQ	
	SCSS-086M-0001-SO	Selenium	0.22	mg/kg	J	J	DL-LOQ	

Attachment 2
Summary of Remedial Investigation Sample Data Qualifications for the Sand Creek Disposal Road Landfill

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason Code	
							1	2
SCSS-073	SCSS-087M-0001-SO	1,2-Dichlorobenzene	0.100	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	1,3-Dichlorobenzene	0.026	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	1,4-Dichlorobenzene	0.048	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	2,4-Dinitrotoluene	0.092	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	2-Methylnaphthalene	0.330	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Acenaphthene	0.064	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Anthracene	0.150	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Benzo(a)anthracene	0.390	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Benzo(a)pyrene	0.350	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Benzo(ghi)perylene	0.210	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Benzo(k)fluoranthene	0.170	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.950	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Carbazole	0.099	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Chrysene	0.390	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Dibenzo(a,h)anthracene	0.092	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Dibenzofuran	0.100	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Di-n-Butyl Phthalate	0.130	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Fluorene	0.055	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Indeno(1,2,3-cd)pyrene	0.210	mg/kg	J	J	DL-LOQ	
	SCSS-087M-0001-SO	Naphthalene	0.240	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
Subsurface Soil Samples								
SCSB-035	SCSB-035M-0001-SO	Benzo(a)anthracene	0.046	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Benzo(a)pyrene	0.042	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Benzo(b)fluoranthene	0.054	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Benzo(ghi)perylene	0.023	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Chrysene	0.043	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Di-n-Butyl Phthalate	0.093	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Fluoranthene	0.140	mg/kg	J	J	DL_LOQ	
	SCSB-035M-0001-SO	Indeno(1,2,3-cd)pyrene	0.024	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Isophorone	0.210	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Naphthalene	0.029	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Phenanthrene	0.160	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0001-SO	Pyrene	0.097	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	2-Methylnaphthalene	0.280	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Benzo(a)pyrene	0.036	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Benzo(b)fluoranthene	0.062	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Benzo(ghi)perylene	0.140	mg/kg	J	J	D;L-LOQ	
	SCSB-035M-0002-SO	Dibenzofuran	0.035	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Di-n-Butyl Phthalate	0.110	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Fluoranthene	0.027	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Fluorene	0.044	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-035	SCSB-035M-0002-SO	Naphthalene	0.110	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Phenanthrene	0.130	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0002-SO	Pyrene	0.072	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0003-SO	2-Methylnaphthalene	0.036	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0003-SO	Benzo(ghi)perylene	0.022	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0003-SO	N-Nitroso-di-n-Propylamine	0.070	mg/kg	U	J	DL-LOQ	
	SCSB-035M-0004-SO	2-Methylnaphthalene	0.030	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0004-SO	Di-n-Butyl Phthalate	0.084	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0004-SO	Mercury	0.0077	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0005-SO	Isophorone	0.320	mg/kg	J	J	DL-LOQ	
	SCSB-035M-0005-SO	Mercury	0.0059	mg/kg	J	J	DL-LOQ	
SCSB-036	SCSB-036M-0001-SO	2-Methylnaphthalene	0.200	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Anthracene	0.030	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Benzo(a)anthracene	0.160	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Benzo(a)pyrene	0.160	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Benzo(b)fluoranthene	0.220	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Benzo(ghi)perylene	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Benzo(k)fluoranthene	0.083	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Chrysene	0.170	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Dibenzo(a,h)anthracene	0.060	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Dibenzofuran	0.046	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-036	SCSB-036M-0001-SO	Di-n-Butyl Phthalate	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Fluoranthene	0.320	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Indeno(1,2,3-cd)pyrene	0.100	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Isophorone	0.073	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Naphthalene	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Phenanthrene	0.190	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0001-SO	Pyrene	0.250	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0002-SO	Di-n-Butyl Phthalate	0.089	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0002-SO	Isophorone	0.180	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0002-SO	Selenium	0.14	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	2-Methylnaphthalene	0.280	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	Acenaphthene	0.056	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	Acenaphthylene	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	Dibenzo(a,h)anthracene	0.320	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	Dibenzofuran	0.350	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	Di-n-Butyl Phthalate	0.190	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0003-SO	Fluorene	0.064	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0004-SO	2-Methylnaphthalene	0.068	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0004-SO	Benzo(ghi)perylene	0.048	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0004-SO	Isophorone	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0004-SO	Naphthalene	0.060	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-036	SCSB-036M-0004-SO	Phenanthrene	0.038	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0004-SO	Selenium	0.53	mg/kg	JV	J	DL-LOQ	
	SCSB-036M-0005-SO	2-Methylnaphthalene	0.046	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0005-SO	Benzo(ghi)perylene	0.025	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0005-SO	Cadmium	0.049	mg/kg	JV	J	DL-LOQ	
	SCSB-036M-0005-SO	Mercury	0.0067	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0005-SO	Naphthalene	0.028	mg/kg	J	J	DL-LOQ	
	SCSB-036M-0005-SO	Phenanthrene	0.034	mg/kg	J	J	DL-LOQ	
SCSB-037	SCSB-037D-0001-SO	1,2-Dimethylbenzene	0.013	mg/kg	J	J	DL-LOQ	
	SCSB-037D-0001-SO	Toluene	0.012	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	1,2-Dichlorobenzene	0.049	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	2-Methylnaphthalene	0.260	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Anthracene	0.032	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Antimony	0.93	mg/kg	JV	J	DL-LOQ	
	SCSB-037M-0001-SO	Benzo(a)anthracene	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Benzo(a)pyrene	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Benzo(b)fluoranthene	0.260	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Benzo(ghi)perylene	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Benzo(k)fluoranthene	0.069	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.088	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Carbazole	0.033	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-037	SCSB-037M-0001-SO	Chrysene	0.160	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Dibenzo(a,h)anthracene	0.032	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Dibenzofuran	0.069	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Di-n-Butyl Phthalate	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Fluoranthene	0.360	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Indeno(1,2,3-cd)pyrene	0.093	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Naphthalene	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Phenanthrene	0.280	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0001-SO	Pyrene	0.280	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	1,2-Dichlorobenzene	0.043	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	1,4-Dichlorobenzene	0.022	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	2-Methylnaphthalene	0.240	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Benzo(a)anthracene	0.053	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Benzo(a)pyrene	0.048	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Benzo(b)fluoranthene	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Benzo(ghi)perylene	0.038	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Benzo(k)fluoranthene	0.027	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Chrysene	0.089	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Dibenzofuran	0.055	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Di-n-Butyl Phthalate	0.270	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Fluoranthene	0.170	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-037	SCSB-037M-0002-SO	Indeno(1,2,3-cd)pyrene	0.025	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Naphthalene	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Phenanthrene	0.190	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0002-SO	Pyrene	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0003-SO	Antimony	0.52	mg/kg	JV	J	DL-LOQ	
	SCSB-037M-0003-SO	Bis(2-Ethylhexyl)phthalate	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0003-SO	Di-n-Butyl Phthalate	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0003-SO	Isophorone	0.220	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0004-SO	2,6-Dinitrotoluene	0.047	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0004-SO	Isophorone	0.310	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0005-SO	Di-n-Butyl Phthalate	0.084	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0005-SO	Isophorone	0.054	mg/kg	J	J	DL-LOQ	
	SCSB-037M-0005-SO	Selenium	0.67	mg/kg	JV	J	DL-LOQ	
SCSB-038	SCSB-038M-0001-SO	2-Methylnaphthalene	0.097	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0001-SO	Antimony	0.16	mg/kg	UVY	UJ	MS/SD	
	SCSB-038M-0001-SO	Arsenic	7	mg/kg	Y	J	MS/SD	
	SCSB-038M-0001-SO	Benzo(ghi)perylene	0.048	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0001-SO	Cadmium	0.012	mg/kg	UVY	UJ	MS/SD	
	SCSB-038M-0001-SO	Cobalt	22.3	mg/kg	M	J	MS/MSD	
	SCSB-038M-0001-SO	Copper	20.8	mg/kg	YM	J	MS/MSD	SD
	SCSB-038M-0001-SO	Di-n-Butyl Phthalate	0.160	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-038	SCSB-038M-0001-SO	Lead	11.1	mg/kg	Y	J	MS/SD	
	SCSB-038M-0001-SO	Naphthalene	0.074	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0001-SO	Nickel	24.8	mg/kg	YM	J	MS/MSD	MS/SD
	SCSB-038M-0001-SO	Phenanthrene	0.047	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0001-SO	Selenium	1	mg/kg	YM	J	MS/MSD	MS/SD
	SCSB-038M-0001-SO	Thallium	2.5	mg/kg	YM	J	MS/MSD	MS/SD
	SCSB-038M-0001-SO	Vanadium	19.6	mg/kg	Y	J	MS/SD	
	SCSB-038M-0001-SO	Zinc	68.7	mg/kg	YM	J	MS/MSD	MS/SD
	SCSB-038M-0002-SO	Di-n-Butyl Phthalate	0.093	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0002-SO	Isophorone	0.190	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0002-SO	Selenium	0.53	mg/kg	JV	J	DL-LOQ	
	SCSB-038M-0003-SO	Antimony	0.26	mg/kg	JV	J	DL-LOQ	
	SCSB-038M-0003-SO	Isophorone	0.280	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0003-SO	Mercury	0.0053	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0003-SO	Selenium	0.26	mg/kg	JV	J	DL-LOQ	
	SCSB-038M-0004-SO	2-Methylnaphthalene	0.072	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0004-SO	Dibenzofuran	0.025	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0004-SO	Mercury	0.0057	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0004-SO	Phenanthrene	0.039	mg/kg	J	J	DL-LOQ	
	SCSB-038M-0004-SO	Selenium	0.45	mg/kg	JV	J	DL-LOQ	
	SCSB-038M-0005-SO	2-Methylnaphthalene	0.035	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-038	SCSB-038M-0005-SO	Selenium	0.6	mg/kg	JV	J	DL-LOQ	
SCSB-039	SCSB-039M-0001-SO	1,2,4-Trichlorobenzene	0.021	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	1,2-Dichlorobenzene	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	1,3-Dichlorobenzene	0.020	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	1,4-Dichlorobenzene	0.019	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,4,5-Trichlorophenol	0.130	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,4,6-Trichlorophenol	0.130	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,4-Dichlorophenol	0.120	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,4-Dimethylphenol	0.100	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,4-Dinitrophenol	0.700	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,4-Dinitrotoluene	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2,6-Dinitrotoluene	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2-Chloronaphthalene	0.023	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2-Chlorophenol	0.350	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2-Methylnaphthalene	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2-Nitroaniline	0.023	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	2-Nitrophenol	0.280	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	3-Nitroaniline	0.022	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	4,6-Dinitro-2-Methylphenol	0.270	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	4-Bromophenyl Phenyl Ether	0.025	mg/kg	UH	UJ	HT	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-039	SCSB-039M-0001-SO	4-Chloro-3-Methylphenol	0.390	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	4-Chloroaniline	0.040	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	4-Chlorophenyl Phenyl Ether	0.026	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	4-Nitrobenzenamine	0.030	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	4-Nitrophenol	0.410	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Acenaphthene	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Acenaphthylene	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Anthracene	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Antimony	0.11	mg/kg	J	J	Dl-LOQ	
	SCSB-039M-0001-SO	Benzo(a)anthracene	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Benzo(a)pyrene	0.023	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Benzo(b)fluoranthene	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Benzo(ghi)perylene	0.022	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Benzo(k)fluoranthene	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Benzoic Acid	0.300	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Benzyl Alcohol	0.084	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Bis(2-Chloroethoxy)methane	0.023	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Bis(2-Chloroethyl)ether	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Bis(2-Chloroisopropyl)ether	0.030	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.120	mg/kg	JH	J	DL-LOQ	HT
	SCSB-039M-0001-SO	Butyl Benzyl Phthalate	0.074	mg/kg	UH	UJ	HT	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-039	SCSB-039M-0001-SO	Carbazole	0.028	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Chrysene	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Cresols (Total)	0.660	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Dibenzo(a,h)anthracene	0.022	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Dibenzofuran	0.024	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Diethyl Phthalate	0.065	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Dimethyl Phthalate	0.064	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Di-n-Butyl Phthalate	0.160	mg/kg	JH	J	DL-LOQ	HT
	SCSB-039M-0001-SO	Di-n-Octyl Phthalate	0.060	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Fluoranthene	0.026	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Fluorene	0.025	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Hexachlorobenzene	0.028	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Hexachlorobutadiene	0.063	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Hexachlorocyclopentadiene	0.053	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Hexachloroethane	0.034	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Indeno(1,2,3-cd)pyrene	0.023	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Isophorone	0.110	mg/kg	JH	J	DL-LOQ	HT
	SCSB-039M-0001-SO	Mercury	0.0072	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0001-SO	Naphthalene	0.021	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Nitrobenzene	0.060	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	N-Nitroso-di-n-Propylamine	0.071	mg/kg	UH	UJ	HT	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-039	SCSB-039M-0001-SO	N-Nitrosodiphenylamine	0.051	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	o-Cresol	0.430	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Pentachlorophenol	0.240	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Phenanthrene	0.030	mg/kg	JH	J	DL-LOQ	HT
	SCSB-039M-0001-SO	Phenol	0.160	mg/kg	UH	UJ	HT	
	SCSB-039M-0001-SO	Pyrene	0.026	mg/kg	UH	UJ	HT	
	SCSB-039M-0002-SO	2,4,5-Trichlorophenol	0.130	mg/kg	UM	UJ	MS/MSD	
	SCSB-039M-0002-SO	2-Methylnaphthalene	0.190	mg/kg	J	J	MS/MSD	
	SCSB-039M-0002-SO	2-Nitrophenol	0.280	mg/kg	UM	UJ	MS/MSD	
	SCSB-039M-0002-SO	4,6-Dinitro-2-Methylphenol	0.270	mg/kg	UM	UJ	MS/MSD	
	SCSB-039M-0002-SO	Arsenic	15.6	mg/kg			MS/MSD	
	SCSB-039M-0002-SO	Cobalt	11.8	mg/kg	M	J	MS/MSD	
	SCSB-039M-0002-SO	Di-n-Butyl Phthalate	0.081	mg/kg	J	J	MS/MSD	
	SCSB-039M-0002-SO	Fluorene	0.034	mg/kg	J	J	MS/MSD	
	SCSB-039M-0002-SO	Hexachlorocyclopentadiene	0.052	mg/kg	UM	UJ	MS/MSD	
	SCSB-039M-0002-SO	Iron	31400	mg/kg	M	J	MS/MSD	
	SCSB-039M-0002-SO	Mercury	0.0069	mg/kg	J	J	MS/MSD	
	SCSB-039M-0002-SO	Naphthalene	0.053	mg/kg	J	J	MS/MSD	
	SCSB-039M-0002-SO	Pentachlorophenol	0.240	mg/kg	UM	UJ	MS/MSD	
	SCSB-039M-0002-SO	Phenanthrene	0.110	mg/kg	J	J	MS/MSD	
	SCSB-039M-0002-SO	Thallium	0.71	mg/kg	M	J	MS/MSD	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-039	SCSB-039M-0002-SO	Zinc	56.5	mg/kg	M	J	MS/MSD	
	SCSB-039M-0003-SO	2-Methylnaphthalene	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0003-SO	Isophorone	0.170	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0003-SO	Mercury	0.0057	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0003-SO	Naphthalene	0.032	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0003-SO	Phenanthrene	0.028	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0004-SO	2-Methylnaphthalene	0.088	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0004-SO	Dibenzofuran	0.024	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0004-SO	Di-n-Butyl Phthalate	0.092	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0004-SO	Mercury	0.0073	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0004-SO	Naphthalene	0.057	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0004-SO	Phenanthrene	0.049	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0005-SO	2-Methylnaphthalene	0.061	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0005-SO	Isophorone	0.090	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0005-SO	Mercury	0.0059	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0005-SO	Naphthalene	0.045	mg/kg	J	J	DL-LOQ	
	SCSB-039M-0005-SO	Phenanthrene	0.036	mg/kg	J	J	DL-LOQ	
SCSB-040	SCSB-040M-0001-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-040M-0001-SO	Di-n-Butyl Phthalate	0.090	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0002-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-040M-0002-SO	Bis(2-Ethylhexyl)phthalate	0.850	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-040	SCSB-040M-0002-SO	Isophorone	0.062	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0002-SO	Mercury	0.0064	mg/kg	J	J	DL-lOQ	
	SCSB-040M-0003-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-040M-0003-SO	Isophorone	0.097	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0003-SO	Mercury	0.0055	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0004-SO	2-Methylnaphthalene	0.082	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0004-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-040M-0004-SO	Isophorone	0.088	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0004-SO	Mercury	0.004	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0004-SO	Naphthalene	0.057	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0005-SO	2-Methylnaphthalene	0.082	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0005-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-040M-0005-SO	Mercury	0.0041	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0005-SO	Naphthalene	0.051	mg/kg	J	J	DL-LOQ	
	SCSB-040M-0005-SO	Phenanthrene	0.038	mg/kg	J	J	DL-LOQ	
SCSB-041	SCSB-041M-0001-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-041M-0001-SO	Di-n-Butyl Phthalate	0.110	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0001-SO	Isophorone	0.053	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0001-SO	Mercury	0.0068	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0002-SO	2,4,5-Trichlorophenol	0.130	mg/kg	UM	UJ	MS/MSD	
	SCSB-041M-0002-SO	2,4-Dinitrophenol	0.700	mg/kg	UM	UJ	MS/MSD	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-041	SCSB-041M-0002-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-041M-0002-SO	4,6-Dinitro-2-Methylphenol	0.270	mg/kg	UM	UJ	MS/MSD	
	SCSB-041M-0002-SO	Hexachlorocyclopentadiene	0.053	mg/kg	UM	UJ	MS/MSD	
	SCSB-041M-0002-SO	Isophorone	0.110	mg/kg	J	J	MS/MSD	
	SCSB-041M-0002-SO	Mercury	0.0049	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0002-SO	Pentachlorophenol	0.240	mg/kg	UM	UJ	MS/MSD	
	SCSB-041M-0003-SO	2-Methylnaphthalene	0.043	mg/kg	J	J	DL/LOQ	
	SCSB-041M-0003-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-041M-0003-SO	Antimony	0.24	mg/kg	J	J	MS/MSD	
	SCSB-041M-0003-SO	Mercury	0.0079	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0003-SO	Naphthalene	0.029	mg/kg	J	J	DL/LOQ	
	SCSB-041M-0003-SO	Phenanthrene	0.028	mg/kg	J	J	DL/LOQ	
	SCSB-041M-0004-SO	2-Methylnaphthalene	0.084	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0004-SO	Mercury	0.0055	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0004-SO	Naphthalene	0.057	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0004-SO	Phenanthrene	0.042	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0005-SO	2-Methylnaphthalene	0.080	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0005-SO	3,3'-Dichlorobenzidine	0.0150	mg/kg	UZ	UJ	CCAL	
	SCSB-041M-0005-SO	Mercury	0.0066	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0005-SO	Naphthalene	0.056	mg/kg	J	J	DL-LOQ	
	SCSB-041M-0005-SO	Phenanthrene	0.051	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-042	SCSB-042M-0001-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-042M-0002-SO	Isophorone	0.070	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0002-SO	Mercury	0.0052	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0003-SO	2-Methylnaphthalene	0.049	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0003-SO	Di-n-Butyl Phthalate	0.100	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0003-SO	Naphthalene	0.035	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0003-SO	Phenanthrene	0.034	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0004-SO	2-Methylnaphthalene	0.068	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0004-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-042M-0004-SO	Antimony	0.25	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0004-SO	Dibenzofuran	0.024	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0004-SO	Mercury	0.0059	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0004-SO	Naphthalene	0.060	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0005-SO	2-Methylnaphthalene	0.073	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0005-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-042M-0005-SO	Mercury	0.0044	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0005-SO	Phenanthrene	0.040	mg/kg	J	J	DL-LOQ	
	SCSB-042M-0005-SO	Thallium	0.19	mg/kg	JV	J	DL-LOQ	
SCSB-043	SCSB-043M-0001-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-043M-0002-SO	Isophorone	0.064	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0002-SO	Mercury	0.0042	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-043	SCSB-043M-0003-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-043M-0003-SO	Di-n-Butyl Phthalate	0.240	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0003-SO	Isophorone	0.094	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0003-SO	Mercury	0.0064	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0004-SO	2-Methylnaphthalene	0.049	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0004-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-043M-0004-SO	Isophorone	0.100	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0004-SO	Mercury	0.006	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0004-SO	Naphthalene	0.054	mg/kg	J	J	DA-LOQ	
	SCSB-043M-0004-SO	Phenanthrene	0.037	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0005-SO	3,3'-Dichlorobenzidine	0.150	mg/kg	UZ	UJ	CCAL	
	SCSB-043M-0005-SO	4,6-Dinitro-2-Methylphenol	0.270	mg/kg	U	J	DL-LOQ	
	SCSB-043M-0005-SO	Antimony	0.11	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0005-SO	Mercury	0.007	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0005-SO	Naphthalene	0.043	mg/kg	J	J	DL-LOQ	
	SCSB-043M-0005-SO	Phenanthrene	0.034	mg/kg	J	J	DL-LOQ	
SCSB-044	SCSB-044M-0001-SO	Cyanide, Total	0.32	mg/kg	J	J	DL-LOQ	
	SCSB-044M-0001-SO	Di-n-Butyl Phthalate	0.094	mg/kg	J	J	DL-LOQ	
	SCSB-044M-0001-SO	Nitroguanidine	0.0012	mg/kg	P	J	P	
	SCSB-044M-0001-SO	Selenium	0.22	mg/kg	JV	J	DL-LOQ	
SCSB-045	SCSB-045M-0001-SO	1,2-Dichlorobenzene	0.029	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-045	SCSB-045M-0001-SO	2-Methylnaphthalene	0.100	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Acenaphthene	0.032	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Anthracene	0.098	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Antimony	1.3	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Benzo(a)anthracene	0.260	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Benzo(a)pyrene	0.410	mg/kg	JS	J	DL-LOQ	
	SCSB-045M-0001-SO	Benzo(b)fluoranthene	0.630	mg/kg	S	J	DL-LOQ	
	SCSB-045M-0001-SO	Benzo(ghi)perylene	0.220	mg/kg	JS	J	DL-LOQ	
	SCSB-045M-0001-SO	Benzo(k)fluoranthene	0.140	mg/kg	JS	J	DL-LOQ	
	SCSB-045M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.110	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Carbazole	0.067	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Chrysene	0.270	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Dibenzofuran	0.038	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Di-n-Butyl Phthalate	0.220	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Fluorene	0.040	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Indeno(1,2,3-cd)pyrene	0.190	mg/kg	JS	J	DL-LOQ	
	SCSB-045M-0001-SO	Methylene Chloride	0.00069	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Naphthalene	0.076	mg/kg	J	J	DL-LOQ	
	SCSB-045M-0001-SO	Selenium	0.86	mg/kg	JV	J	DL-LOQ	
SCSB-046	SCSB-046M-0001-SO	2-Methylnaphthalene	0.052	mg/kg	J	J	DL-LOQ	
	SCSB-046M-0001-SO	Acenaphthene	0.086	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-046	SCSB-046M-0001-SO	Anthracene	0.210	mg/kg	J	J	DL-LOQ	
	SCSB-046M-0001-SO	Antimony	0.41	mg/kg	JV	J	DL-LOQ	
	SCSB-046M-0001-SO	Benzo(a)anthracene	0.340	mg/kg	J	J	DL-LOQ	
	SCSB-046M-0001-SO	Benzo(a)pyrene	0.290	mg/kg	JS	J	DL-LOQ	
	SCSB-046M-0001-SO	Benzo(b)fluoranthene	0.520	mg/kg	S	J	DL-LOQ	
	SCSB-046M-0001-SO	Benzo(ghi)perylene	0.072	mg/kg	JS	J	DL-LOQ	
	SCSB-046M-0001-SO	Benzo(k)fluoranthene	0.160	mg/kg	JS	J	DL-LOQ	
	SCSB-046M-0001-SO	Carbazole	0.110	mg/kg	J	J	DL-LOQ	
	SCSB-046M-0001-SO	Chrysene	0.290	mg/kg	J	J	DL-LOQ	
	SCSB-046M-0001-SO	Di-n-Butyl Phthalate	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-046M-0001-SO	Fluorene	0.094	mg/kg	J	J	DL-LOQ	
SCSB-047	SCSB-046M-0001-SO	Phenanthrene	0.410	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	2-Methylnaphthalene	0.310	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Acenaphthene	0.029	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Acenaphthylene	0.057	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Anthracene	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Benzo(a)anthracene	0.290	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Benzo(a)pyrene	0.350	mg/kg	JS	J	DL-LOQ	
	SCSB-047M-0001-SO	Benzo(b)fluoranthene	0.960	mg/kg	S	J	DL-LOQ	
	SCSB-047M-0001-SO	Benzo(ghi)perylene	0.074	mg/kg	JS	J	DL-LOQ	
	SCSB-047M-0001-SO	Benzo(k)fluoranthene	0.330	mg/kg	JS	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-047	SCSB-047M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.095	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Carbazole	0.060	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Chromium	0.79	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Chrysene	0.390	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Dibenzo(a,h)anthracene	0.036	mg/kg	JS	J	DL-LOQ	
	SCSB-047M-0001-SO	Dibenzofuran	0.076	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Di-n-Butyl Phthalate	0.190	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Fluorene	0.034	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Indeno(1,2,3-cd)pyrene	0.088	mg/kg	JS	J	DL-LOQ	
	SCSB-047M-0001-SO	Naphthalene	0.230	mg/kg	J	J	DL-LOQ	
	SCSB-047M-0001-SO	Phenanthrene	0.350	mg/kg	J	J	DL-LOQ	
SCSB-048	SCSB-048M-0001-SO	4,4'-DDE	0.0051	mg/kg	JV	J	DL-LOQ	
	SCSB-048M-0001-SO	Acenaphthylene	0.034	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Anthracene	0.065	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Benzo(a)anthracene	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Benzo(a)pyrene	0.150	mg/kg	JS	J	DL-LOQ	
	SCSB-048M-0001-SO	Benzo(b)fluoranthene	0.410	mg/kg	S	J	DL-LOQ	
	SCSB-048M-0001-SO	Benzo(k)fluoranthene	0.160	mg/kg	JS	J	DL-LOQ	
	SCSB-048M-0001-SO	Carbazole	0.035	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Chrysene	0.180	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Dibenzofuran	0.076	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-048	SCSB-048M-0001-SO	Dibenzofuran	0.093	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Di-n-Butyl Phthalate	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Fluoranthene	0.240	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Fluorene	0.041	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Heptachlor	0.0019	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Indeno(1,2,3-cd)pyrene	0.049	mg/kg	JS	J	DL-LOQ	
	SCSB-048M-0001-SO	Naphthalene	0.330	mg/kg	J	J	DL-LOQ	
	SCSB-048M-0001-SO	Phenanthrene	0.280	mg/kg	J	J	DL-LOQ	
SCSB-049	SCSB-049M-0001-SO	1,2-Dichlorobenzene	0.024	mg/kg	J	J	DL-LOQ	
	SCSB-049M-0001-SO	2,4,6-Trinitrotoluene	0.0001	mg/kg	JP	J	DL-LOQ	
	SCSB-049M-0001-SO	2-Amino-4,6-Dinitrotoluene	0.00026	mg/kg	JP	J	DL-LOQ	
	SCSB-049M-0001-SO	Acenaphthylene	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-049M-0001-SO	Antimony	0.71	mg/kg	JV	J	DL-LOQ	
	SCSB-049M-0001-SO	Benzo(ghi)perylene	1.3	mg/kg	S	J	DL-LOQ	
	SCSB-049M-0001-SO	Benzo(k)fluoranthene	4.4	mg/kg	S	J	DL-LOQ	
	SCSB-049M-0001-SO	Dibenzo(a,h)anthracene	0.550	mg/kg	S	J	DL-LOQ	
	SCSB-049M-0001-SO	Di-n-Butyl Phthalate	0.130	mg/kg	J	J	DL-LOQ	
	SCSB-049M-0001-SO	Indeno(1,2,3-cd)pyrene	1.6	mg/kg	S	J	DL-LOQ	
	SCSB-049M-0001-SO	Pyrene	0.240	mg/kg	J	J	DL-LOQ	
	SCSB-049M-0001-SO	Selenium	0.51	mg/kg	JV	J	DL-LOQ	
	SCSB-049M-0001-SO	Silver	0.17	mg/kg	JV	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-050	SCSB-050M-0001-SO	2-Amino-4,6-Dinitrotoluene	0.00026	mg/kg	JP	J	DL-LOQ	
	SCSB-050M-0001-SO	Acenaphthene	0.061	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Acenaphthylene	0.066	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Anthracene	0.250	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Benzo(a)pyrene	1.3	mg/kg	S	J	DL-LOQ	
	SCSB-050M-0001-SO	Benzo(b)fluoranthene	2.7	mg/kg	S	J	DL-LOQ	
	SCSB-050M-0001-SO	Benzo(ghi)perylene	0.280	mg/kg	JS	J	DL-LOQ	
	SCSB-050M-0001-SO	Benzo(k)fluoranthene	1.1	mg/kg	S	J	DL-LOQ	
	SCSB-050M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Carbazole	0.130	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Dibenzo(a,h)anthracene	0.100	mg/kg	JS	J	DL-LOQ	
	SCSB-050M-0001-SO	Dibenzofuran	0.170	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Di-n-Butyl Phthalate	0.180	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Fluorene	0.100	mg/kg	J	J	DL-LOQ	
	SCSB-050M-0001-SO	Indeno(1,2,3-cd)pyrene	0.340	mg/kg	JS	J	DL-LOQ	
	SCSB-050M-0001-SO	m-Nitrotoluene	0.00032	mg/kg	J	J	DL-LOQ	
SCSB-051	SCSB-051M-0001-SO	Antimony	0.41	mg/kg	UVY	UJ	MS/SD	
	SCSB-051M-0001-SO	Benzo(a)pyrene	0.035	mg/kg	JS	J	DL-LOQ	
	SCSB-051M-0001-SO	Benzo(b)fluoranthene	0.039	mg/kg	JS	J	DL-LOQ	
	SCSB-051M-0001-SO	Benzoic Acid	0.320	mg/kg	J	J	DL-LOQ	
	SCSB-051M-0001-SO	Beryllium	0.6	mg/kg			MS/MSD	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-051	SCSB-051M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.170	mg/kg	J	J	DL-LOQ	
	SCSB-051M-0001-SO	Cadmium	0.031	mg/kg	UVY	UJ	MS/SD	
	SCSB-051M-0001-SO	Di-n-Butyl Phthalate	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-051M-0001-SO	Fluoranthene	0.031	mg/kg	J	J	DL-LOQ	
	SCSB-051M-0001-SO	Pentachlorophenol	0.380	mg/kg	J	J	DL-LOQ	
	SCSB-051M-0001-SO	Phenanthrene	0.027	mg/kg	J	J	DL-LOQ	
	SCSB-051M-0001-SO	Silver	0.13	mg/kg	JV	J	DL-LOQ	
	SCSB-051M-0001-SO	Thallium	1.7	mg/kg	M	J	DL-LOQ	
	SCSB-051M-0001-SO	Zinc	66.6	mg/kg	M	J	DL-LOQ	
SCSB-052	SCSB-052M-0001-SO	Pyrene	0.029	mg/kg	J	J	DL-LOQ	
	SCSB-052M-0001-SO	Selenium	0.53	mg/kg	JV	J	DL-LOQ	
SCSB-053	SCSB-053M-0001-SO	2-Methylnaphthalene	0.026	mg/kg	J	J	DL-LOQ	
	SCSB-053M-0001-SO	Benzo(b)fluoranthene	0.061	mg/kg	JS	J	DL-LOQ	
	SCSB-053M-0001-SO	Benzo(k)fluoranthene	0.035	mg/kg	JS	J	DL-LOQ	
	SCSB-053M-0001-SO	Chrysene	0.034	mg/kg	J	J	DL-LOQ	
	SCSB-053M-0001-SO	Di-n-Butyl Phthalate	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-053M-0001-SO	Fluoranthene	0.046	mg/kg	J	J	DL-LOQ	
	SCSB-053M-0001-SO	Phenanthrene	0.033	mg/kg	J	J	DL-LOQ	
	SCSB-053M-0001-SO	Selenium	0.72	mg/kg	JV	J	DL-LOQ	
SCSB-054	SCSB-054M-0001-SO	Pyrene	0.046	mg/kg	J	J	DL-LOQ	
SCSB-055	SCSB-055M-0001-SO	Bis(2-Ethylhexyl)phthalate	0.140	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-055	SCSB-055M-0001-SO	Di-n-Butyl Phthalate	0.130	mg/kg	J	J	DL-LOQ	
SCSB-056	SCSB-056M-0001-SO	Di-n-Butyl Phthalate	0.140	mg/kg	J	J	DL-LOQ	
	SCSB-056M-0001-SO	Selenium	0.46	mg/kg	JV	J	DL-LOQ	
SCSB-037	SCSB-080M-0001-SO	Antimony	0.67	mg/kg	JV	J	DL-LOQ	
	SCSB-080M-0001-SO	Di-n-Butyl Phthalate	0.092	mg/kg	J	J	DL-LOQ	
	SCSB-080M-0001-SO	Isophorone	0.180	mg/kg	J	J	DL-LOQ	
SCSB-038	SCSB-081M-0005-SO	Mercury	0.0076	mg/kg	J	J	DL-LOQ	
	SCSB-081M-0005-SO	Selenium	0.45	mg/kg	JV	J	DL-LOQ	
SCSB-040	SCSB-082M-0002-SO	Di-n-Butyl Phthalate	0.100	mg/kg	J	J	DL-LOQ	
	SCSB-082M-0002-SO	Isophorone	0.180	mg/kg	J	J	DL-LOQ	
	SCSB-082M-0002-SO	Mercury	0.0053	mg/kg	J	J	DL-LOQ	
SCSB-042	SCSB-083M-0003-SO	2-Methylnaphthalene	0.058	mg/kg	J	J	DL-LOQ	
	SCSB-083M-0003-SO	Bis(2-Ethylhexyl)phthalate	0.150	mg/kg	J	J	DL-LOQ	
	SCSB-083M-0003-SO	Di-n-Butyl Phthalate	0.130	mg/kg	J	J	DL-LOQ	
	SCSB-083M-0003-SO	Isophorone	0.200	mg/kg	J	J	DL-LOQ	
	SCSB-083M-0003-SO	Mercury	0.0051	mg/kg	J	J	DL-LOQ	
	SCSB-083M-0003-SO	Naphthalene	0.041	mg/kg	J	J	DL-LOQ	
	SCSB-083M-0003-SO	Phenanthrene	0.036	mg/kg	J	J	DL-LOQ	
SCSB-048	SCSB-084D-0001-SO	Di-n-Butyl Phthalate	0.200	mg/kg	J	J	DL-LOQ	
	SCSB-084D-0001-SO	Ethylbenzene	0.021	mg/kg	J	J	DL-LOQ	
	SCSB-084D-0001-SO	Xylene, (Total)	0.063	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSB-048	SCSB-084M-0001-SO	4,4'-DDE	0.0046	mg/kg	JV	J	DL-LOQ	
	SCSB-084M-0001-SO	Acenaphthylene	0.047	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Anthracene	0.073	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Benzo(a)anthracene	0.160	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Benzo(a)pyrene	0.210	mg/kg	JS	J	DL-LOQ	
	SCSB-084M-0001-SO	Benzo(ghi)perylene	0.049	mg/kg	JS	J	DL-LOQ	
	SCSB-084M-0001-SO	Benzo(k)fluoranthene	0.260	mg/kg	JS	J	DL-LOQ	
	SCSB-084M-0001-SO	Carbazole	0.037	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Chrysene	0.240	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Dibenzo(a,h)anthracene	0.022	mg/kg	US	UJ	LCS	
	SCSB-084M-0001-SO	Dibenzofuran	0.098	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Di-n-Butyl Phthalate	0.120	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Endosulfan II	0.0036	mg/kg	JV	J	DL-LOQ	
	SCSB-084M-0001-SO	Fluoranthene	0.280	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Fluorene	0.047	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Indeno(1,2,3-cd)pyrene	0.052	mg/kg	JS	J	DL-LOQ	
	SCSB-084M-0001-SO	Naphthalene	0.360	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Phenanthrene	0.270	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Selenium	1.7	mg/kg	JV	J	DL-LOQ	
	SCSB-084M-0001-SO	Toluene	0.037	mg/kg	J	J	DL-LOQ	
	SCSB-084M-0001-SO	Xylene, (Total)	0.063	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
Sediment Samples								
SCSD-070	SCSD-070M-0001-SD	1,2-Dichlorobenzene	0.044	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	1,4-Dichlorobenzene	0.040	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	2-Methylnaphthalene	0.043	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	4,4'-DDT	0.011	mg/kg	JV	J	DL-LOQ	
	SCSD-070M-0001-SD	4,4'-DDT	0.0068	mg/kg	P	J	DL-LOQ	
	SCSD-070M-0001-SD	alpha-Chlordane	0.0023	mg/kg	JP	J	DL-LOQ	
	SCSD-070M-0001-SD	Benzo(a)anthracene	0.057	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Benzo(a)pyrene	0.067	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Benzo(b)fluoranthene	0.110	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Benzo(ghi)perylene	0.026	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Benzo(k)fluoranthene	0.047	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	beta-BHC	0.0012	mg/kg	JP	J	DL-LOQ	
	SCSD-070M-0001-SD	Chrysene	0.070	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Di-n-Butyl Phthalate	0.300	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Endosulfan Sulfate	0.0055	mg/kg	P	J	DL-LOQ	
	SCSD-070M-0001-SD	Fluoranthene	0.089	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Heptachlor	0.0057	mg/kg	P	J	DL-LOQ	
	SCSD-070M-0001-SD	Indeno(1,2,3-cd)pyrene	0.026	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Naphthalene	0.029	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Phenanthrene	0.053	mg/kg	J	J	DL-LOQ	

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
SCSD-070	SCSD-070M-0001-SD	Pyrene	0.089	mg/kg	J	J	DL-LOQ	
	SCSD-070M-0001-SD	Selenium	1.4	mg/kg	JV	J	DL-LOQ	
SCSD-071	SCSD-071M-0001-SD	4,4'-DDD	0.00061	mg/kg	JP	J	DL-LOQ	
	SCSD-071M-0001-SD	4,4'-DDT	0.00091	mg/kg	JP	J	DL-LOQ	
	SCSD-071M-0001-SD	Antimony	0.45	mg/kg	JV	J	DL-LOQ	
	SCSD-071M-0001-SD	Benzo(b)fluoranthene	0.046	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Chrysene	0.027	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Cyanide, Total	0.36	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Di-n-Butyl Phthalate	0.110	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Fluoranthene	0.047	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Heptachlor	0.002	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Methoxychlor	0.0021	mg/kg	JP	J	DL-LOQ	P
	SCSD-071M-0001-SD	Nitroguanidine	0.0012	mg/kg	P	J	DL-LOQ	
	SCSD-071M-0001-SD	Phenanthrene	0.027	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Pyrene	0.040	mg/kg	J	J	DL-LOQ	
	SCSD-071M-0001-SD	Selenium	0.68	mg/kg	JV	J	DL-LOQ	
Equipment Rinsate Blank Samples								
NA	SCQC-001-0001-ER	3,3'-Dichlorobenzidine	0.73	mg/L	UMQ	UJ	MS/MSD	LCS
	SCQC-001-0001-ER	Benzyl Alcohol	0.74	mg/L	J	J	DL-LOQ	
	SCQC-001-0001-ER	Mercury	0.06	mg/L	J	J	DL-LOQ	
	SCQC-002-0001-ER	3,3'-Dichlorobenzidine	0.69	mg/L	UQM	UJ	MS/MSD	LCS

Table C-2 (continued)
Summary Table of Sample Data Qualifications

Sample Location	Sample Location ID	Analyte	Result	Units	Laboratory Qualifier	Validation Qualifier	Reason	
NA	SCQC-002-0001-ER	Benzyl Alcohol	0.7	mg/L	J	J	DL-LOQ	
	SCQC-003-0001-ER	3,3'-Dichlorobenzidine	0.69	mg/L	UQZ	UJ	LCS	
	SCQC-003-0001-ER	Manganese	0.95	mg/L	J	J	DL-LOQ	
	SCQC-004-0001-ER	3,3'-Dichlorobenzidine	0.75	mg/L	UM	UJ	MS/MSD	
	SCQC-004-0001-ER	Chloromethane	0.81	mg/L	J	J	DL-LOQ	
	SCQC-004-0001-ER	Endosulfan I	0.01	mg/L	UQ	UJ	LCS	
	SCQC-004-0001-ER	Methylene Chloride	0.61	mg/L	J	J	DL-LOQ	
	SCQC-004-0001-ER	Nickel	1.4	mg/L	J	J	DL-LOQ	
	SCQC-004-0001-ER	Pyrene	420	mg/L	J	J	DL-LOQ	
	SCQC-005-0001-ER	2,4-Dinitrotoluene	0.56	mg/L	JP	J	DL-LOQ	P
	SCQC-005-0001-ER	Endosulfan I	0.0098	mg/L	UQ	UJ	LCS	
	SCQC-005-0001-ER	gamma-Chlordane	0.0076	mg/L	UM	UJ	MS/MSD	
	SCQC-005-0001-ER	Manganese	1.3	mg/L	J	J	DL-LOQ	
	SCQC-005-0001-ER	Methoxychlor	0.022	mg/L	JP	J	DL-LOQ	P

Notes:
DL = detection limit
LCS = laboratory control sample
LOQ = level of quantitation
µg/L = micrograms per kilogram
mg/kg = milligrams per kilogram
NA = not applicable

Laboratory Qualifier Definitions:
H = Holding time exceeded
J = Estimated value.
M = Matrix spike and/or matrix spike duplicate recovery outside of acceptance limits.
P = Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q = Laboratory control sample outside acceptance limits.
S = Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
U = Analyte concentration was not above the detection limit.
V = Raised quanititation or reporting limit due to limited sample amount or dilution for matrix background interference.
Y = Replicate/duplicate precision outside acceptance limits.
Z = Calilbration criteria exceeded.

Validation Qualifier Defintions:
J = Estimated. The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
U = Not detected. The analyte was analyzed for, but not detected above the detection limit.
UJ = Not detected. The detection limits and quantitation limits are approximate.

Reason Code Description:
CCAL = For organic methods, continuing calibration evaluation criteria not met.
DL-LOQ = Sample result between the detection limit and level of quantitation.
HT = Holding time requirement was not met.
LCS = Laboratory control sample evaluation criteria not met.
MS/MSD = Matrix spike/matrix spike duplicate accuracy and/or precision criteria not met.
MS/SD = For inorganic methods, the matrix spike/matrix spike duplicate recovery is outside acceptance rang e.
P = The detected concentration difference between the primary and secondary column is greater than 40%.

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MEC^{x} Data Validation Report

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U.S. Army Corps of Engineers
Louisville District

Ravenna Army Ammunition Plant
Sand Creek Disposal Road Landfill
and Open Demolition Area #1
2010 Sampling
Ravenna, Ohio

Final Data Validation Report
Sample Delivery Groups:
81575, 81578, 81623, 81670, 82400, 82452

April 2013

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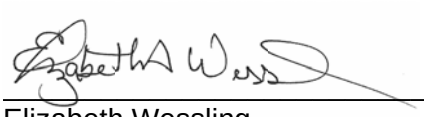
CONTRACTOR STATEMENT OF INDEPENDANT TECHNICAL REVIEW

MEC^X, LP (MEC^X) has completed the Data Validation Report for Multiple Sample Delivery Groups from the Ravenna Army Ammunition Plant Sand Creek Disposal Road Landfill and Open Demolition Area #1, 2010 Sampling. Notice is hereby given that an independent technical review has been conducted to determine the usability and bias of the analytical data.

Significant concerns and the resolution are as follows:

None

As noted above, all concerns resulting from this independent technical review have been considered.



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EXECUTIVE SUMMARY

The overall objective of the project described in this document was to define the nature and extent of contamination at the Sand Creek Disposal Road Landfill (Sand Creek) and Open Demolition Area #1 (ODA1) and complete a Remedial Investigation/Feasibility Study as applicable. Sampling was conducted by the Shaw Environmental and Infrastructure (Shaw) from September to November 2010. Samples collected are described in the table below.

Analysis	ODA1			Sand Creek					
	Soil			Soil			Sediment		
	MI	Discrete	Duplicate	MI	Discrete	Duplicate	MI	Discrete	Duplicate
Metals	90	0	7	77	0	8	1	0	0
Semivolatiles	11	0	2	77	0	8	1	0	0
Explosives	90	0	7	77	0	8	1	0	0
Volatiles	2	20	2	0	7	4	0	1	0
Pesticides	10	0	2	8	0	4	1	0	0
PCBs	10	0	2	8	0	4	1	0	0
Nitroguanidine	26	0	3	8	0	4	1	0	0
Nitrocellulose	26	0	3	8	0	4	1	0	0
Hexavalent Chromium	10	0	2	14	0	4	1	0	0
Cyanide	10	0	2	8	0	4	1	0	0

This report details the findings of the primary sample data validation, analysis of field duplicate results, and the determination of data usability performed by MEC^X, LP (MEC^X) on the samples described above.

One or more of the following analyses were performed for the primary samples by CT Laboratories (CT) located in Baraboo, Wisconsin:

- United States Environmental Protection Agency (USEPA) SW-846 Method 6010C for metals
- USEPA SW-846 Methods 7470A/7471A for mercury
- USEPA SW-846 Method 8330B for explosive compounds
- USEPA SW-846 8330 Modified for nitroguanidine
- USEPA SW-846 9056 Modified for nitrocellulose
- USEPA SW-846 Method 8260B for volatile organic compounds (VOCs)
- USEPA SW-846 Method 8270C for semivolatile compounds (SVOCs)
- USEPA SW-846 Method 8081 for pesticides
- USEPA SW-846 Method 8082 for polychlorinated biphenyls (PCBs)
- USEPA SW-846 Method 7196A for hexavalent chromium
- USEPA SW-846 Method 9012 for cyanide

A total of 18 quality assurance soil samples were submitted to RTI Laboratories (RTI) in Livonia, Michigan. The samples were analyzed for one or more of the aforementioned analyses and the results are discussed in a separate report, *Ravenna Army Ammunition Plant Sand Creek Disposal Road Landfill and Open Demolition Area #1 2010 Sampling Chemical Quality Assurance Report*.

Specific concerns regarding the data are noted below:

- 3 hexavalent chromium DLs exceeded the Facility-Wide Cleanup Goal (FWCUG) of 1.64 mg/Kg, at 1.9 mg/Kg.
- 5 benzo(a)pyrene DLs nominally exceeded the FWCUG of 0.023 mg/Kg, at 0.022 mg/Kg.
- Manual integrations performed for the MRL standards did not consistently adjust the baseline to account for a baseline anomaly that occurred just prior to the nitroguanidine retention time.
- Due to instrument limitations, the hexavalent chromium raw data did not list the sample absorbances; therefore, the reviewer was not able to calculate the sample results from the raw data.
- The actual temperature upon receipt was not noted by the laboratory. The temperature was noted only as being below some temperature (e.g. <4.2^{o}C).
- All explosive extractions were performed beyond the holding time.

Some data were rejected due to matrix spike/matrix spike duplicate recovery and calibration outliers. Rejected data are not usable. Results with DLs that exceed project criteria may be usable for their intended purposes; however, it is dependent on the final data user to make this determination on a case-by-case basis. All remaining results are usable for their intended purposes as qualified by MEC^{X}.

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APPENDICES

Appendix A Qualified Sample Forms Is

Appendix B Sample Qualification Summary

Appendix C Primary/Field Duplicate Sample Comparisons

Appendix D Validator Checklists

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARNG	Army National Guard
°C	Degrees Celsius
CCB	Continuing Calibration Blank
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CT	CT Laboratories
%D	Percent Difference
DL	Detection Limit
DoD	Department of Defense
EDD	Electronic Data Deliverable
FWCUG	Facility-Wide Cleanup Goals
FWQAPP	Facility-Wide Quality Assurance Project Plan
GC/MS	Gas Chromatography/Mass Spectrometry
ICSA	Interference Check Sample A
ICSAB	Interference Check Sample AB
ICV	Initial Calibration Verification
ICP	Inductively Coupled Plasma
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantitation
MEC^X	MEC^X, LP
MRL	Method Reporting Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ODA1	Open Demolition Area #1
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RPD	Relative Percent Difference
RRF	Relative Response Factor
RSD	Relative Standard Deviation
RSL	Regional Screening Level
RTI	RTI Laboratories
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
Shaw	Shaw Environmental and Infrastructure
SPCC	System Performance Check Compound
SVOC	Semivolatile Organic Compounds
USACE	United State Army Corps of Engineers
USEPA	United State Environmental Protection Agency
VOC	Volatile Organic Compounds

1. INTRODUCTION

1.1 PROJECT OVERVIEW

The overall objective of the project described in this document was to define the nature and extent of contamination at the Sand Creek Disposal Road Landfill (Sand Creek) and Open Demolition Area #1 (ODA1) and complete a Remedial Investigation/Feasibility Study as applicable. Sampling was conducted by the Shaw Environmental and Infrastructure (Shaw) from September to November 2010. Samples collected are described in the table below.

Table 1. Sample analysis counts by Area of Concern

Analysis	ODA1			Sand Creek					
	Soil			Soil			Sediment		
	MI	Discrete	Duplicate	MI	Discrete	Duplicate	MI	Discrete	Duplicate
Metals	90	0	7	77	0	8	1	0	0
Semivolatiles	11	0	2	77	0	8	1	0	0
Explosives	90	0	7	77	0	8	1	0	0
Volatiles	2	20	2	0	7	4	0	1	0
Pesticides	10	0	2	8	0	4	1	0	0
PCBs	10	0	2	8	0	4	1	0	0
Nitroguanidine	26	0	3	8	0	4	1	0	0
Nitrocellulose	26	0	3	8	0	4	1	0	0
Hexavalent Chromium	10	0	2	14	0	4	1	0	0
Cyanide	10	0	2	8	0	4	1	0	0

One or more of the following analyses were performed for the primary samples by CT Laboratories (CT) located in Baraboo, Wisconsin:

- United States Environmental Protection Agency (USEPA) SW-846 Method 6010C for metals
- USEPA SW-846 Methods 7470A/7471A for mercury
- USEPA SW-846 Method 8330B for explosive compounds
- USEPA SW-846 8330 Modified for nitroguanidine
- USEPA SW-846 9056 Modified for nitrocellulose
- USEPA SW-846 Method 8260B for volatile organic compounds (VOCs)
- USEPA SW-846 Method 8270C for semivolatile compounds (SVOCs)
- USEPA SW-846 Method 8081 for pesticides
- USEPA SW-846 Method 8082 for polychlorinated biphenyls (PCBs)
- USEPA SW-846 Method 7196A for hexavalent chromium
- USEPA SW-846 Method 9012 for cyanide

A total of 18 quality assurance soil samples were submitted to RTI Laboratories (RTI) in Livonia, Michigan. The samples were analyzed for one or more of the aforementioned analyses and the results are discussed in a separate report, *Ravenna Army Ammunition Plant Sand Creek*

Disposal Road Landfill and Open Demolition Area #1 2010 Sampling Chemical Quality Assurance Report.

This report describes findings of the primary sample data validation, analysis of primary/field duplicate results, and the determination of data usability performed by MEC^X, LP (MEC^X) on the site samples reported in seven sample delivery groups (SDGs) from CT.

1.2 PREVIOUS ACTIVITIES AND DATA

The following summary was adapted from the *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (FWQAPP) prepared by Science Applications International Corporation (SAIC), March 2001 and the *Final Sampling and Analysis Plan Addendum No. 1 for Environmental Services at RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site* (SAP) prepared by Shaw Environment and Infrastructure (Shaw), November 2010.

Located in northeastern Ohio on approximately 21,000 acres, Ravenna Army Ammunitions Plant (RVAAP) was established in 1940 to load, store, and demilitarize conventional artillery ammunition, bombs, mines, fuses and boosters, primers and percussion elements. Originally RVAAP operated as two separate units, the Portage Ordnance Depot and the Ravenna Ordnance Plant. During World War II, a contractor operated the Ravenna Ordnance Depot and the government operated the Portage Ordnance Depot. Ordnance production and storage for World War II continued until August 1945, at which time the facility was renamed the Ravenna Arsenal, and the government assumed control of all operations. Then, from 1951 to 1999, the entire facility was operated by contractors. Ordnance production at the facility was phased out and sent to Plum Brook Ordnance Works in Sandusky, Ohio and Keystone Ordnance Works in Meadville, Pennsylvania. All production at the facility had ceased by 1957 and the plant was placed on standby. In 1961, the plant was operational for seven months, processing and performing explosive melt-out of bombs. After deactivation late in 1961, the facility was renamed RVAAP. From mid-1968 until 1971, the plant was reactivated to load, assemble, and pack munitions on three load lines and two component lines. Operations ceased at Load Lines 1, 2, 3, and 4 in 1971; however, the Lines were reactivated to perform demilitarization operations for several months in 1973 and 1974. In 1992, RVAAP was again placed on "Inactive" status. Salvage and demolition operations started in 1998 and administrative control of the facility was transferred to the Army National Guard (ARNG) in 1999.

Information specific to ODA1 and Sand Creek is provided in sections 4.1 and 5.1 of this report, respectively.

Samples collected in association with the project described in this document were from soils and sediments collected from Sand Creek and soils collected from ODA1. The samples were collected in order to provide the additional characterization of the nature and extent of contamination at Sand Creek and ODA1.

2. DESCRIPTION OF WORK PERFORMED

This section describes the data verification and data validation procedures used during the evaluation of the site samples reported in SDGs 81575, 81578, 81584, 81623, 81670, 82400, and 82452 from CT.

2.1 DATA VALIDATION PROCESS

Level IV validation was performed on 10% of the total number of primary samples collected. Primary samples with associated QA and field duplicate samples were prioritized for Level IV validation; however, not all samples validated at Level IV had associated QA or field duplicate samples. Samples validated at Level IV for ODA1 are listed in Section 4.2 and the samples validated at Level IV for Sand Creek are listed in Section 5.2.

Data validators assessed results based on the FWQAPP, the SAP, *Department of Defense Quality Systems Manual for Environmental Laboratories Version 4.1* (DoD QSM), FWQAPP, the specific EPA methods, the *National Functional Guidelines for Superfund Organic Methods Data Review* (2008), and the *National Functional Guidelines for Inorganic Data Review* (2004). The following were reviewed for Level IV validation:

- Sample management (collection techniques, sample containers, preservation, handling, transport, chain-of-custody, holding times),
- Calibration data summary forms (initial and continuing),
- Method reporting limit (MRL) standard recoveries,
- Blank sample results (method, calibration, equipment, field),
- Laboratory control sample (LCS) or LCS/LCS duplicate (LCS/LCSD) recoveries and/or precision,
- Laboratory duplicate precision,
- Surrogate recoveries (if applicable),
- Matrix spike/matrix spike duplicate (MS/MSD) recoveries and precision,
- Post digestion spike recoveries,
- Field QA/QC sample results,
- Inductively coupled plasma (ICP) interference check sample (ICS) recoveries,
- Serial dilution precision,
- Gas Chromatography/Mass Spectrometry (GC/MS) tuning, if a GC/MS is used,
- Internal standards performance (if applicable),
- Sample results verification,
- Target compound identification,
- Raw data.

Blanks – method, calibration, trip, field and equipment – were assessed using the National Functional Guidelines 5× and 10× rules. Target compounds detected in the samples at concentrations less than or equal to 5× a blank detect and common laboratory contaminant compounds detected in the samples at concentrations less than or equal to 10× a blank detect

were qualified as nondetected. Nondetected results were reported at the limit of detection (LOD) if the original detect was less than or equal to the LOD, or reported at the level of contamination if the original detect was greater than the LOD.

2.2 DATA VALIDATION QUALIFIERS

Data qualifiers, as defined below, were applied following the FWQAPP and the DoD QSM:

U Nondetected at the limit of detection
The analyte was analyzed for but not definitively detected.

J Estimated
The identification of the analyte is acceptable but the quality assurance criteria indicate that the quantitative values may be outside the normal expected range of precision. Additionally used to identify detects reported below the limit of quantitation (LOQ).

N Identity Presumptive and Tentative
There is presumptive evidence that the analyte is present but it has not been confirmed. There is an indication that the reported analyte is present; however, all quality control requirements necessary for confirmation were not met.

R Rejected
Data are considered to be rejected and shall not be used for environmental decisions.

2.3 DATA VALIDATION FLAGGING CODES

The qualification codes in the following table may have been used to flag the data described in this document: Sample qualifications are summarized in Appendix B. All qualifications and associated qualification codes have been entered into the electronic data deliverables (EDD) received from the laboratories and may be reviewed in the Appendix A of this report.

Table 2. Qualification code reference table

Qualifier	Organics	Inorganics
H	Holding times were exceeded.	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.	The sequence or number of standards used for the calibration was incorrect.
C	Calibration %RSD or %D was noncompliant. MRL recovery outlier of missing MRL.	Correlation coefficient was noncompliant. MRL recovery outlier of missing MRL.
R	Calibration RRF was noncompliant.	%R for calibration is not within control limits.
B	Presumed contamination as indicated by the preparation (method) blank results.	Presumed contamination as indicated by the preparation (method) or calibration blank results.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.	Laboratory Control Sample %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.	MS recovery was poor.
E	Not applicable	Duplicates showed poor agreement.
I	Internal standard performance was unsatisfactory.	ICP ICS results were unsatisfactory.
A	Not applicable.	ICP Serial Dilution %D were not within control

Qualifier	Organics	Inorganics
		limits.
M	Tuning (BFB or DFTPP) was noncompliant.	ICPMS tuning was noncompliant
T	Presumed contamination as indicated by the trip blank results.	Not applicable.
+	False positive – reported compound was not present.	False positive – reported compound was not present.
-	False negative – compound was present but not reported.	False negative – compound was present but not reported.
F	Presumed contamination as indicated by the FB or ER results.	Presumed contamination as indicated by the FB or ER results.
$	Reported result or other information was incorrect.	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.	Not applicable.
D	The analysis with this flag should not be used because another more technically sound analysis is available.	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.	Post Digestion Spike recovery was not within control limits.
*II, *III	A deficiency was found that has been described in the "Sample Management," section (*II) or the "Method Analyses" section (*III).	A deficiency was found that has been described in the "Sample Management," section (*II) or the "Method Analyses" section (*III).

3. DATA ACQUISITION ACTIVITIES

3.1 SAMPLE COLLECTION

Soil samples were collected from September to November 2010. The samples were submitted under chain-of-custody to the primary laboratory, CT.

Unless otherwise noted in Sections 4.2.1 and 5.2.1, the chains-of-custody associated with the samples validated at Level IV were appropriately signed by both field and/or laboratory personnel with all samples and analyses accounted for, cooler custody seals intact, and within the temperature limits of 4±2°C. All documentation regarding sample handling as presented in the case narratives, chains-of-custody, correspondence, and sample condition upon receipt forms was evaluated.

3.2 SAMPLE ANALYSIS

CT, the primary laboratory, analyzed the samples shown in Table 1, and 9 equipment rinsate samples, 1 field blank, and 14 trip blank samples. Analyses performed by CT included USEPA SW-846 Method 6010C for various metals, USEPA SW-846 Methods 7470A/7471A for mercury, USEPA SW-846 Method 8270C for SVOCs, USEPA SW-846 Method 8081 for pesticides, USEPA SW-846 Method 8082 for PCBs, USEPA SW-846 Method 8260B for VOCs, USEPA Method SW-846 8330B for explosive compounds, USEPA Method SW-846 8330 Modified for nitroguanidine, USEPA Method SW-846 9056 Modified for nitrocellulose, USEPA Method SW-846 7196A for hexavalent chromium, and USEPA SW-846 Method 9012A for cyanide.

3.3 DATA COMPLETENESS

Data completeness for the project described in this report was found to be generally acceptable as no deliverables were missing.

3.4 SAMPLE PRESERVATION AND HOLDING TIME REQUIREMENTS

Unless noted otherwise in Sections 4.2.3 and 5.2.3, all method preservation requirements were met. The extraction and analytical holding times for the analyses reviewed in this document are as follows:

Table 3. Holding Times

Method	Analysis	Holding Time			
		Extraction		Analysis	
		Water	Soil	Water	Soil
6010C	Metals	N/A	N/A	180 days	180 days
7470A/7471A	Mercury	N/A	N/A	28 days	28 days
8260B	VOCs	N/A	N/A	14 days	14 days
8270C	SVOCs	7 days	14 days	40 days	40 days
8081	Pesticides	7 days	14 days	40 days	40 days
8082	PCBs	7 days	14 days	40 days	40 days
8330B	Explosives	7 days	14 days	40 days	40 days
8330 M	Nitroguanidine	7 days	14 days	40 days	40 days

Method	Analysis	Holding Time			
		Extraction		Analysis	
		Water	Soil	Water	Soil
9056 M	Nitrocellulose	N/A	N/A	28 days	28 days
7196A	Hexavalent chromium	24 hours	30 days	24 hours	24 hours
9012A	Cyanide	N/A	N/A	14 days	14 days

Unless noted otherwise in Sections 4.2.3 and 5.2.3, all holding times were met.

3.5 DETECTION LIMIT REQUIREMENTS

Please note: All hardcopy and EDD report nondetected results to the detection limit (DL). Correspondence with E. Korthals of CT indicated the laboratory had not completed its change to the LOQ/LOD/DL reporting system at the time these samples were analyzed. The DLs and LODs were appropriately set, but the laboratory information management system incorrectly reported nondetects to the DL instead of the LOD.

As per the SAP, the site specific cleanup goals (FWCUGs) for the Residential Farmer Adult, Residential Farmer Child, and National Guard Trainee, presented in the *Final Facility-Wide Human Health Remediation Goals at the RVAAP* (2010) were applicable to the ODA1 and Sand Creek sites. Due to the reporting issue noted above, MEC^X compared to the detection limit (DL) for the nondetected analytes to the most stringent FWCUG for each nondetected analyte. As per the SAP, if no FWCUG was listed, the USEPA Region 9 Residential Regional Screening Level (RSL) was utilized.

Some DLs exceeded project criteria. These are listed in Sections 4.2.4 and 5.2.4. Results with DLs that exceed project criteria may be usable for their intended purposes; however, it is dependent on the final data user to make this determination on a case-by-case basis.

4. OPEN DEMOLITION AREA #1

4.1 PREVIOUS ACTIVITIES AND DATA

ODA1 is approximately 6-acres in size and was used in the 1940s for open burning and open detonation of munitions, explosives and associated materials. Visual inspections of the site indicate that burning and detonation activities may have been conducted in small areas in the plane storage area adjacent to ODA1. The open burn sites at ODA1 may have been cleared by scraping debris and scrap to the periphery, using heavy equipment. Since the burning and detonation activities ceased, ODA1 has been unused although some ARNG troop training has occurred at the surrounding plane storage site since 1969.

A Phase I remedial Investigation was conducted at ODA1 by SAIC in 1999 and an interim removal action was performed by MKM Engineers (MKM) in 2000 and 2001. Shaw prepared a *Data Quality Objective Report* based on these investigations and determined additional sampling was necessary to address data gaps.

4.2 CURRENT INVESTIGATION

Samples collected in association with the project described in this document were from soils collected from ODA1. The samples were collected in order to provide the additional characterization of the nature and extent of contamination at ODA1.

Table 4. Total sample count for ODA1

Matrix	Primary Samples	Field Duplicates	Split Samples	Explosives	Propellants	Pesticides	PCBs	SVOCs	VOCs	Metals	Cr^{6+}	Cyanide
Soil	110	9	7	97	29	12	12	13	24	97	12	12

Table 5. ODA1 validated samples and methods

Sample ID	SDG	Matrix	Collected	Explosives	Propellants	Pesticides	PCBs	SVOCs	VOCs	Metals	Cr^{6+}	Cyanide
DA1SB-055M-0001-SO	81543	Soil	9/22/2010	x	--	--	--	--	--	x	--	--
DA1SB-059D-0201-SO	81543	Soil	9/23/2010	--	--	--	--	--	x	--	--	--
DA1SB-059M-0201-SO	81543	Soil	9/23/2010	x	x	x	x	x	--	x	x	x
DA1SB-063M-0202-SO	81543	Soil	9/23/2013	x	x	--	--	--	--	x	--	--
DA1SB-068D-0201-SO	81613	Soil	9/24/2010	--	--	--	--	--	x	--	--	--
DA1SB-068M-0201-SO	81613	Soil	9/24/2010	x	x	--	--	x	--	x	--	--
DA1SB-070D-0201-SO	81613	Soil	9/24/2010	--	--	--	--	--	x	--	--	--
DA1SB-070M-0204-SO	81613	Soil	9/24/2010	x	x	--	--	--	--	--	--	--
DA1SB-072M-0204-SO	81613	Soil	9/24/2010	x	x	--	--	--	--	--	--	--
DA1SB-074M-0202-SO	82400	Soil	11/10/2010	x	x	--	--	--	--	--	--	--

Sample ID	SDG	Matrix	Collected	Explosives	Propellants	Pesticides	PCBs	SVOCs	VOCs	Metals	Cr^{6+}	Cyanide
DA1SS-050M-0201-SO	81613	Soil	9/27/2010	x	x	--	--	--	--	--	--	--
DA1SS-054M-0201-SO	82400	Soil	11/10/2010	x	x	--	--	--	--	--	--	--

Table 6. ODA1 field duplicate samples

Duplicate Sample ID	Parent Sample
DA1SB-081M-0203-SO	DA1SB-059M-0203-SO
DA1SB-082M-0202-SO	DA1SB-063M-0202-SO
DA1SB-083M-0202-SO	DA1SB-065M-0202-SO
DA1SB-084D-0201-SO	DA1SB-068D-0201-SO
DA1SB-084M-0201-SO	DA1SB-068M-0201-SO
DA1SB-085D-0204-SO	DA1SB-070D-0203-SO
DA1SB-085M-0204-SO	DA1SB-070M-0204-SO
DA1SB-086M-0204-SO	DA1SB-072M-0204-SO
DA1SS-080M-0201-SO	DA1SS-050M-0201-SO

4.2.1 Sample Collection

Except as noted below, no sample collection issues were noted.

SDG	Issue
All	The sample receipt temperatures were listed by the laboratory only as <## ^{o}C (e.g. <2.6^{o}C). As the samples were not received above 6.0^{o}C and were not noted to be frozen or damaged, no qualifications were applied.
Most	Some corrections made to the chain-of-custody by the sampler or by the laboratory were overwritten and some correction were not initialed or dated.
81575	Some collection times listed on the chain-of-custody did not match the sample containers. Shaw advised the laboratory to use the times listed on the sample containers.
81623	Sample DA1SB-070M-0204-SO was listed on the chain-of-custody but was not received. As per Shaw, volume from the field duplicate, DA1SB-085M-0204-SO was used for the DA1SB-070M-0204-SO sample analyses. The field duplicate was not considered a valid replacement for the parent sample.

4.2.2 Data Completeness

Data completeness for the project described in this report was found to be generally acceptable as no deliverables were missing from the SDGs reviewed.

4.2.3 Preservation and Holding Time Requirements

All method preservation requirements were met. Except as noted in the table below, all holding times, as listed in Table 3, were met. Results listed in the table below were qualified as estimated, "UJ," for nondetects and estimated with a potential negative bias, "J-," for detects. The qualified results were coded with an "H" qualification code.

Samples qualified for exceeded holding time			
Method	Analytes	Sample	Days past extraction holding time
8330B	All	DA1SB-055M-0001-SO	5
		DA1SB-059M-0201-SO, DA1SB-063M-0202-SO	9
8330B	All	DA1SB-068M-0201-SO	9
		DA1SB-070M-0204-SO	
		DA1SB-072M-0204-SO	
8330B	All	DA1SS-050M-0201-SO	6
8330	Nitroguanidine	DA1SB-059M-0201-SO	9
8270C	All	DA1SB-059M-0201-SO	8
		DA1SB-068M-0201-SO	7
8330B	All	DA1SB-074M-0202-SO	1
8330	Nitroguanidine	DA1SB-068M-0201-SO	10
8330	Nitroguanidine	DA1SB-063M-0202-SO	9
9012	Cyanide	DA1SB-059M-0201-SO	16

4.2.4 Detection Limit Requirements

As per the SAP, the site specific cleanup goals (FWCUGs) for the Residential Farmer Adult, Residential Farmer Child, and National Guard Trainee, presented in the *Final Facility-Wide Human Health Remediation Goals at the RVAAP* (2010) were applicable to the ODA1 and Sand Creek sites. Due to the reporting issue noted in Section 3.5, MEC^X compared the DL for the nondetected analytes to the most stringent FWCUG for each nondetected analyte. As per the SAP, if no FWCUG was listed, the USEPA Region 9 Residential Regional Screening Level (RSL) was utilized.

These analytes had DLs which exceeded the FWCUG:

- 2 benzo(a)pyrene DLs (nominally exceeded by 0.01 mg/Kg)
- 1 hexavalent chromium DL exceeded the control limit of 1.9 mg/Kg by 0.26 mg/Kg

No analytes had DLs which exceeded the RSLs:

The following had no FWCUG or RSL:

- 1 metal: potassium (nutrient)
- 8 pesticide compounds: alpha-chlordane, chlordane, endosulfan I, endosulfan II, endosulfan sulfate, endrin aldehyde, endrin ketone, and gamma-chlordane
- 3 VOCs: chloroethane, cis-1,3-dichloropropene, trans-1,3-dichloropropene
- 2 PCBS: Aroclor 1262, Aroclor-1268
- 2 VOCs: cis-1,3-dichloropropene, trans-1,3-dichloropropene
- 9 SVOC compounds: acenaphthylene, benzo(g,h,i)perylene, dimethyl phthalate, phenanthrene, 1,3-dichlorobenzene, 2-nitrophenol, 3-nitroaniline, 4-bromophenyl phenyl ether, 4-chlorophenyl phenyl ether

Results with DLs that exceed project criteria may be usable for their intended purposes; it is dependent on the final data user to make this determination on a case-by-case basis.

4.3 ODA1 DATA QUALITY EVALUATION

4.3.1 Explosives

CT analyzed 90 primary MI soil samples, 7 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for explosive compounds by USEPA SW-846 Method 8330B. MEC^X validated 9 soil samples at Level IV.

- Detection Limit (DL) studies were not evaluated as part of this project.
- Calibration:
    - Initial calibration average percent relative standard deviations (%RSDs) were within the control limits listed in DoD QSM Table F-3 of ≤20%, or the linear regression r^2 values were ≥0.990.
    - The second source initial calibration verification standard (ICV) recoveries for both the primary and confirmation calibrations were within the control limits listed in DoD QSM Table F-3 of ±20%.
    - The continuing calibration verification (CCV) standard recoveries were within the control limits listed in DoD QSM Table F-3 of ±20%.
    - As per FWQAPP Section 8.3.2.1.2, MRLs were analyzed. No control limits were listed in the FWQAPP; therefore, the reviewer utilized the reasonable control limits of 70-130%. One recovery for 2,6-dinitrotoluene was 60%; therefore, the nondetected results for 2,6-dinitrotluene in DA1SB-074M-0202-SO and DA1SS-054M-0201-SO were qualified as estimated, "UJ." Recoveries for 2,4-dinitrotoluene and nitroglycerin were 64% and 58%, respectively, in the MRL associated with DA1SB-074M-0202-SO; therefore, the nondetected results for these compounds in DA1SB-074M-0202-SO were qualified as estimated, "UJ." The qualified results were coded with a "C" qualification code. All remaining recoveries were within the control limits.
- Blanks: The method blanks associated with the validated samples had no target compound detects above the control limits listed in DoD QSM Table F-3 of one-half the LOQ or one-tenth the amount detected in a sample.
- Laboratory Control Samples: 4-Amino-2,6-dinitrotoluene (control limits: 80-125%) was recovered at 77% in the LCS associated with DA1SB-070M-0204-SO and DA1SB-072M-0204-SO; therefore, nondetected 4-amino-2,6-dinitrotluene in these samples was qualified as estimated, "UJ." The qualified results were coded with an "L" qualification code. The remaining recoveries were within the control limits listed in DoD QSM Tables

G-2 (poor performers) and G-13 for the listed compounds and within the reasonable laboratory control limits of 50-150% for nitroglycerin and PETN.

- Surrogate Recovery: As no surrogate control limit was listed in the DoD QSM, surrogate recoveries were assessed against the reasonable laboratory-established control limits of 50-150%. All surrogate recoveries were within the control limits.

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on validated samples DA1SB-055M-0001-SO and DA1SS-050M-0201-SO. 4-Amino-2,6-dinitrotoluene was recovered above the control limit in the DA1SB-055M-0001-SO MS only and did not require qualification. Both 2,4-dinitrotoluene RPDs exceeded the control limit at 22% and 24%; respectively. The nondetected results for 2,4-dinitrotoluene in DA1SB-055M-0001-SO and DA1SS-050M-0201 were qualified as estimated, "UJ," and coded with a "Q" qualification code. All remaining recoveries were within the control limits listed in DoD QSM Tables G-2 (poor performers) and G-13 for the listed compounds and within the reasonable laboratory control limits for nitroglycerin and PETN. The remaining RPDs were within the control limits listed in DoD QSM Table F-3 of ≤20%.

- Triplicates: Triplicate analyses were performed on soil samples DA1SB-055M-0001-SO, DA1SB-063M-0202-SO and DA1SS-050M-0201-SO. The %RSDs were within the control limit listed in DoD QSM Table F-3 of ≤20%.

- Compound Identification: Compound identification was verified for those samples validated at a Level IV. Review of the sample chromatograms and retention times indicated no problems with target compound identification. As there were no primary column detects, no confirmation analyses were performed.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for those samples validated at a Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

  In some instances, nitrobenzene, 2,4-dinitrotoluene and 2,6-dinitrotoluene were reported by both Methods 8330B and 8270C and both methods were validated at Level IV. As there were no detects for these compounds in the 8330B analyses and the 8270C LOQs were lower, the results for these compounds were rejected, "R," in the 8330B analyses in favor of the 8270C results, for the samples validated at Level IV. All rejected analytes were coded with a "D" qualification code.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations: Some manual integrations were performed for CCVs and sample data reviewed at Level IV. All manual integrations were performed in order to report incompletely resolved peaks and were deemed acceptable by the reviewer.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsates and one field blank sample collected in association with the ODA1 samples. There were no detects above the DL in these samples.

    - Field Duplicates: A total of 7 soil field duplicates were collected and analyzed for explosive compounds. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

4.3.2 Propellants

CT analyzed 26 primary MI soil samples, 3 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for nitroguanidine by USEPA SW-846 Method 8330 Modified and for nitrocellulose as nitrate/nitrite by modified SW-846 Method 9056. MEC^X validated 3 soil samples at Level IV.

- DL studies were not evaluated as part of this project.

- Calibration

    - Nitroguanidine initial calibration %RSDs were within the control limits listed in DoD QSM Table F-2 of ≤20%, or the linear regression r^2 values were ≥0.990. Nitrocellulose linear regression r values were within the control limit listed in the DoD QSM Table F-11 of ≥0.995.

    - The nitroguanidine second source ICV for both the primary and confirmation calibrations were within the control limits listed in DoD QSM Table F-2 of 85-115%. The nitrocellulose ICV recoveries were within the control limits listed in DoD QSM Table F-11 of 90-110%.

    - The nitroguanidine CCV standard %Ds were within the control limits listed in DoD QSM Table F-2 of ≤15%. The nitrocellulose CCV recoveries were within the control limits listed in DoD QSM Table F-11 of 90-110%.

    - As per FWQAPP Section 8.3.2.1.2, MRL standards are required and were analyzed. All recoveries were reported to be within the reasonable control limits of 70-130%; however, please see the Manual Integration bullet below.

- Blanks: The method blanks associated with the validated samples had no target compound detects above the control limits listed in DoD QSM Tables F-2 and F-11 of one-half the LOQ or one-tenth the amount detected in a sample.

- Laboratory Control Samples: No nitroguanidine LCS control limits are listed in the DoD QSM. All nitroguanidine recoveries were within the laboratory-established control limits of 50-150%. The nitrocellulose recoveries were within the control limits listed in DoD QSM Table F-11 of 80-120%.

- Surrogate Recovery: A surrogate is not required for the analyses of nitrocellulose. Surrogate control limits for 1,2-dinitrobenzene are not listed in the DoD QSM; therefore, the nitroguanidine surrogate recoveries were assessed against the laboratory control limits of 75-127%. The recoveries were within the control limits.

- Triplicates: Nitroguanidine triplicate analyses were performed on sample DA1SD-063M-0202-SO. The %RSD was within the control limit listed in DoD QSM Table F-3 of ≤20%.

- Matrix Spike/Matrix Spike Duplicate: No MS/MSD analyses were performed on a validated sample. Method accuracy was evaluated based on LCS results.

- Compound Identification: Compound identification was verified for those samples validated at a Level IV. Review of the sample chromatograms and retention times indicated no problems with target compound identification. As there were no primary column detects, no confirmation analyses were performed.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for those samples validated at a Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." The laboratory reported nitroguanidine nondetects to the DL instead of the LOD. Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual Integrations: Some manual integrations were performed for the nitroguanidine MRLs. Manual integrations performed for the MRL standards did not consistently adjust the baseline to account for a baseline anomaly that occurred just prior to the nitroguanidine retention time. As the inconsistent baseline may have affected the MRL recoveries, it was the reviewer's professional opinion that nondetected nitroguanidine in DA1SB-068M-0201-SO, DA1SB-059M-0201-SO and DA1SB-063M-0202-SO should be qualified as estimated, "UJ." The qualified results were coded with an "*III" qualification code. The low level calibration standard was also manually integrated to correct the baseline which was affected by a significant amount of noise.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsates and one field blank sample associated with the ODA1 site samples. Nitroguanidine was not detected above the DL in any of the equipment rinsates.

    - Field Duplicates: A total of 3 field duplicate pairs were collected and analyzed for nitroguanidine and nitrocellulose. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

4.3.3 Polychlorinated Biphenyls (PCBS)

CT analyzed 10 primary MI soil samples, 2 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for PCBs by USEPA SW-846 Method 8082. MEC^X validated 1 soil sample at Level IV.

- DL studies were not evaluated as part of this project.

- Calibration: Calibration criteria listed in the DoD QSM Table F-2 were met.

    - Initial calibration average %RSDs were within the control limits of ≤20% or r^2 values ≥0.990.

    - The second source ICV was within the control limit of ±20% of the true value for all applicable Aroclors.

    - The CCV standard %Ds were within the control limits of ±20%.

    - As per FWQAPP Section 8.3.2.1.2, MRL standards are required. Some recoveries were above the control limits; however, these did require qualification of nondetected results. All average MRL recoveries affecting sample data were within the reasonable control limits of 70-130%.

- Blanks: The method blanks had no target compound detects above the control limits listed in the DoD QSM Table F-2, of one-half the LOQ for target compounds or one-tenth the amount detected in a sample.

- Laboratory Control Samples: LCS recoveries were within the control limits listed in DoD QSM Table G-17 for soils, of 40-140% and 60-130% for Aroclors 1016 and 1260, respectively.

- Surrogate Recovery: Recoveries were within the control limits listed in DoD QSM Table G-3 of 60-125% for soils.

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on soil sample DA1SB-059M-0201-SO. All recoveries were within the control limits listed in DoD QSM Table G-17 for soils, of 40-140% and 60-130% for Aroclors 1016 and 1260, respectively. The RPDs were within the control limit listed in the DoD QSM Table F-2 of ≤30%.

- Compound Identification: Compound identification was verified for the validated sample. Review of the sample chromatograms, standards, and retention times indicated no problems with target compound identification. The sample was analyzed on two analytical columns for target compound confirmation; however, the sample had no Aroclors detected on the primary column.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the sample validated at a Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations were not performed for the sample or calibration and QC data associated with the sample data.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsates and one field blank sample associated with the ODA1 site samples. These samples had no detects above the DL.

    - Field Duplicates: There were 2 soil field duplicate pairs collected and analyzed for PCBs. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

4.3.4 Pesticides

CT analyzed 10 primary MI soil samples, 2 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for pesticides by USEPA SW-846 Method 8081. MEC^X validated 1 soil sample at Level IV.

- DL studies were not evaluated as part of this project.

- Calibration: Calibration criteria listed in the DoD QSM Table F-2 were met.

  - Initial calibration %RSDs were within the control limit of ≤20%, or r^2 values ≥0.990.

  - The ICV recoveries for all target analytes were within the control limit of ±20% of the true value.

  - The DDT/Endrin breakdown standards were within the control limit listed in the DoD QSM Table F-2 of ≤15%.

  - All bracketing CCV %Ds were within the control limit of ≤20%.

  - As per FWQAPP Section 8.3.2.1.2, MRL standards are required. All MRL recoveries affecting sample data were within the reasonable control limits of 70-130%.

- Blanks: The method blanks had no target compound detects above the control limits listed in the DoD QSM Table F-2, of one-half the LOQ or one-tenth the amount detected in a site sample.

- Laboratory Control Samples: Recoveries were within the control limits listed in the DoD QSM Table G-15.

- Surrogate Recovery: Recoveries were within the control limits listed in the DoD QSM Table G-3.

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on soil sample DA1SB-059M-0201-SO. Endrin ketone was recovered below the control limits of 65-135%, at 63%, in the MS only, and did not require qualification. Endrin aldehyde was recovered below the control limits of 35-145% in both the MS and MSD, at 18% and 16%, respectively. The nondetected result for endrin aldehyde in sample DA1SB-059M-0201-SO was qualified as estimated, "UJ," and coded with a "Q" qualification code. Remaining recoveries were within the control limits listed in DoD QSM Table G-15 and all RPDs were within the control limit of ≤30% listed in the DoD QSM Table F-2.

- Compound Identification: Compound identification was verified for the sample validated at Level IV. Review of the sample chromatograms and retention times indicated no problems with target compound identification.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the validated sample. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

The sample was analyzed on two analytical columns for target compound confirmation. The sample had no confirmed target compound detects.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations were not performed for the sample validated at Level IV or calibration and QC data associated with the sample data.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsates and one field blank sample associated with the ODA1 site samples. These samples had no detects above the DL. One equipment rinsate had a detect between the DL and LOQ for methoxychlor; however, methoxychlor was not detected in the validated sample. There were no other target compound detects above the DL.

    - Field Duplicates: There were 2 soil field duplicate pairs collected and analyzed for PCBs. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

4.3.5 Semivolatile Organic Compounds (SVOCs)

CT analyzed 11 primary MI soil samples, 2 field duplicate samples, 1 field blank, and 3 equipment rinsate samples for SVOCs by USEPA Method 8270C. MEC^X validated 2 soil samples at Level IV.

- DL studies were not evaluated as part of this project.

- GC/MS Tuning: The DFTPP tunes met the method abundance criteria. The samples were analyzed within 12 hours of the DFTPP injection time.

- Calibration: Calibration criteria listed in the DoD QSM Table F-4 were met for all target compounds of interest, with exceptions affecting sample data listed below.

    - Initial calibration average RRFs and ICV and CCV RRFs were within method control limits of ≥0.050 for system performance check compounds (SPCCs). All initial calibration %RSDs were within the method control limits listed in the DoD QSM Table F-4 of ≤30% for calibration check compounds (CCCs) and ≤15% for remaining compounds, or r^2 values ≥0.990.

- All second source ICV standard recoveries were within the control limit of ±20%.

- The CCV bracketing the sample analyses had a %D for 3,3'-dichlorobenzidine (25.8%) that exceeded the control limit; therefore, the nondetected results for these analytes were qualified as estimated, "UJ," in DA1SB-059M-0201-SO and DA1SB-068M-0201-SO. The qualified results were coded with a "C" qualification code. All remaining continuing calibration %Ds affecting sample data were within the control limit of ≤20%.

- As per FWQAPP Section 8.3.2.1.2, MRL standards are required. Recoveries were within the reasonable control limits of 70-130%, with exceptions affecting sample data listed in the table below. Nondetected results associated with recoveries less than 10% were rejected, "R." Remaining results listed in the table below, all nondetects, were qualified as estimated, "UJ." All results were coded with a "C" qualification code.

Samples qualified for MRL recovery outliers		
Analyte	**%R**	**Qualified Samples**
Hexachlorocyclopentadiene	9%	DA1SB-059M-0201-SO, DA1SB-068M-0201-SO
4-Nitroaniline	58%	
2,4-Dinitrophenol	66%	
Benzyl alcohol	5%	
4,6-Dinitro-2-methylphenol	50%	
Indeno(1,2,3-cd)pyrene	68%	
Benzo(g,h,i)perylene	54%	

Bold indicates rejected nondetect results

- Blanks: The method blanks had no target compound detects above the control limits listed in DoD QSM Table F-4 of one-half the LOQ for target compounds or one-tenth the amount detected in any sample, and no common laboratory contaminants.

- Laboratory Control Samples: Recoveries were within the control limits listed in the DoD QSM Tables G-2 (poor performers) and G-7, or within the laboratory-established control limits when no QSM limit was prescribed.

- Surrogate Recovery: Surrogate recoveries were within the control limits listed in the DoD QSM Table G-3.

- Matrix Spike/Matrix Spike Duplicate: No MS/MSD analyses were performed on a validated sample. Method accuracy was evaluated based on LCS results.

- Internal Standards Performance: The internal standard area counts and retention times were within the DoD QSM Table F-4 control limits established by the initial calibration midpoint standard: ±30 seconds for retention times and -50% / +100% for internal standard areas.

- Compound Identification: Compound identification was verified for the samples validated at Level IV. Review of the sample chromatograms, retention times, and spectra indicated no problems with target compound identification.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the samples validated at Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J," by the laboratory. Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Some routine manual integrations were performed for the samples and calibration and QC data associated with the sample data. All manual integrations reviewed at Level IV were considered appropriate.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsate samples collected and analyzed for SVOCs. There were no detects above the DL in these samples.

    - Field Duplicate Samples: A total of 2 field duplicate samples were collected and analyzed for SVOCs. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

4.3.6 Volatile Organic Compounds (VOCs)

CT analyzed 2 primary MI soil samples, 20 primary discrete soil samples, 2 soil field duplicate samples, 1 field blank, 3 equipment rinsate samples, and 7 trip blank samples for volatile compounds by USEPA SW-846 Method 8260B. MEC^X validated 3 primary soil samples at Level IV.

- DL studies were not evaluated as part of this project.

- GC/MS Tuning: The BFB tunes met the method abundance criteria. Samples were analyzed within 12 hours of the BFB injection time.

- Calibration: Calibration criteria listed in the DoD QSM Table F-4 were met for all target compounds, with exceptions affecting sample data noted below.

- Initial calibration average RRFs were within the control limit of ≥0.05, and the %RSDs were within the control limit of ≤15%, or r values ≥0.995.

- The ICV RRFs were within the control limit of ≥0.05. Recoveries for all target analytes were within the control limits of ±20% of the true value.

- Continuing calibration RRFs were within the control limit of ≥0.05 for all target compounds, and %Ds were within the control limit of ≤20.

- As per FWQAPP Section 8.3.2.1.2, MRL standards are required. With exceptions noted in the table below, all recoveries affecting sample data were within the reasonable control limits of 70-130%. Some recoveries were above the control limit; however, these did not affect nondetected results. Nondetected results associated with recoveries less than 10% were rejected, "R," and remaining qualified results, all nondetects, were qualified as estimated, "UJ." All qualified results were coded with a "C" qualification code. Sample DA1SB-070D-0201-SO was not qualified for poor MRL recoveries, as all MS/MSD recoveries for the outliers listed in the table below were at or above 98%, indicating good method accuracy for the individual sample matrix.

Samples qualified for MRL recovery outliers		
Analyte	**MRL %Rs Begin / End**	**Qualified Samples**
2-hexanone	37% / 62%	DA1SB-059D-0201-SO
chloroethane	**5% / 4%**	
chloromethane	**0% / 0%**	
2-hexanone	38% / **3%**	DA1SB-068D-0201-SO
chloroethane	**0%** / 17%	
chloromethane	**0% / 0%**	
4-methyl-2-pentanone	--- / 69%	
acetone	--- / 67%	
m,p-xylenes	--- / 11%	

- Blanks: The method blanks had no target compound detects above the control limits listed in DoD QSM Table F-4 of one-half the LOQ for target compounds and no common laboratory contaminant detects above the LOQ.

- Laboratory Control Samples: Recoveries were within the control limits listed in DoD QSM Table G-5.

- Surrogate Recovery: Recoveries were within the control limits listed in DoD QSM Table G-3 or within laboratory-established control limits for those not listed in Table G-3.

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on sample DA1SB-070D-0201-SO. All recoveries affecting parent sample data were within the control limits listed in DoD QSM Table G-5. The RPDs for 2-butanone, 2-hexanone, and

acetone exceeded the control limit; therefore, the nondetected results for those compounds were qualified as estimated, "UJ," in the parent sample and were coded with a "Q" qualification code. All remaining RPDs were within the control limit listed in DoD QSM Table F-4 of ≤30%.

- Internal Standards Performance: The internal standard area counts and retention times were within the DoD QSM Table F-4 control limits established by the initial calibration midpoint standard: ±30 seconds for retention times and -50%/+100% for internal standard areas.

- Compound Identification: Compound identification was verified for the samples validated at Level IV. Review of the sample chromatograms, retention times, and spectra indicated no problems with target compound identification.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the samples validated at Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations were not performed for the samples validated at Level IV or the associated calibration or QC.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Trip Blanks: The laboratory analyzed seven trip blank samples. Chloromethane was detected in one trip blank but was not detected in a validated sample. The trip blanks had no other target compounds detected above the DL.

    - Field Blanks and Equipment Rinsates: One field blank and three equipment rinsate samples were associated with the ODA1 samples. The field blank and equipment rinsates all had detects at or just above the LOQ for chloroform and detects between the DL and LOQ for methylene chloride, and the field blank also had a detect below the LOQ for chloromethane. None of the field QC contaminants were detected in the validated site samples. The field blank and equipment rinsates had no other target compound detects above the DL.

    - Field Duplicates and Field Split Samples: There were 2 soil field duplicate pairs collected and analyzed for VOCs. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases

where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

4.3.7 Metals

CT analyzed 90 primary MI soil samples, 7 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for various metals by USEPA Methods 6010C and 7470A/7471A. MEC^X validated 9 primary soil samples at Level IV.

- DL studies were not evaluated as part of this project.
- Calibration: Except as noted below, calibration criteria were met.
    - Initial calibration: Linear regression r-values were within the control limit listed in the DoD QSM Tables F-7 and F-8 of ≥0.995.
    - The ICV recoveries were within the control limits listed in DoD QSM Table F-7 of 90-110%. The laboratory analyzed a pair of CCVs. The lower concentration CCV had analyte concentrations too high to be considered a low-level calibration check standard; therefore, it was assessed against the CCV control limits of 90-110%. CCV recoveries were within the control limits. The mercury ICV and CCV recoveries were within the control limits listed in DoD QSM Table F-7 of 90-110% and 80-120%, respectively.
    - The laboratory analyzed CRDL standards which ranged from nominally above the LOQ to more than 10× the LOQ. Except as noted below, the CRDL standard recoveries were within the reasonable control limits of 80-120%. Results listed in the table below were qualified as estimated, "UJ," for nondetects and, "J," for detects. In the absence of qualifications with conflicting bias, detected results associated with high recoveries were qualified as estimated with a potential high bias, "J+," and detects associated with low recoveries were qualified as estimated with a potential low bias, "J-." All qualified results were coded with a "C" qualification code.

Samples qualified for CRDL recovery outliers		
Analyte	**%R**	**Qualified Samples**
Thallium	78%	DA1SB-059M-0201-SO
Sodium	70%	DA1SB-070M-0204-SO, DA1SB-072M-0204-SO, DA1SS-050M-0201
Antimony	74%	DA1SB-074M-0202-SO
Selenium	129%	DA1SS-054M-0201-SO

The MRL required in DoD QSM Table F-7 is to be at or below the analyte LOQ. As no MRL was analyzed for beryllium, cadmium, manganese, potassium, and sodium, sample results for these analytes which were less than 10× the LOQ were qualified as estimated, "J," for detects and, "UJ," for nondetects. Results

higher than 10× the LOQ were not qualified as it was the reviewer professional opinion that at those concentrations, the CCVs were indicative of instrument performance.

- Blanks: Except as noted below, the method blanks and CCBs had no applicable detects above the control limit listed in DoD QSM Tables F-7 and F-8 of one-half the LOQ or one-tenth the amount detected in a sample.

  Results associated with negative blanks were qualified as estimated, "UJ," for nondetects. The remaining results listed in the table below were qualified as nondetected, "U," at the level of contamination. All qualified results were coded with a "B" qualification code.

Samples qualified for CCB detects		
Analyte	**Blank Detect**	**Qualified Samples**
Selenium	0.1 mg/Kg	DA1SB-055M-0001-SO, DA1SB-063M-0202-SO
Cadmium	-0.393 ug/L	DA1SB-070M-0204-SO, DA1SB-072M-0204-SO
Thallium	-3.03 ug/L	DA1SB-074M-0202-SO
Thallium	-4.91 ug/L	DA1SS-054M-0201-SO
Selenium	-2.68 ug/L	DA1SB-074M-0202-SO
Mercury	-0.08 ug/L	DA1SB-074M-0202-SO

- Interference Check Samples: ICP interference check sample A (ICSA) and AB (ICSAB) recoveries were within the control limits listed in DoD QSM Table F-8 of 80-120%. No analytes were detected in the ICSA above the control limit listed in DoD QSM Table F-8 of <LOD.

- Laboratory Control Samples: The recoveries were within the control limits listed in DoD QSM Tables G-18 and G-19 of 80-120%.

- Laboratory Duplicates: Laboratory duplicate analyses were performed on DA1SB-0 DA1SS-053M-0201-SO, DA1SB-070M-0201-SO, DA1SB-055M-0001-SO, and DA1SB-063M-0201-SO. Except as noted below, the laboratory duplicate RPDs were within the control limits listed in DoD QSM Table F-7 of ≤20%. The duplicate criterion was only applied when the original sample result was nominally ≥5× the LOQ. In cases where the original sample result was <5× the LOQ, the reasonable control limit of ± the LOQ was applied.

  Results listed in the table below were qualified as estimated, "J," for detects and, "UJ," for nondetects. All qualified results were coded with an "E" qualification code. As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for a laboratory duplicate RPD outlier.

Samples qualified for laboratory duplicate RPD outliers			
Parent Sample	**Analyte**	**RPD**	**Qualified Samples**
DA1SB-073M-0201-SO	Antimony	38%	DA1SB-074M-0202-SO,

Samples qualified for laboratory duplicate RPD outliers			
Parent Sample	**Analyte**	**RPD**	**Qualified Samples**
	Cadmium	28%	DA1SS-054M-0201-SO
	Copper	22%	
	Mercury	27%	
DA1SS-053M-0201-SO	Sodium	36%	DA1SB-074M-0202-SO, DA1SS-054M-0201-SO

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on DA1SB-0 DA1SS-053M-0201-SO, DA1SB-070M-0201-SO, DA1SB-055M-0001-SO, and DA1SB-063M-0201-SO. Except as noted below, recoveries were within the control limits listed in DoD QSM Table G-19 of 80-120%. Matrix spike control limits were not applied when the native sample concentration exceeded the spiked amount by a factor of four or more.

  Nondetected results listed in the table below associated with recoveries less than 30% were rejected, "R." The remaining results noted in the table below were qualified as estimated, "J," for detects and "UJ," for nondetects in the associated samples; however, nondetected results were not qualified for recoveries above the control limit. Results were qualified when one or both recoveries were outside the control limits. All qualified results were coded with a "Q" qualification code. When no other qualifications with conflicting bias were assigned to a result, detected results with low recoveries were assigned a negative bias, "J-," and detected results with high recoveries were assigned a positive bias, "J+." As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for an MS/MSD recovery outlier. Parent samples were only qualified for outliers reported in that parent sample.

Samples qualified for MS/MSD recovery outliers			
Parent Sample	**Analyte**	**%Rs**	**Qualified Samples**
DA1SB-063M-0201-SO	Aluminum	14%, ---	DA1SB-063M-0202-SO, DA1SB-059M-0201-SO
	Antimony	**21%, 19%**	
	Cadmium	72%, 68%	
	Chromium	0%, 0%	
	Calcium	---, 79%	
	Cobalt	79%, 73%	
	Copper	76%, 64%	
	Magnesium	---, 76%	
	Manganese	1%, 0%	
	Thallium	55%, 52%	
	Zinc	78%, 62%	
DA1SB-055M-0001-SO	**Antimony**	**19%, 19%**	DA1SB-055M-0001-SO, DA1SB-059M-0201-SO
	Cadmium	64%, 72%	
	Chromium	0%, 0%	
	Cobalt	76%, 76%	
	Copper	66%, 66%	
	Manganese	0%, 0%	

Samples qualified for MS/MSD recovery outliers			
Parent Sample	**Analyte**	**%Rs**	**Qualified Samples**
	Selenium	78%, 0%	
	Thallium	54%, 55%	
	Zinc	64%, 66%	
	Manganese	---, 78%	
DA1SB-070M-0201-SO	Aluminum	13%, 36%	DA1SB-068M-0201-SO, DA1SB-070M-0204-SO, DA1SB-072M-0204-SO, DA1SS-050M-0201-SO
	Antimony	19%, 23%	
	Arsenic	79%, ---	
	Cadmium	73%, 77%	
	Chromium	69%, ---	
	Cobalt	70%, 70%	
	Manganese	0%, 2%	
	Nickel	69%, ---	
	Selenium	77%, ---	
	Silver	73%, ---	
	Thallium	60%, 65%	
	Vanadium	73%, ---	
	Zinc	68%, ---	
	Potassium	78%, ---	
	Sodium	73%, 78%	
DA1SB-073M-0201-SO	Aluminum	77%, 46%	DA1SB-074M-0202-SO, DA1SS-053M-0201-SO
	Antimony	24%, 24%	
	Iron	53%, 21%	
	Magnesium	11%, ---	
	Zinc	128%, ---	
	Lead	---, 75%	
	Selenium	---, 79%	
	Thallium	---, 75%	
DA1SS-053M-0201-SO	Antimony	4%, 21%	DA1SB-074M-0202-SO, DA1SS-054M-0201-SO
	Arsenic	78%, ---	
	Cadmium	72%, ---	
	Cobalt	29%, ---	
	Lead	69%, ---	
	Nickel	64%, ---	
	Selenium	---. 79%	
	Silver	60%, 64%	
	Thallium	65%, 70%	

Bold indicates rejected nondetected results

"- -" Indicates an acceptable sample recovery.

Except as noted below, MS/MSD RPDs were within the control limit listed in DoD QSM Tables G-7 and G-8 of ≤20%. Results noted in the table below were qualified as estimated, "J," for detects and "UJ," for nondetects. All qualified results were coded with an "*III" qualification code. As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for an RPD outlier. Parent samples were only qualified for outliers reported in that parent sample.

Samples qualified for MS/MSD RPD outliers			
Parent Sample	**Analyte**	**RPD**	**Qualified Samples**
DA1SB-063M-0201-SO	Aluminum	19%	DA1SB-063M-0201-SO, DA1SB-059M-0201-SO
	Barium	30%	
	Beryllium	29%	
	Calcium	25%	
	Chromium	39%	
	Cobalt	42%	
	Copper	45%	
	Magnesium	34%	
	Manganese	20%	
	Nickel	44%	
	Vanadium	33%	
	Zinc	41%	
DA1SB-055M-0001-SO	Barium	14%	DA1SB-055M-0001-SO, DA1SB-059M-0201-SO
	Beryllium	11%	
	Calcium	11%	
	Chromium	22%	
	Cobalt	22%	
	Copper	25%	
	Lead	54%	
	Nickel	23%	
	Vanadium	18%	
	Zinc	22%	
DA1SS-053M-0201-SO	Antimony	77%	DA1SB-074M-0202-SO, DA1SS-054M-0201-SO
	Cobalt	38%	
	Lead	29%	

- Serial Dilution: Serial dilution analyses were performed on DA1SB-0 DA1SS-053M-0201-SO, DA1SB-070M-0201-SO, DA1SB-055M-0001-SO, and DA1SB-063M-0201-SO. Except as noted below, serial dilution %Ds were within the control limit listed in DoD QSM Table F-8 of ≤10%. The serial dilution control limit is only applicable when the original sample concentration is minimally ≥50× the DL for ICP analytes and ≥25× the DL for mercury.

  All detected results for the analytes noted in the table below were qualified as estimated, "J," and were coded with an "A" qualification code. When no other qualifications with conflicting bias were assigned to a result, detected results were assigned a negative bias, "J-." As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for an associated %D outlier. Parent samples were only qualified for outliers reported in that parent sample.

Samples qualified for serial dilution %D outliers			
Parent Sample	**Analyte**	**%D**	**Qualified Samples**
DA1SB-063M-0201-SO	Aluminum	19%	DA1SB-063M-0201-SO, DA1SB-059M-0201-SO
	Barium	30%	

Samples qualified for serial dilution %D outliers			
Parent Sample	**Analyte**	**%D**	**Qualified Samples**
	Beryllium	29%	
	Calcium	25%	
	Chromium	39%	
	Cobalt	42%	
	Copper	45%	
	Magnesium	34%	
	Manganese	20%	
	Nickel	44%	
	Vanadium	33%	
	Zinc	41%	
DA1SB-055M-0001-SO	Barium	14%	DA1SB-055M-0001-SO, DA1SB-059M-0201-SO
	Beryllium	11%	
	Calcium	11%	
	Chromium	22%	
	Cobalt	22%	
	Copper	25%	
	Lead	54%	
	Nickel	23%	
	Vanadium	18%	
	Zinc	22%	
DA1SB-070M-0201-SO	Arsenic	20%	DA1SB-068M-0201-SO, DA1SB-070M-0204-SO, DA1SB-072M-0204-SO, DA1SS-050M-0201-SO
	Beryllium	16%	
	Calcium	19%	
	Chromium	16%	
	Cobalt	19%	
	Copper	23%	
	Lead	22%	
	Magnesium	13%	
	Nickel	21%	
	Vanadium	13%	
	Zinc	20%	
	Mercury	24%	
DA1SS-053M-0201-SO	Aluminum	20%	DA1SB-074M-0202-SO, DA1SS-053M-0201-SO
	Barium	12%	
	Cadmium	29%	
	Chromium	17%	
	Cobalt	23%	
	Copper	23%	
	Iron	12%	
	Magnesium	23%	
	Manganese	17%	
	Nickel	22%	
	Vanadium	18%	
	Zinc	21%	
	Mercury	33%	

Samples qualified for serial dilution %D outliers			
Parent Sample	**Analyte**	**%D**	**Qualified Samples**
DA1SB-073M-0201-SO	Aluminum	12%	DA1SB-074M-0202-SO, DA1SS-053M-0201-SO
	Cadmium	36%	
	Chromium	12%	
	Cobalt	16%	
	Copper	17%	
	Iron	12%	
	Lead	12%	
	Nickel	16%	
	Zinc	12%	

- Sample Result Verification: For Level IV validation, calculations were verified and the sample results reported on the sample result summary were verified against the raw data. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

  During the raw data review, the reviewer noted negative results for cadmium and silver. In general, the absolute values of the cadmium results exceeded the sample LOQs and the absolute values of the silver results exceeded the DLs. It was the reviewer's professional opinion that all affected samples should have the results, DLs, and LOQs, as necessary, raised to the level of interference; therefore, the absolute value of the negative result was converted to soil units using the sample preparation factors. This revised result is listed in the table below. All changed results were denoted with a "$" qualification code.

Samples with negative results and raised DLs/LOQs			
Sample	Analyte	Negative result (ug/L)	Revised Result (mg/Kg)
DA1SB-055M-0001-SO	Cadmium	-5.25	0.26
	Silver	-1.60	0.08
DA1SB-063M-0202-SO	Cadmium	-4.15	0.20
	Silver	-1.94	0.10
DA1SB-068M-0201-SO	Silver	-1.81	0.10
DA1SB-070M-0204	Cadmium	-1.55	0.08
DA1SB-072M-0204-SO	Cadmium	-3.94	0.20

- Manual Integrations: No manual integrations were noted in the mercury analyses.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

  o Field Blanks and Equipment Rinsates: Three equipment rinsates and one field blank sample were collected in association with the samples in this field effort.

There were detects in these samples, but none at sufficient concentrations to qualify the soil samples.

- Field Duplicate Samples: Seven field duplicate samples were collected and analyzed for metals. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. Except as noted below, all results were within the control limits. See Appendix C for comparisons of all samples and analytes.

Table 7. ODA1 metals field duplicate outliers

Metals field duplicate outliers				
Primary Sample	**Field Duplicate**	**Analyte**	**RPD**	**W/In LOQ**
DA1SB-059M-0203-SO	DA1SB-081M-0203-SO	Aluminum	91%	N/A
		Barium	83%	N/A
		Calcium	186%	N/A
		Chromium	120%	N/A
		Cobalt	63%	N/A
		Magnesium	116%	N/A
		Manganese	70%	N/A
		Vanadium	55%	N/A
		Beryllium	N/A	No
		Thallium	N/A	No
DA1SB-068M-0201-SO	DA1SB-084M-0201-SO	Arsenic	73%	N/A
		Chromium	116%	N/A
		Lead	75%	N/A
		Potassium	62%	N/A
		Cadmium	N/A	No
		Sodium	N/A	No
DA1SS-050M-0201-SO	DA1SS-080M-0201-SO	Chromium	88%	N/A
		Antimony	N/A	No
DA1SB-065M-0202-SO	DA1SB-083M-0202-SO	Arsenic	N/A	No
DA1SB-072M-0204-SO	DA1SB-086M-0204-SO	Mercury	N/A	No

4.3.8 General Chemistry - Hexavalent Chromium and Cyanide

CT analyzed 10 primary MI soil samples, 2 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for hexavalent chromium by USEPA Method 7196A and cyanide by USEPA Method 9012A. MEC^X validated 1 hexavalent chromium sample and 1 cyanide sample at Level IV.

- DL studies were not evaluated as part of this project.
- Calibration: Calibration criteria were met.
  - Initial calibration: Initial calibration linear regression r values were within the control limit listed in the DoD QSM Tables F-9 and F-10 of ≥0.995.

- The ICV and CCV recoveries were within the control limits listed in DoD QSM Table F-9 of 90-110% for hexavalent chromium and Table F-10 of 85-115% for cyanide.

- As per FWQAPP Section 8.3.2.1.2, MRLs are required. Cyanide MRLs analyzed in association with the soil samples were recovered within the reasonable control limits of 70-130%. As the laboratory did not analyze hexavalent chromium MRLs, the hexavalent chromium result, a nondetect, was qualified as estimated, "UJ." The qualified result was coded with a "C" qualification code.

- Blanks: The method blanks and CCBs had no applicable detects above the control limit listed in the DoD QSM Table F-9 and F-10 of one-half the LOQ or one-tenth the amount detected in a sample.

- Laboratory Control Samples: There are no QSM control limits for hexavalent chromium or cyanide LCS recoveries. The hexavalent chromium recoveries were within the laboratory-established control limits of 83-115% and cyanide was within the laboratory-established control limits of 69-128%.

- Laboratory Duplicates: Laboratory duplicate analyses were performed on SCSS-057M-0001-SO for hexavalent chromium and cyanide. There were no detects in either the parent or duplicate samples.

- Matrix Spike/Matrix Spike Duplicate: Soluble and insoluble matrix spikes were performed on SCSS-057M-0001-SO for hexavalent chromium. The recoveries were 13% and 19%, respectively. As per the National Function Guidelines, because the hexavalent chromium post digestion spike was recovered within the control limits of 75-125%, the results were not rejected. Nondetected hexavalent chromium in DA1SB-059M-0201-SO was qualified as estimated, "UJ." The qualified result was coded with a "Q" qualification code.

- Sample Result Verification: For Level IV validation, calculations were verified and the sample results reported on the sample result summary were verified against the raw data. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

  Due to the age of the hexavalent chromium instrument, sample absorbances were not reported. As such, the reviewer was not able to verify the sample results from the raw data.

- Manual Integrations: Manual integrations are not applicable to these analyses.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the

field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

- Field Blanks and Equipment Rinsates: Three equipment rinsates and one field blank were collected and analyzed for cyanide in association with the ODA1 site samples. Cyanide was not detected above the DL in any of these samples. No equipment rinsate samples were analyzed for hexavalent chromium.

- Field Duplicate Samples: A total of 2 field duplicate pairs were collected and analyzed for hexavalent chromium. All other RPDs were within the control limits in FWQAPP Table 3-of ≤50%. The RPD criterion was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. See Appendix C for comparisons of all samples and analytes.

4.4 DATA USABILITY

One planned ODA1 sample was not received at the laboratory. The field completeness was, therefore, 99%.

Some data were rejected for poor MS/MSD and calibration standard recoveries. In instances where a data point had multiple results, the reviewer chose the most technically sound result to report and rejected the remaining data points. These data points rejected to choose the most technically sound data do not affect data quality or usability and are not included in the table below. Data with RLs that exceeded the established criteria and data estimated for quality control outliers or for detects between the DL and the LOQ were included in the table below for informational purposes only.

Table 8. Analytical completeness for ODA1 validated primary data

			Number of Results					
Analysis	**Samples Analyzed**	**Analytes per Sample**	**Total**	**Rejected**	**DLs Exceeding Criteria**	**Estimated for QC Outliers**	**Estimated for Detects <LOQ**	**Percent Complete**
Explosives	9	17	149	0	0	149	0	100%
PCBs	1	9	9	0	0	0	0	100%
Pesticides	1	22	22	0	0	1	0	100%
SVOCs*	2	66	130	4	2	126	2	96.9%
VOCs	3	37	111	5	0	7	0	96.4%
Metals	9	23	207	2	0	176	6	99.0%
Nitroguanidine	1	1	1	0	0	1	0	100%
Nitrocellulose	4	1	4	0	0	0	0	100%
Hexavalent chromium	1	1	1	0	1	1	0	100%
Cyanide	1	1	1	0	0	1	0	100%

Analysis	Samples Analyzed	Analytes per Sample	Number of Results: Total	Rejected	DLs Exceeding Criteria	Estimated for QC Outliers	Estimated for Detects <LOQ	Percent Complete
Totals			**635**	**11**	**3**	**462**	**2**	**98.3%**

* The reviewer chose to report nitrobenzene, 2,4-dinitrotoluene and 2,6-dinitrotoluene from either the 8330B analyses or the 8270C analyses; therefore, these compounds are not included in the analytes count.

The analytical completeness goal for the project established in the FWQAPP was 90% for each method. The completeness goal was met for all analyses.

4.5 PRIMARY AND FIELD DUPLICATE COMPARISON SUMMARY

Primary and field duplicate sample comparisons were considered to be in good agreement as only 4% of the field duplicate pair results were above the FWQAPP control limit of 50% for soils or +/- the RL for results below the LOQ.

All of the outliers were metals and most discrepancies occurred in field duplicate pairs DA1SB-059M-0201-SO/DA1SB-081M-0203-SO and DA1SB-068M-0201-SO/DA1SB-084M-0201-SO. According to documents supplied by Shaw, DA1SB-059M-0201-SO was collected from 5-8 feet below ground surface and DA1SB-081M-0203-SO was collected between 8-12 feet below ground surface. Some sample heterogeneity likely between these depths and may explain some of the comparison outliers. All comparison results are presented in Appendix C.

Table 9. ODA1 primary/field duplicate sample comparison summary

Method	Number of Analytes	Primary/Field Duplicate Pairs	Total Analytes	Number of results within control limits	Number of results above control limit
Explosives*	17	7	117	117	0
PCBs	9	1	9	9	0
Pesticides	22	1	22	22	0
SVOCs*	66	1	63	63	0
VOCs*	2	37	71	71	0
Metals*	23	7	160	140	20
Nitroguanidine	1	2	2	2	0
Nitrocellulose	1	2	2	2	0
Hexavalent chromium	1	1	1	1	0
Cyanide	1	1	1	1	0

*Total analyte count affected by rejected results

4.6 SPECIFIC DATA CONCERNS

Specific concerns regarding the data are noted below:

- 2 benzo(a)pyrene DLs nominally exceeded the FWCUG by 0.01 mg/Kg)
- 1 hexavalent chromium DL exceeded the FWCUG of 1.9 mg/Kg by 0.26 mg/Kg
- Manual integrations performed for the MRL standards did not consistently adjust the baseline to account for a baseline anomaly that occurred just prior to the nitroguanidine retention time.
- Due to instrument limitations, the hexavalent chromium raw data did not list the sample absorbances; therefore, the reviewer was not able to calculate the sample results from the raw data.
- The actual temperature upon receipt was not noted by the laboratory. The temperature was noted only as being below some temperature (e.g. <4.2^{o}C).
- All explosive analyses were performed beyond the holding time.

In order to avoid repetition of the issues noted above, the following actions should be taken:

- MEC^{X} recommends the laboratory be requested to review the nitroguanidine manual integrations and determine their accuracy and set a policy for consistent baseline manual integration of MRL and low level calibration standards.
- MEC^{X} recommends the laboratory be requested to alter the hexavalent chromium instrument set up, if possible, in order to capture the raw absorbance.

5. SAND CREEK

5.1 PREVIOUS ACTIVITIES AND DATA

Sand Creek is a former open dump area containing construction and demolition type material. This debris was delivered to the site and dumped over approximately 1,200 feet of embankment located immediately adjacent to Sand Creek. There are no records indicating the quantities or materials dumped at the site and the operational dates for the landfill are unknown. Several buildings associated with the former Sand Creek Sewage Treatment Plant are located northeast of the site.

A removal action was performed by MKM in 2003 and included the removal of most of the surface debris. Shaw prepared a *Data Quality Objective Report* based on confirmation sampling performed by MKM and determined additional sampling was necessary to address data gaps.

5.2 CURRENT INVESTIGATION

Samples collected in association with the project described in this document were from soils and sediments collected from Sand Creek. The samples were collected in order to provide the additional characterization of the nature and extent of contamination at Sand Creek.

Table 10. Total sample count for Sand Creek

Matrix	Primary Samples	Field Duplicates	Split Samples	Explosives	Propellants	Pesticides	PCBs	SVOCs	VOCs	Metals	Cr^{6+}	Cyanide
Sediment	1	0	0	1	1	1	1	1	1	1	1	1
Soil	86	12	11	85	12	12	12	85	11	85	18	12

Table 11. Sand Creek validated samples and methods

Sample ID	SDG	Matrix	Collected	Explosives	Propellants	Pesticides	PCBs	SVOCs	VOCs	Metals	Cr^{6+}	Cyanide
SCSB-037M-0001-SO	81578	Soil	9/22/2010	x	--	--	--	x	--	x		--
SCSB-038M-0005-SO	81578	Soil	9/22/2010	x	--	--	--	x	--	x		--
SCSB-042M-0003-SO	81578	Soil	9/21/2010	x	--	--	--	x	--	x		--
SCSB-048D-0001-SO	81670	Soil	9/29/2010	--	--	--	--	--	x	--	--	--
SCSB-048M-0001-SO	81670	Soil	9/29/2010	x	x	x	x	x	--	x	x	--
SCSD-070M-0001-SD	81670	Sediment	9/28/2010	x	--	--	--	x	--	x	x	x
SCSS-058M-0001-SO	81670	Soil	9/23/2010	x	--	--	--	x	--	x	--	--
SCSS-068M-0001-SO	81578	Soil	9/21/2010	x	--	--	--	x	--	x	--	--
SCSS-073M-0001-SO	82400	Soil	11/9/2010	x	--	--	--	x	--	x	--	--
SCSS-076M-0001-SO	82400	Soil	11/9/2010	x	--	--	--	--	--	x	--	--

Table 12. Sand Creek field duplicate samples

Duplicate Sample ID	Parent Sample
SCSB-080D-0001-SO	SCSB-037D-0001-SO
SCSB-080M-0001-SO	SCSB-037M-0001-SO
SCSB-081D-0005-SO	SCSB-038D-0005-SO
SCSB-081M-0005-SO	SCSB-038M-0005-SO
SCSB-082M-0002-SO	SCSB-040M-0002-SO
SCSB-083M-0003-SO	SCSB-042M-0003-SO
SCSB-084D-0001-SO	SCSB-048D-0001-SO
SCSB-084M-0001-SO	SCSB-048M-0001-SO
SCSS-085M-0001-SO	SCSS-058M-0001-SO
SCSS-086D-0001-SO	SCSS-068D-0001-SO
SCSS-086M-0001-SO	SCSS-068M-0001-SO
SCSS-087M-0001-SO	SCSS-073M-0001-SO

5.2.1 Sample Collection

Except as noted below, no sample collection issues were noted.

SDG	Issue
All	The sample receipt temperatures were listed by the laboratory only as <## ^{o}C (e.g. <2.6 ^{o}C). As the samples were not received above 6.0 ^{o}C and were not noted to be frozen or damaged, no qualifications were applied.
Most	Some corrections made to the chain-of-custody by the sampler or by the laboratory were overwritten and some corrections were not initialed or dated.
81578	Sample SCSB-042M-0003-SO was listed on the chain-of-custody but was not received. The sample was apparently received in a following shipment as it was listed in the sample log-in.
81578	Sample SCSB-038M-0005-SO was listed on the chain-of-custody twice and two samples were received. As per Shaw, one sample was sent to the QA laboratory.
81578	Some collection times listed on the chain-of-custody did not match the sample containers. Shaw advised the laboratory to use the times listed on the sample containers.

5.2.2 Data Completeness

Data completeness for the project described in this report was found to be generally acceptable as no deliverables were missing from the SDGs reviewed.

5.2.3 Preservation and Holding Time Requirements

All method preservation requirements were met. Except as noted in the table below, all holding times, as listed in Table 3, were met. Results listed in the table below were qualified as estimated, “UJ,” for nondetects and estimated with a potential negative bias, “J-“ for detects. All qualified results were coded with an “H” qualification code.

Samples qualified for exceeded holding time			
Method	Analytes	Sample	Days past extraction holding time
8330B	All	SCSB-038M-0005-SO	7
		SCSB-042M-0003-SO, SCSB-037M-0001-SO	8
8330	Nitroguanidine	SCSB-048M-0001-SO	4
8330B	All	SCSB-048M-0001-SO	3
8330B	All	SCSD-070M-0001-SD	5
8330B	All	SCSS-058M-0001-SO	10
9012	Cyanide	SCSD-070M-0001-SD	8
8270C	All	SCSB-048M-0001-SO	5
8270C	All	SCSD-070M-0001-SD	6
8270C	All	SCSS-058M-0001-SO	8
8270C	All	SCSB-042M-0003-SO	10

5.2.4 Detection Limit Requirements

As per the SAP, the site specific cleanup goals (FWCUGs) for the Residential Farmer Adult, Residential Farmer Child, and National Guard Trainee, presented in the *Final Facility-Wide Human Health Remediation Goals at the RVAAP* (2010) were applicable to the ODA1 and Sand Creek sites. Due to the reporting issue noted in Section 3.5, MEC^X compared to the DL for the nondetected analytes to the most stringent FWCUG for each nondetected analyte. As per the SAP, if no FWCUG was listed, the USEPA Region 9 Residential Regional Screening Levels (RSL) was utilized.

These analytes had DLs which exceeded the FWCUG:

- 3 benzo(a)pyrene DLs nominally exceeded the FWCUG by 0.01 mg/Kg
- 2 hexavalent chromium DLs exceeded the FWCUG of 1.9 mg/Kg by 0.26 mg/Kg

No analytes had DLs which exceeded the RSLs.

The following had no FWCUG or RSL:

- 1 metal: potassium (nutrient)
- 8 pesticide compounds: alpha-chlordane, chlordane, endosulfan I, endosulfan II, endosulfan sulfate, endrin aldehyde, endrin ketone, and gamma-chlordane
- 3 VOCs: chloroethane, cis-1,3-dichloropropene, trans-1,3-dichloropropene
- 2 PCBS: Aroclor 1262, Aroclor-1268
- 2 VOCs: cis-1,3-dichloropropene, trans-1,3-dichloropropene
- 9 SVOC compounds: acenaphthylene, benzo(g,h,i)perylene, dimethyl phthalate, phenanthrene, 1,3-dichlorobenzene, 2-nitrophenol, 3-nitroaniline, 4-bromophenyl phenyl ether, 4-chlorophenyl phenyl ether

Results with DLs that exceed project criteria may be usable for their intended purposes; it is dependent on the final data user to make this determination on a case-by-case basis.

5.3 SAND CREEK DATA QUALITY EVALUATION

5.3.1 Explosives

CT analyzed 77 primary MI soil samples, 1 primary MI sediment sample, 8 soil field duplicate samples, 1 field blank, and 6 equipment rinsate samples for explosive compounds by USEPA SW-846 Method 8330B. MEC^X validated 8 soil and 1 sediment sample at Level IV.

- Detection Limit (DL) studies were not evaluated as part of this project.
- Calibration
    - Initial calibration average percent relative standard deviations (%RSDs) were within the control limits listed in DoD QSM Table F-3 of ≤20%, or the linear regression r^2 values were ≥0.990.
    - The second source initial calibration verification standard (ICV) recoveries for both the primary and confirmation calibrations were within the control limits listed in DoD QSM Table F-3 of ±20%.
    - The %D for 4-amino-2,6-dinitrotoluene in one CCV bracketing SCSB-042M-0003-SO was 18%; therefore, nondetected 4-amino-2,6-dinitrotoluene in SCSB-042M-0003-SO was qualified as estimated, "UJ." The qualified result was coded with a "C" qualification code. The remaining continuing calibration verification (CCV) standard recoveries were within the control limits listed in DoD QSM Table F-3 of ±20%.
    - As per FWQAPP Section 8.3.2.1.2, MRLs were analyzed. No control limits were listed in the FWQAPP; therefore, the reviewer utilized the reasonable control limits of 70-130%. One recovery for 2,6-dinitrotoluene was 60%; therefore, nondetected 2,6-dinitrotoluene in SCSS-076M-0001-SO was qualified as estimated, "UJ." All remaining recoveries were within the control limits.
- Blanks: The method blanks associated with the validated samples had no target compound detects above the control limits listed in DoD QSM Table F-3 of one-half the LOQ or one-tenth the amount detected in a sample.
- Laboratory Control Samples: Recoveries were within the control limits listed in DoD QSM Tables G-2 (poor performers) and G-13 for the listed compounds and within the reasonable laboratory control limits of 50-150% for nitroglycerin and PETN.
- Surrogate Recovery: As no surrogate control limit was listed in the DoD QSM, surrogate recoveries were assessed against the reasonable laboratory-established control limits of 75-127%. All recoveries were within the control limits.

- Matrix Spike/Matrix Spike Duplicate: No MS/MSD analyses were performed on a validated sample. Method accuracy was evaluated based on LCS results.

- Triplicates: No triplicate analyses were performed on a validated sample.

- Compound Identification: Compound identification was verified for those samples validated at a Level IV. Review of the sample chromatograms and retention times indicated no problems with target compound identification.

  The laboratory reported detects from the primary column. As DoD QSM Table F-3 does not designate which column results are to be reported from, the reviewer assessed both columns. For those samples validated at Level IV, no interferences were noted on the primary column; however, co-eluting peaks were noted on the confirmation column. It was the reviewer's professional opinion that the results should stand as reported by the laboratory.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for those samples validated at a Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

  In some instances, nitrobenzene, 2,4-dinitrotoluene and 2,6-dinitrotoluene were reported by both Methods 8330B and 8270C and both methods were validated at Level IV. As there were no detects for these compounds in the 8330B analyses and the 8270C LOQs were lower, the results for these compounds were rejected, "R," in the 8330B analyses in favor of the 8270C results, for the samples validated at Level IV. All rejected analytes were coded with a "D" qualification code.

- Target compound confirmation was performed for detects in the validated samples. The intercolumn RPD for 2,4,6-trinitrotoluene in SCSS-058M-0001-SO was 73%; therefore, the result was qualified as estimated, "J," and coded with an "*III" qualification code. All remaining RPDs were within the criteria listed in DoD QSM Table F-3 of ≤40%.

- System Performance: Review of the raw data indicated no problems with system performance.

- Some manual integrations were performed for initial calibration standards, CCVs and sample data reviewed at Level IV. All manual integrations were performed in order to report incompletely resolved peaks and were deemed acceptable by the reviewer.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

- Field Blanks and Equipment Rinsates: There were 6 equipment rinsate samples and 1 field blank associated with the Sand Creek site samples. 2,4-Dinitrotoluene was detected in one of the equipment rinsates but was not detected in any of the site samples. There were no other detects above the DL in these samples.

- Field Duplicates: A total of 8 soil field duplicates were collected and analyzed for explosive compounds. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

5.3.2 Propellants

CT analyzed 8 primary MI soil samples, 1 primary MI sediment sample, 4 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for nitroguanidine by USEPA SW-846 Method 8330 and nitrocellulose as nitrate/nitrite by modified SW-846 Method 9056. MEC^X validated 1 soil sample at Level IV.

- DL studies were not evaluated as part of this project.

- Calibration

  - Nitroguanidine initial calibration average percent relative standard deviations (%RSDs) were within the control limits listed in DoD QSM Table F-2 of ≤20%, or the linear regression r^2 values were ≥0.990. Nitrocellulose linear regression r values were within the control limit listed in the DoD QSM Table F-11 of ≥0.995.

  - The nitroguanidine second source ICV for both the primary and confirmation calibrations were within the control limits listed in DoD QSM Table F-2 of 85-115%. The nitrocellulose ICV recoveries were within the control limits listed in DoD QSM Table F-11 of 90-110%.

  - The nitroguanidine CCV standard %Ds were within the control limits listed in DoD QSM Table F-2 of ≤15%. The nitrocellulose CCV recoveries were within the control limits listed in DoD QSM Table F-11 of 90-110%.

  - As per FWQAPP Section 8.3.2.1.2, MRL standards are required and were analyzed. All recoveries were within the reasonable control limits of 70-130%.

- Blanks: The method blanks associated with the validated samples had no target compound detects above the control limits listed in DoD QSM Tables F-2 and F-11 of one-half the LOQ or one-tenth the amount detected in a sample.

- Laboratory Control Samples: No nitroguanidine LCS control limits are listed in the DoD QSM. All nitroguanidine recoveries were within the laboratory-established control limits of

50-150%. The nitrocellulose recoveries were within the control limits listed in DoD QSM Table F-11 of 80-120%.

- Surrogate Recovery: A surrogate was not used for the analyses of nitrocellulose. Surrogate control limits for 1,2-dinitrobenzene are not listed in the DoD QSM; therefore, the nitroguanidine surrogate recoveries were assessed against the laboratory control limits of 75-127%. The recoveries were within the control limits.

- Triplicates: No triplicate analyses were performed on a validated sample in these SDGs.

- Matrix Spike/Matrix Spike Duplicate: No matrix spikes were performed on a validated sample. Method accuracy was evaluated based on LCS results.

- Compound Identification: Compound identification was verified for those samples validated at a Level IV. Review of the sample chromatograms and retention times indicated no problems with target compound identification. As there were no primary column detects, no confirmation column analyses were performed.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for those samples validated at a Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Some manual integrations were performed for the nitroguanidine MRLs. Manual integrations performed for the MRL standards did not consistently adjust the baseline to account for a baseline anomaly that occurred just prior to the nitroguanidine retention time. As the inconsistent baseline may have affected the MRL recoveries, it was the reviewer's professional opinion that nondetected nitroguanidine in SCSB-048M-0001-SO should be qualified as estimated, "UJ." The qualified results were coded with an "*III" qualification code. The low level calibration standard was also manually integrated to correct the baseline which was affected by a significant amount of noise.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsate samples and 1 field blank associated with the Sand Creek site samples. There were no detects above the DL in any of these samples.

- Field Duplicates: A single field duplicate pair was collected and analyzed for nitroguanidine and nitrocellulose. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

5.3.3 Polychlorinated Biphenyls (PCBS)

CT analyzed 8 primary MI soil samples, 1 primary MI sediment sample, 4 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for PCBs by USEPA SW-846 Method 8082. MEC^X validated 1 soil sample at Level IV.

- DL studies were not evaluated as part of this project.
- Calibration: Calibration criteria listed in the DoD QSM Table F-2 were met.
  - Initial calibration average %RSDs were within the control limits of ≤20% or r^2 values ≥0.990.
  - The second source ICV was within the control limit of ±20% of the true value for all applicable Aroclors.
  - The CCV standard %Ds were within the control limits of ±20%.
  - As per FWQAPP Section 8.3.2.1.2, MRL standards are required. Some recoveries were above the control limit; however, these did not affect nondetected results. All average MRL recoveries affecting sample data were within the reasonable control limits of 70-130%.
- Blanks: The method blanks had no target compound detects above the control limits listed in the DoD QSM Table F-2, of one-half the LOQ for target compounds or one-tenth the amount detected in a sample.
- Laboratory Control Samples: LCS recoveries were within the control limits listed in DoD QSM Table G-17 for soils, of 40-140% and 60-130% for Aroclors 1016 and 1260, respectively.
- Surrogate Recovery: Recoveries were within the control limits listed in DoD QSM Table G-3 of 60-125% for soils.
- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were not performed on the validated soil sample from this SDG. Evaluation of method accuracy was based on the LCS results.
- Compound Identification: Compound identification was verified for the sample validated at Level IV. Review of the sample chromatograms, standards, and retention times

indicated no problems with target compound identification. The sample was analyzed on two analytical columns for target compound confirmation; however, the sample had no Aroclors detected on the primary column.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the sample validated at a Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations were not performed for the sample or calibration and QC data associated with the sample data.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsate samples and 1 field blank associated with the Sand Creek site samples. There were no Aroclor detects above the DL in these samples.

    - Field Duplicates: There was 1 soil field duplicate pair collected and analyzed for PCBs. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

5.3.4 Pesticides

CT analyzed 8 primary MI soil samples, 1 primary MI sediment sample, 4 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for pesticides by USEPA SW-846 Method 8081. MEC^X validated 1 soil sample at Level IV.

- DL studies were not evaluated as part of this project.

- Calibration: Calibration criteria listed in the DoD QSM Table F-2 were met.

    - Initial calibration %RSDs were within the control limit of ≤20%, or r^2 values ≥0.990.

    - The ICV recoveries for all target analytes were within the control limit of ±20% of the true value.

- The DDT/Endrin breakdown standards were within the control limit listed in the DoD QSM Table F-2 of ≤15%.

- All bracketing CCV %Ds were within the control limit of ≤20%.

- As per FWQAPP Section 8.3.2.1.2, MRL standards are required. All MRL recoveries affecting sample data were within the reasonable control limits of 70-130%, with the exception of recoveries in both the beginning and ending MRLs for endrin on the secondary column of 60.0% and 59.5%, respectively. The nondetected result for endrin in sample SCSB-048M-0001-SO was qualified as estimated, "J," and qualified with a "C" qualification code.

- Blanks: The method blanks had no target compound detects above the control limits listed in the DoD QSM Table F-2, of one-half the LOQ or one-tenth the amount detected in a site sample.

- Laboratory Control Samples: Recoveries were within the control limits listed in the DoD QSM Table G-15.

- Surrogate Recovery: Recoveries were within the control limits listed in the DoD QSM Table G-3.

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were not performed on the validated soil sample from this SDG. Evaluation of method accuracy was based on the LCS results.

- Compound Identification: Compound identification was verified for the sample validated at Level IV. Review of the sample chromatograms and retention times indicated no problems with target compound identification.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the validated sample. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

  The sample was analyzed on two analytical columns for target compound confirmation. Intercolumn RPDs for sample detects were ≤40%.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations were not performed for the sample validated at Level IV or calibration and QC data associated with the sample data.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    - Field Blanks and Equipment Rinsates: There were 3 equipment rinsate samples and 1 field blank associated with the Sand Creek site samples. The field blank had no detects above the DL. One equipment rinsate had a detect between the DL and LOQ for methoxychlor; however, methoxychlor was not detected in the associated sample. There were no other target compound detects above the DL. .

    - Field Duplicates: There was 1 soil field duplicate pair collected and analyzed for PCBs. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

5.3.5 Semivolatile Organic Compounds (SVOCs)

CT analyzed 77 primary MI soil samples, 1 primary MI sediment sample, 8 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for SVOCs by USEPA Method 8270C. MEC^X validated 7 soil samples and 1 sediment sample at Level IV.

- DL studies were not evaluated as part of this project.

- GC/MS Tuning: The DFTPP tunes met the method abundance criteria. The samples were analyzed within 12 hours of the DFTPP injection time.

- Calibration: Calibration criteria listed in the DoD QSM Table F-4 were met for all target compounds of interest, with exceptions affecting sample data listed below.

    - Initial calibration average RRFs and ICV and CCV RRFs were within method control limits of ≥0.050 for system performance check compounds (SPCCs). All initial calibration %RSDs were within the method control limits listed in the DoD QSM Table F-4 of ≤30% for calibration check compounds (CCCs) and ≤15% for remaining compounds, or r^2 values ≥0.990.

    - All second source ICV standard recoveries were within the control limit of ±20%.

    - Except as noted below, the continuing calibration %Ds affecting sample data were ≤20%. Results listed in the table below, all nondetects, were qualified as estimated, "UJ." All qualified results were coded with a "C" qualification code.

Samples qualified for CCV %D outliers		
Analyte	**%D**	**Qualified Samples**
3,3'-Dichlorobenzidine	25.8%	SCSB-042M-0003-SO

Samples qualified for CCV %D outliers		
Analyte	**%D**	**Qualified Samples**
3,3'-Dichlorobenzidine	25.8%	SCSB-037M-0001-SO, SCSB-038M-0001-SO

o As per FWQAPP Section 8.3.2.1.2, MRL standards are required. Recoveries were within the reasonable control limits of 70-130%, with exceptions noted below. Nondetected results associated with recoveries less than 10% were rejected, "R." The remaining results listed in the table below were qualified as estimated, "UJ," for nondetects, and "J," for detects. In the absence of qualifications with conflicting bias, detected results were estimated with a potential negative bias, "J-," or a potential positive bias, "J+." All qualified results were coded with a "C" qualification code.

Samples qualified for MRL recovery outliers		
Analyte	**%R**	**Qualified Samples**
4-Nitrophenol	62%	SCSS-073M-0001-SO
Benzyl alcohol	59%	SCSB-048M-0001-SO, SCSD-070M-0001-SD
3-Nitroaniline	68%	
2,4-Dinitrophenol	**0%**	
4-Nitrophenol	58%	
2-Nitrophenol	59%	
Hexachlorocyclopentadiene	**0%**	
2,4,5-Trichlorophenol	39%	
4,6-Dinitro-2-methylphenol	**0%**	
Benzo(k)fluoranthene	141%	
Indeno(1,2,3-cd)pyrene	36%	
Dibenzo(a,h)anthracene	39%	
Benzo(g,h,i)perylene	28%	
Benzyl alcohol	**5%**	SCSS-058M-0001-SO
Hexachlorocyclopentadiene	**9%**	
2,4-Dinitrophenol	66%	
4,6-Dinitro-2-methylphenol	50%	
Indeno(1,2,3-cd)pyrene	68%	
Benzo(g,h,i)perylene	54%	
4-Nitroaniline	58%	
Hexachlorocyclopentadiene	45%	SCSS-068M-0001-SO
3-Nitroaniline	42%	
Benzyl alcohol	58%	SCSB-037M-0001-SO, SCSB-038M-0001-SO
Hexachlorocyclopentadiene	11%	
2,4-Dinitrophenol	66%	
Benzyl alcohol	49%	SCSB-042M-0003-SO
4-Nitroaniline	58%	

Bold indicates rejected nondetect result

- Blanks: The method blanks had no target compound detects above the control limits listed in DoD QSM Table F-4 of one-half the LOQ for target compounds or one-tenth the amount detected in any sample, and no common laboratory contaminants.

- Laboratory Control Samples: Recoveries were within the control limits listed in the DoD QSM Tables G-2 (poor performers) and G-7, or within the laboratory-established control limits when no QSM limit was prescribed.

- Surrogate Recovery: Surrogate recoveries were within the control limits listed in the DoD QSM Table G-3.

- Matrix Spike/Matrix Spike Duplicate: No MS/MSD analyses were performed on a validated sample. Method accuracy was evaluated based on LCS results.

- Internal Standards Performance: Perylene-d12 was recovered at 38% in the analysis of SCSB-048M-0001-SO; therefore, the associated target compounds benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene were qualified as estimated, "J," for detects and, "UJ," for nondetects. The qualified results were coded with an "I" qualification code. All remaining internal standard area counts and all retention times were within the DoD QSM Table F-4 control limits established by the initial calibration midpoint standard: ±30 seconds for retention times and -50% / +100% for internal standard areas.

- Compound Identification: Compound identification was verified for the samples validated at Level IV. Review of the sample chromatograms, retention times, and spectra indicated no problems with target compound identification.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the samples validated at Level IV. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J," by the laboratory. Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Some routine manual integrations were performed for the samples and calibration and QC data associated with the sample data. All manual integrations reviewed at Level IV were considered appropriate.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

- Field Blanks and Equipment Rinsates: A total of 6 equipment rinsate samples and 1 field blank were collected and analyzed for SVOCs. Benzyl alcohol was detected several of these samples but was not detected in the associated validated samples. Bis(2-ethylhexyl)phthalate was detected in the equipment rinsates associated with SCSS-068M-0001-SO and SCSB-037M-0001-SO at 1.7 and 1.9 µg/L, respectively; therefore, the detects for bis(2-ethylhexyl)phthalate in these samples were qualified as nondetected, "U," at the LOD. There were no other reportable detects above the DL in the equipment rinsates.

- Field Duplicate Samples: A total of 7 field duplicate samples were collected and analyzed for SVOCs. The control limit listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. Except as noted below, all results were within the control limits. See Appendix C for comparisons of all samples and analytes.

SVOC field duplicate outliers				
Primary Sample	**Field Duplicate**	**Analyte**	**RPD**	**W/In LOQ**
SCSD-058M-0001-SO	SCSB-085M-0001-SO	Benzo(b)fluoranthene	N/A	No
		Fluoranthene	N/A	No
		Phenanthrene	N/A	No
		Pyrene	N/A	No

5.3.6 Volatile Organic Compounds (VOCs)

CT analyzed 7 primary discrete soil samples, 1 primary discrete sediment sample, 4 soil field duplicate samples, 1 field blank, 3 equipment rinsate samples, and 7 trip blank samples for volatile compounds by USEPA SW-846 Method 8260B. MEC^X validated 1 primary soil sample at Level IV.

- DL studies were not evaluated as part of this project.

- GC/MS Tuning: The BFB tunes met the method abundance criteria. Samples were analyzed within 12 hours of the BFB injection time.

- Calibration: Calibration criteria listed in the DoD QSM Table F-4 were met for all target compounds, with exceptions affecting sample data noted below.

  - Initial calibration average RRFs were within the control limit of ≥0.05, and the %RSDs were within the control limit of ≤15%, or r values ≥0.995.

  - The ICV RRFs were within the control limit of ≥0.05. Recoveries for all target analytes were within the control limits of ±20% of the true value.

  - Continuing calibration RRFs were within the control limit of ≥0.05 for all target compounds, and %Ds were within the control limit of ≤20.

- As per FWQAPP Section 8.3.2.1.2, MRL standards are required. With exceptions noted in the table below, all recoveries affecting sample data were within the reasonable control limits of 70-130%. Recoveries above the control limits did not affect nondetected results. The results listed in the table below, all nondetects, were qualified as estimated, "UJ." All qualified results were coded with a "C" qualification code.

Samples qualified for MRL recovery outliers		
Analyte	**MRL %Rs Begin / End**	**Qualified Samples**
Carbon disulfide	--- / 68%	SCSB-048D-0001-SO
Dibromochloromethane	--- / 63%	
trans-1,3-Dichloropropene	--- / 69%	

- Blanks: The method blank had no target compound detects above the control limits listed in DoD QSM Table F-4 of one-half the LOQ for target compounds and no common laboratory contaminant detects above the LOQ.

- Laboratory Control Samples: Recoveries were within the control limits listed in DoD QSM Table G-5.

- Surrogate Recovery: Recoveries were within the control limits listed in DoD QSM Table G-3 or within laboratory-established control limits for those not listed in Table G-3.

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were not performed on the validated sample in this SDG. Evaluation of method accuracy was based on the LCS results.

- Internal Standards Performance: The internal standard area counts and retention times were within the DoD QSM Table F-4 control limits established by the initial calibration midpoint standard: ±30 seconds for retention times and -50%/+100% for internal standard areas.

- Compound Identification: Compound identification was verified for the sample validated at Level IV. Review of the sample chromatogram, retention times, and spectra indicated no problems with target compound identification.

- Compound Quantification and Reported Detection Limits: Compound quantification was verified for the validated sample. The LOQs were supported by the low point of the initial calibration and the laboratory DLs. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- System Performance: Review of the raw data indicated no problems with system performance.

- Manual integrations were not performed for the samples validated at Level IV or the associated calibration or QC.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

  - Trip Blanks: The laboratory analyzed 7 trip blank samples. The trip blanks had no target compounds detected above the DL.

  - Field Blanks and Equipment Rinsates: There were 3 equipment rinsates and one field blank associated with the Sand Creek site samples. These samples had detects at or just above the LOQ for chloroform and detects between the DL and LOQ for methylene chloride and chloromethane. None of the field QC contaminants were detected in the validated site samples. The field blank and equipment rinsates had no other target compound detects above the DL.

  - Field Duplicates and Field Split Samples: There were 4 soil field duplicate pairs collected and analyzed for VOCs. The control limit listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. Except as noted below, all results were within the control limits. See Appendix C for comparisons of all samples and analytes.

VOC field duplicate outliers				
Primary Sample	**Field Duplicate**	**Analyte**	**RPD**	**W/In LOQ**
SCSD-048D-0001-SO	SCSB-084D-0001-SO	Benzene	N/A	No
		Ethylbenzene	N/A	No
		m,p-Xylenes	N/A	No
		o-Xylene	N/A	No
		Toluene	N/A	No

5.3.7 Metals

CT analyzed 77 primary MI soil samples, 1 primary MI sediment sample, 8 soil field duplicate samples, 1 field blank, and 3 equipment rinsate samples for various metals by USEPA Methods 6010C and 7470A/7471A. MEC^X validated 8 soils and 1 sediment sample at Level IV.

- DL studies were not evaluated as part of this project.

- Calibration: Except as noted below, calibration criteria were met.

  - Initial calibration: Linear regression r-values were within the control limit listed in the DoD QSM Tables F-7 and F-8 of ≥0.995.

  - The ICV recoveries were within the control limits listed in DoD QSM Table F-7 of 90-110%. The laboratory analyzed a pair of CCVs. The lower concentration CCV

had analyte concentrations too high to be considered a low-level calibration check standard; therefore, it was assessed against the CCV control limits of 90-110%. Except as noted below, the CCVs were within the control limits. The mercury ICV and CCV recoveries were within the control limits listed in DoD QSM Table F-7 of 90-110% and 80-120%, respectively.

- The laboratory analyzed CRDL standards which ranged from nominally above the LOQ to almost 10× the LOQ. Except as noted below, the CRDL standard recoveries were within the reasonable control limits of 80-120%. Results listed in the table below were qualified as estimated, "UJ," for nondetects and, "J," for detects. All qualified results were coded with a "C" qualification code.

Samples qualified for CRDL recovery outliers		
Analyte	**%R**	**Qualified Samples**
Thallium	78%	SCSB-042M-0003-SO
Antimony	121%	SCSS-073M-0001-SO
Selenium	129%	SCSS-073M-0001-SO
Selenium	78%	SCSS-076M-0001-SO
Mercury	75%	SCSS-076M-0001-SO

The MRL required in DoD QSM Table F-7 is to be at or below analyte LOQ. As no MRL was analyzed for beryllium, cadmium, manganese, potassium, and sodium, sample results for these analytes which were less than 10× the LOQ were qualified as estimated, "J," for detects and, "UJ," for nondetects. Results higher than 10× the LOQ were not qualified as it was the reviewer professional opinion that at those concentrations, the CCVs were indicative of instrument performance.

- Blanks: Except as noted below, the method blanks and CCBs had no applicable detects above the control limit listed in DoD QSM Tables F-7 and F-8 of one-half the LOQ or one-tenth the amount detected in a sample.

  Results associated with negative blanks were qualified as estimated, "UJ," for nondetects and, "J," for detects. In the absence of qualifications with conflicting bias, detects were qualified as estimated with a potential negative bias, "J-." The remaining results listed in the table below were qualified as nondetected, "U," at the LOD if detected below the LOD or at the level of contamination if detected above. All qualified results were coded with a "B" qualification code.

Samples qualified for CCB detects			
Analyte	**Blank Detect**	**LOD**	**Qualified Samples**
Thallium	-4.91 µg/L	0.082 µg/L	SCSS-073M-0001-SO
Thallium	-8.33 µg/L	0.082 µg/L	SCSS-076M-0001-SO

- Interference Check Samples: ICP and ICPMS interference check sample A (ICSA) and AB (ICSAB) recoveries were within the control limits listed in DoD QSM Table F-8 of 80-

120%. No analytes were detected in the ICSA above the control limit listed in DoD QSM Table F-8 of <LOD.

- Laboratory Control Samples: The recoveries were within the control limits listed in DoD QSM Tables G-18 and G-19 of 80-120%.

- Laboratory Duplicates: Laboratory duplicate analyses were performed on SCSB-041M-0002-SO, SCSB-039M-0002-SO, SCSB-038M-0001-SO, and SCSS-057M-0001-SO. Except as noted below, the laboratory duplicate RPDs were within the control limits listed in DoD QSM Table F-7 of ≤20%. The duplicate criterion was only applied when the original sample result was nominally ≥5× the LOQ. In cases where the original sample result was <5× the LOQ, the reasonable control limit of ± the LOQ was applied.

  Results listed in the table below were qualified as estimated, "J," for detects and, "UJ," for nondetects. All qualified results were coded with an "E" qualification code. As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for a laboratory duplicate RPD outlier.

Samples qualified for laboratory duplicate RPD outliers			
Parent Sample	**Analyte**	**RPD**	**Qualified Samples**
SCSB-038M-0001-SO	Arsenic	38%	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Copper	22%	
	Lead	28%	
	Nickel	21%	
	Thallium	22%	
	Vanadium	24%	
	Zinc	22%	
SCSB-038M-0005-SO	Arsenic	±LOQ	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Thallium	±LOQ	
SCSS-057M-0001-SO	Arsenic	32%	SCSB-048M-0001-SO, SCSD-070M-0001-SD, SCSS-058M-0001-SO
	Thallium	±LOQ	

- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on SCSB-041M-0002-SO, SCSB-039M-0002-SO, SCSB-038M-0001-SO, and SCSS-057M-0001-SO. Except as noted below, recoveries were within the control limits listed in DoD QSM Table G-19 of 80-120%. Matrix spike control limits were not applied when the native sample concentration exceeded the spiked amount by a factor of four or more.

  Nondetected cadmium results listed in the table below associated with recoveries less than 30% had post digestion spike recoveries greater than 75%; therefore, as per the National Functional Guidelines, nondetected cadmium results were qualified as estimated instead of rejected. The nondetected antimony results associated with recoveries less than 30% were rejected, "R." The remaining results noted in the table

below were qualified as estimated, "J," for detects and "UJ," for nondetects in the associated samples; however, nondetected results were not qualified for recoveries above the control limit. Results were qualified when one or both recoveries were outside the control limits. All qualified results were coded with a "Q" qualification code. When no other qualifications with conflicting bias were assigned to a result, detected results with low recoveries were assigned a negative bias, "J-," and detected results with high recoveries were assigned a positive bias, "J+." As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for an MS/MSD recovery outlier. Parent samples were only qualified for outliers reported in that parent sample.

Samples qualified for MS/MSD recovery outliers			
Parent Sample	**Analyte**	**%Rs**	**Qualified Samples**
SCSB-041M-0002-SO	**Antimony**	**24%, 23%**	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Cobalt	12%, 10%	
	Copper	69%, 63%	
	Nickel	72%, 67%	
	Vanadium	79%, 74%	
	Zinc	74%, 68%	
	Manganese	14%, 10%	
	Thallium	74%, 73%	
	Aluminum	52%, 37%	
	Potassium	76%, 76%	
	Cadmium	---, 76%	
	Lead	---, 72%	
	Magnesium	---, 75%	
	Selenium	---, 78%	
SCSB-039M-0002-SO	**Antimony**	**0%, 0%**	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Cadmium	78%, 78%	
	Cobalt	50%, 50%	
	Copper	71%, 70%	
	Selenium	71%, 70%	
	Vanadium	68%, 66%	
	Zinc	71%, 67%	
	Thallium	70%, 75%	
	Potassium	78%, ---	
	Nickel	---, 78%	
SCSB-038M-0001-SO	**Antimony**	**0%, 0%**	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Cadmium	56%, 0%	
	Chromium	0%, 0%	
	Cobalt	63%, 0%	
	Copper	46%, 0%	
	Nickel	74%, 0%	
	Selenium	71%, 4%	
	Thallium	56%, 2%	
	Vanadium	75%, ---	

Samples qualified for MS/MSD recovery outliers			
Parent Sample	**Analyte**	**%Rs**	**Qualified Samples**
	Zinc	74%, ---	
	Arsenic	---, 7%	
	Lead	---, 0%	
SCSS-057M-0001-SO	**Antimony**	**26%, 29%**	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Potassium	67%, 59%	
	Sodium	72%, 72%	
SCSB-051M-0001-SO	Aluminum	28%, 23%	SCSB-048M-0001-SO, SCSD-070M-0001-SD, SCSS-058M-0001-SO
	Antimony	24%, 18%	
	Lead	179%, ---	
	Thallium	69%, 63%	
	Cadmium	---, 69%	
	Cobalt	---, 75%	
	Copper	---, 55%	
	Nickel	---, 75%	
	Zinc	---, 55%	

"- -" Indicates an acceptable sample recovery.

Except as noted below, MS/MSD RPDs were within the control limit listed in DoD QSM Tables G-7 and G-8 of ≤20%. Results noted in the table below were qualified as estimated, "J," for detects and "UJ," for nondetects. All qualified results were coded with an "*III" qualification code. As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for an RPD outlier. Parent samples were only qualified for outliers reported in that parent sample.

Samples qualified for MS/MSD RPD outliers			
Parent Sample	**Analyte**	**RPD**	**Qualified Samples**
SCSB-038M-0001-SO	Arsenic	200%	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Cadmium	200%	
	Cobalt	199%	
	Copper	200%	
	Lead	200%	
	Nickel	200%	
	Thallium	174%	
	Zinc	200%	
SCSB-051M-0001-SO	Antimony	27%	SCSB-048M-0001-SO, SCSD-070M-0001-SD, SCSS-058M-0001-SO
	Cadmium	30%	
	Lead	57%	

- Serial Dilution: Serial dilution analyses were performed on SCSB-041M-0002-SO, SCSB-039M-0002-SO, SCSB-038M-0001-SO, and SCSS-057M-0001-SO. Except as noted below, serial dilution %Ds were within the control limit listed in DoD QSM Table F-8 of ≤10%. The serial dilution control limit is only applicable when the original sample concentration is minimally ≥50× the DL for ICP analytes and ≥25× the DL for mercury.

All detected results for the analytes noted in the table below were qualified as estimated, "J," and were coded with an "A" qualification code. When no other qualifications with conflicting bias were assigned to a result, detected results were assigned a negative bias, "J-." As per the National Functional Guidelines, all samples of the same matrix in an SDG were qualified for an associated %D outlier. Parent samples were only qualified for outliers reported in that parent sample.

Samples qualified for serial dilution %D outliers			
Parent Sample	**Analyte**	**%D**	**Qualified Samples**
SCSB-041M-0002-SO	Antimony	21%	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Arsenic	11%	
	Cobalt	20%	
	Copper	19%	
	Lead	79%	
	Magnesium	11%	
	Nickel	17%	
	Vanadium	24%	
	Zinc	21%	
	Iron	18%	
	Aluminum	13%	
SCSB-039M-0002-SO	Aluminum	11%	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Barium	11%	
	Beryllium	12%	
	Calcium	13%	
	Chromium	16%	
	Cobalt	27%	
	Copper	29%	
	Lead	73%	
	Magnesium	12%	
	Manganese	16%	
	Nickel	18%	
	Vanadium	18%	
	Zinc	28%	
SCSB-038M-0001-SO	Chromium	112%	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Cobalt	23%	
	Copper	26%	
	Lead	31%	
	Magnesium	13%	
	Nickel	25%	
	Vanadium	17%	
	Zinc	19%	
	Mercury	42%	
SCSS-057M-0001-SO	Aluminum	16%	SCSB-037M-0001-SO, SCSB-038M-0005-SO, SCSB-042M-0003-SO, SCSS-068M-0001-SO
	Barium	18%	
	Calcium	16%	
	Chromium	15%	
	Magnesium	16%	

Samples qualified for serial dilution %D outliers			
Parent Sample	**Analyte**	**%D**	**Qualified Samples**
	Manganese	15%	
	Nickel	11%	
	Zinc	17%	
SCSS-057M-0001-SO	Aluminum	16%	SCSB-048M-0001-SO, SCSD-070M-0001-SD, SCSS-058M-0001-SO
	Barium	18%	
	Calcium	16%	
	Chromium	15%	
	Magnesium	16%	
	Manganese	15%	
	Nickel	11%	
	Zinc	17%	
SCSB-051M-0001-SO	Zinc	16%	SCSB-048M-0001-SO, SCSD-070M-0001-SD, SCSS-058M-0001-SO

- Sample Result Verification: For Level IV validation, calculations were verified and the sample results reported on the sample result summary were verified against the raw data. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

- Manual Integrations: No manual integrations were noted in the mercury analyses.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

    o Field Blanks and Equipment Rinsates: There were 3 equipment rinsate samples and 1 field blank associated with the Sand Creek site samples. There were detects in these samples, but not at sufficient concentrations to qualify the soil samples.

    o Field Duplicate Samples: There were 8 field duplicate samples collected and analyzed for metals. Except as noted below, the RPDs were within the control limits in FWQAPP Table 3-1 of ≤50%. The RPD criterion was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. See Appendix C for a complete comparison of all primary and field duplicate results.

Metals field duplicate outliers				
Primary Sample	**Field Duplicate**	**Analyte**	**RPD**	**W/In LOQ**
SCSB-048M-0001-SO	SCSB-084M-0001-SO	Calcium	54%	N/A
		Chromium	100%	N/A
		Magnesium	55%	N/A
		Manganese	54%	N/A

Metals field duplicate outliers				
Primary Sample	**Field Duplicate**	**Analyte**	**RPD**	**W/In LOQ**
		Nickel	70%	N/A
		Potassium	54%	N/A
		Sodium	N/A	No
SCSB-042M-0003-SO	SCSB-083M-0003-SO	Barium	76%	N/A
		Lead	104%	N/A
		Cadmium	N/A	No
		Thallium	N/A	No
SCSB-037M-0001-SO	SCSB-080M-0001-SO	Chromium	52%	N/A
SCSS-058M-0001-SO	SCSS-085M-0001-SO	Calcium	70%	N/A
		Sodium	N/A	No
SCSS-068M-0001-SO	SCSS-086M-0001-SO	Chromium	131%	N/A
		Sodium	N/A	No
SCSB-040M-0002-SO	SCSB-082M-0002-SO	Antimony	N/A	No
		Thallium	N/A	No
SCSS-073M-0001-SO	SCSS-087M-0001-SO	Antimony	N/A	No
		Thallium	N/A	No

5.3.8 General Chemistry - Hexavalent Chromium and Cyanide

CT analyzed 14 primary MI soil samples, 1 primary sediment sample, and 4 soil field duplicate samples for hexavalent chromium by USEPA Method 7196A. CT analyzed 8 primary MI soil samples, 1 primary MI sediment samples, 4 field duplicate samples, 1 field blank, and 3 equipment rinsate samples by USEPA Method 9012A for cyanide. MEC^X validated 1 soil and 1 sediment sample for hexavalent chromium and 1 sediment sample for cyanide at Level IV.

- DL studies were not evaluated as part of this project.
- Calibration: Calibration criteria were met.
    - Initial calibration: Initial calibration linear regression r values were within the control limit listed in the DoD QSM Tables F-9 and F-10 of ≥0.995.
    - The ICV and CCV recoveries were within the control limits listed in DoD QSM Table F-9 of 90-110% for hexavalent chromium and Table F-10 of 85-115% for cyanide.
    - As per FWQAPP Section 8.3.2.1.2, MRLs are required. Cyanide MRLs analyzed in association with the soil samples were recovered within the reasonable control limits of 70-130%. As the laboratory did not analyze hexavalent chromium MRLs, the hexavalent chromium results, both nondetects, were qualified as estimated, "UJ." The qualified results were coded with a "C" qualification code.
- Blanks: The method blanks and CCBs had no applicable detects above the control limit listed in the DoD QSM Table F-9 and F-10 of one-half the LOQ or one-tenth the amount detected in a sample.

- Laboratory Control Samples: There are no QSM control limits for hexavalent chromium or cyanide LCS recoveries. The hexavalent chromium recoveries were within the laboratory-established control limits of 83-115% and cyanide was within the laboratory-established control limits of 69-128%.

- Laboratory Duplicates: Laboratory duplicate analyses were performed on SCSS-057M-0001-SO for hexavalent chromium and cyanide. There were no detects in either the parent or duplicate samples.

- Matrix Spike/Matrix Spike Duplicate: Soluble and insoluble matrix spikes were performed on SCSS-057M-0001-SO for hexavalent chromium. The recoveries were 13% and 19%, respectively. As per the National Function Guidelines, because the hexavalent chromium post digestion spike was recovered within the control limits of 75-125%, the results were not rejected. Nondetected hexavalent chromium in SCSB-048M-0001-SO and SCSD-070M-0001-SD was qualified as estimated, "UJ." The qualified results were coded with a "Q" qualification code.

- Sample Result Verification: For Level IV validation, calculations were verified and the sample results reported on the sample result summary were verified against the raw data. Any result reported between the DL and the LOQ was qualified as estimated, "J." Although all hardcopy and EDD reported nondetected results to the DL, reported nondetects are valid to the LOD.

  Due to the age of the hexavalent chromium instrument, sample absorbances are not reported. As such, the reviewer was not able to verify the sample results from the raw data.

- Manual Integrations: Manual integrations are not applicable to these analyses.

- Field QC Samples: Field QC samples were evaluated, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. Any remaining detects were used to evaluate the associated site samples. Following are findings associated with field QC samples:

  - Field Blanks and Equipment Rinsates: There were 3 equipment rinsates and 1 field blank were collected and analyzed for cyanide in association with the Sand Creek site samples. Cyanide was not detected above the DL in any of the equipment rinsate samples. No equipment rinsate samples were analyzed for hexavalent chromium.

  - Field Duplicate Samples: There was 1 field duplicate pair collected and analyzed for hexavalent chromium. The RPD criterion listed in FWQAPP Table 3-1 of ≤50% was only applied when both sample results were ≥5× the LOQ. In cases where results were <5× the LOQ, the reasonable control limit of ± the LOQ was applied. All results were within the control limits. See Appendix C for comparisons of all samples and analytes.

5.4 DATA USABILITY

As all planned Sand Creek samples were collected, the field completeness was 100%.

Some data were rejected for poor MS/MSD and calibration standard recoveries. In instances where a data point had multiple results, the reviewer chose the most technically sound result to report and rejected the remaining data points. These data points rejected to choose the most technically sound data do not affect data quality or usability and are not included in the table below. Data with RLs that exceeded the established criteria and data estimated for quality control outliers or for detects between the MDL and the RL were included in the table below for informational purposes only.

Table 13. Analytical completeness for Sand Creek validated primary data

			Number of Results					
Analysis	**Samples Analyzed**	**Analytes per Sample**	**Total**	**Rejected**	**DLs Exceeding Criteria**	**Estimated for QC Outliers**	**Estimated for Detects <LOQ**	**Percent Complete**
Explosives	9	17	137	0	0	91	1	100%
PCBs	1	9	9	0	0	0	0	100%
Pesticides	1	22	22	0	0	1	2	100%
SVOCs*	8	66	520	8	3	272	89	98.5%
VOCs	1	37	37	0	0	3	0	100%
Metals	9	23	207	2	0	142	5	99.0%
Nitroguanidine	1	1	1	0	0	1	0	100%
Nitrocellulose	1	1	1	0	0	0	0	100%
Hexavalent chromium	2	1	2	0	2	2	0	100%
Cyanide	1	1	1	0	0	1	1	100%
		Totals	**937**	**10**	**5**	**513**	**98**	**98.9%**

*The reviewer chose to report nitrobenzene, 2,4-dinitrotoluene and 2,6-dinitrotoluene from either the 8330B analyses or the 8270C analyses; therefore, these compounds are not included in the analytes count.

The analytical completeness goal for the project established in the FWQAPP was 90% for each method. The completeness goal was met for all analyses.

5.5 PRIMARY AND FIELD DUPLICATE COMPARISON SUMMARY

Primary and field duplicate sample comparisons were considered to be in good agreement as only 3% of the field duplicate pair results were above the FWQAPP control limit of 50% for soils or +/- the RL for results below the RL.

Most of the outliers were metals and most discrepancies occurred in field duplicate pair SCSS-058M-0001-SO/SCSS-085M-0001-SO. In general, the parent samples had higher concentrations than the field duplicates. No sample depth information was listed in documents

provided by Shaw; therefore, no assessment of sample variability based on differing sample depths could be made. All comparison results are presented in Appendix C.

Table 14. Sand Creek primary/field duplicate sample comparison summary

Method	Number of Analytes	Primary/Field Duplicate Pairs	Total Analytes	Number of results within control limits	Number of results above control limit
Explosives*	8	17	122	122	0
PCBs	1	9	9	9	0
Pesticides	1	22	22	22	0
SVOCs*	7	66	451	447	4
VOCs	4	37	148	143	5
Metals*	8	23	182	162	20
Nitroguanidine	1	1	1	1	0
Nitrocellulose	1	1	1	1	0
Hexavalent chromium	1	1	1	1	0

*Total analyte count affected by rejected results

5.6 SPECIFIC DATA CONCERNS

Specific concerns regarding the data are noted below:

- 3 benzo(a)pyrene DLs (nominally exceeded the FWCUG by 0.01 mg/Kg)
- 2 hexavalent chromium DLs exceeded the FWCUG of 1.9 mg/Kg by 0.26 mg/Kg
- Manual integrations performed for the MRL standards did not consistently adjust the baseline to account for a baseline anomaly that occurred just prior to the nitroguanidine retention time.
- Due to instrument limitations, the hexavalent chromium raw data did not list the sample absorbances; therefore, the reviewer was not able to calculate the sample results from the raw data. Due to instrument limitations, the hexavalent chromium raw data did not list the sample absorbances; therefore, the reviewer was not able to calculate the sample results from the raw data.
- The actual temperature upon receipt was not noted by the laboratory. The temperature was noted only as being below some temperature (e.g. <4.2^{o}C).
- All explosive analyses were performed beyond the holding time.

In order to avoid repetition of the issues noted above, the following actions should be taken:

- MEC^{X} recommends the laboratory be requested to review the nitroguanidine manual integrations and determine their accuracy and set a policy for consistent baseline manual integration of MRL and low level calibration standards.

- MEC^X recommends the laboratory be requested to alter the hexavalent chromium instrument set up, if possible, in order to capture the raw absorbance.

6. DATA USABILITY

A summary of the qualifications applied to the data can be found in Appendix B as can a summary of all rejected results.

AOC-specific field and analytical completeness results can be found in Sections 4 and 5.

Some data were rejected due to matrix spike/matrix spike duplicate recovery and calibration outliers. Rejected data are not usable. Results with DLs that exceed project criteria may be usable for their intended purposes; however, it is dependent on the final data user to make this determination on a case-by-case basis. All remaining results are usable for their intended purposes as qualified by MEC^X.

7. CONCLUSIONS AND RECOMMENDATIONS

Specific concerns regarding the data are noted below:

- 3 hexavalent chromium DLs exceeded the FWCUG of 1.64 mg/Kg, at 1.9 mg/Kg
- 5 benzo(a)pyrene DLs nominally exceeded the FWCUG of 0.023 mg/Kg, at 0.022 mg/Kg
- Manual integrations performed for the MRL standards did not consistently adjust the baseline to account for a baseline anomaly that occurred just prior to the nitroguanidine retention time.
- Due to instrument limitations, the hexavalent chromium raw data did not list the sample absorbances; therefore, the reviewer was not able to calculate the sample results from the raw data. Due to instrument limitations, the hexavalent chromium raw data did not list the sample absorbances; therefore, the reviewer was not able to calculate the sample results from the raw data.
- The actual temperature upon receipt was not noted by the laboratory. The temperature was noted only as being below some temperature (e.g. <4.2^{o}C).
- All explosive analyses were performed beyond the holding time.

In order to avoid repetition of the issues noted above, the following actions should be taken:

- MEC^{X} recommends the laboratory be requested to review the nitroguanidine manual integrations and determine their accuracy and set a policy for consistent baseline manual integration of MRL and low level calibration standards.
- MEC^{X} recommends the laboratory be requested to alter the hexavalent chromium instrument set up, if possible, in order to capture the raw absorbance.
- MEC^{X} recommends the laboratory be requested to record the temperature at receipt.

8. REFERENCES

Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. United States Environmental Protection Agency Contract Laboratory Program (CLP). June 2008.

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Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio. SAIC. March 2001.

Final Sampling and analysis Plan Addendum No. 1 for Environmental Services at RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site. Shaw Environment and Infrastructure. November 2010.

Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant. SAIC. March 2001.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Revision 6. United States Environmental Protection Agency. February 2007.

APPENDIX A

Qualified Sample Result Forms

Qualification Code Reference Table

Qualifier	Organics	Inorganics
H	Holding times were exceeded.	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.	The sequence or number of standards used for the calibration was incorrect.
C	Calibration %RSD or %D was noncompliant.	Correlation coefficient was noncompliant.
R	Calibration RRF was noncompliant.	%R for calibration is not within control limits.
B	Presumed contamination as indicated by the preparation (method) blank results.	Presumed contamination as indicated by the preparation (method) or calibration blank results.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.	Laboratory Control Sample %R was not within control limits.
Q	MS/MSD recovery was poor or RPD high.	MS recovery was poor.
E	Not applicable	Duplicates showed poor agreement.
I	Internal standard performance was unsatisfactory.	ICP ICS results were unsatisfactory.
A	Not applicable	ICP Serial Dilution %D were not within control limits.
M	Tuning (BFB or DFTPP) was noncompliant.	ICPMS tuning was noncompliant
T	Presumed contamination as indicated by the trip blank results.	Not applicable
+	False positive – reported compound was not present.	False positive – reported compound was not present.
-	False negative – compound was present but not reported.	False negative – compound was present but not reported.
F	Presumed contamination as indicated by the FB or ER results.	Presumed contamination as indicated by the FB or ER results.
$	Reported result or other information was incorrect.	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.	Not applicable.
D	The analysis with this flag should not be used because another more technically sound analysis is available.	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.	Post Digestion Spike recovery was not within control limits.
*II, *III	A deficiency was found that has been described in the "Sample Management," section (*II) or the "Method Analyses" section (*III).	A deficiency was found that has been described in the "Sample Management," section (*II) or the "Method Analyses" section (*III).

Open Demolition Area 1

Validated Sample Result Forms for Area: ODA1

Sample Delivery Group: 81543

Analysis Method SW846 6010

Sample Name DA1SB-055M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 851518 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	14400	0.24	0.081	mg/kg			
Antimony	7440-36-0	0.16	0.55	0.16	mg/kg	UV	R	Q
Arsenic	7440-38-2	4.6	0.91	0.26	mg/kg			
Barium	7440-39-3	73.4	0.055	0.016	mg/kg		J	*III, A
Beryllium	7440-41-7	0.53	0.024	0.0081	mg/kg		J	*III, A
Cadmium	7440-43-9	0.26	0.26	0.26	mg/kg	UV	UJ	C, $
Calcium	7440-70-2	18700	1	0.12	mg/kg	M	J	*III, A
Chromium	7440-47-3	31.6	0.13	0.038	mg/kg		J-	Q, *III, A
Cobalt	7440-48-4	10.8	0.099	0.03	mg/kg		J-	Q, *III, A
Copper	7440-50-8	19.1	0.4	0.12	mg/kg		J-	Q, *III, A
Iron	7439-89-6	36300	2	0.61	mg/kg			
Lead	7439-92-1	21	0.28	0.081	mg/kg		J	*III, A
Magnesium	7439-95-4	6120	0.81	0.24	mg/kg			
Manganese	7439-96-5	387	0.1	0.032	mg/kg		J-	Q
Nickel	7440-02-0	26.3	0.12	0.036	mg/kg		J	*III, A
Potassium	7440-09-7	1470	36	11	mg/kg			
Selenium	7782-49-2	0.32	0.85	0.14	mg/kg	JVB	UJ	B, Q
Silver	7440-22-4	0.08	0.11	0.08	mg/kg	UV	U	$
Sodium	7440-23-5	61.2	13	4	mg/kg		J	C
Thallium	7440-28-0	2.1	0.28	0.081	mg/kg		J-	Q
Vanadium	7440-62-2	19.4	0.069	0.022	mg/kg		J	*III, A
Zinc	7440-66-6	55.2	0.24	0.081	mg/kg		J-	Q, *III, A

Sample Delivery Group: 81543

Sample Name DA1SB-059M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	12200	0.61	0.2	mg/kg	B	J-	Q, *III, A
Antimony	7440-36-0	20.5	1.4	0.41	mg/kg		J-	Q
Arsenic	7440-38-2	33	2.3	0.66	mg/kg			
Barium	7440-39-3	869	0.14	0.041	mg/kg		J	*III, A
Beryllium	7440-41-7	0.95	0.061	0.02	mg/kg		J	*III, A
Cadmium	7440-43-9	18.4	0.11	0.031	mg/kg		J-	Q
Calcium	7440-70-2	18800	2.6	0.31	mg/kg		J-	Q, *III, A
Chromium	7440-47-3	101	0.32	0.097	mg/kg		J-	Q, *III, A
Cobalt	7440-48-4	10.1	0.25	0.077	mg/kg		J-	Q, *III, A
Copper	7440-50-8	222	1	0.31	mg/kg		J-	Q, *III, A
Iron	7439-89-6	33000	5.1	1.5	mg/kg	B		
Lead	7439-92-1	416	0.71	0.2	mg/kg		J	*III, A
Magnesium	7439-95-4	3470	2	0.61	mg/kg	B	J-	Q, *III, A
Manganese	7439-96-5	1100	0.26	0.082	mg/kg		J-	Q, *III, A
Nickel	7440-02-0	40.7	0.31	0.092	mg/kg		J	*III, A
Potassium	7440-09-7	2060	37	11	mg/kg			
Selenium	7782-49-2	2.1	2.1	0.36	mg/kg	B	J-	Q
Silver	7440-22-4	115	57	17	mg/kg			
Sodium	7440-23-5	84.2	13	4.1	mg/kg		J	C
Thallium	7440-28-0	2	0.71	0.2	mg/kg		J-	C, Q
Vanadium	7440-62-2	16.5	0.17	0.056	mg/kg	B	J	*III, A
Zinc	7440-66-6	364	0.61	0.2	mg/kg		J-	Q, *III, A

Sample Name DA1SB-063M-0202-SO **AnalysisType:** INORG

Lab Sample Name: 851882 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	13300	0.24	0.081	mg/kg	B	J-	Q, *III, A
Antimony	7440-36-0	0.16	0.55	0.16	mg/kg	UV	R	Q

Sample Delivery Group: 81543

Arsenic	7440-38-2	4.5	0.91	0.26	mg/kg			
Barium	7440-39-3	56.6	0.055	0.016	mg/kg		J	*III, A
Beryllium	7440-41-7	0.43	0.024	0.0081	mg/kg		J	*III, A
Cadmium	7440-43-9	0.2	0.2	0.2	mg/kg	UV	UJ	C, Q, $
Calcium	7440-70-2	27500	1	0.12	mg/kg		J-	Q, *III, A
Chromium	7440-47-3	22.6	0.13	0.038	mg/kg		J-	Q, *III, A
Cobalt	7440-48-4	9.4	0.099	0.03	mg/kg		J-	Q, *III, A
Copper	7440-50-8	16.8	0.4	0.12	mg/kg		J-	Q, *III, A
Iron	7439-89-6	31300	2	0.61	mg/kg			
Lead	7439-92-1	5.8	0.28	0.081	mg/kg			
Magnesium	7439-95-4	7180	0.81	0.24	mg/kg	B	J-	Q, *III, A
Manganese	7439-96-5	299	0.1	0.032	mg/kg		J-	Q, *III, A
Nickel	7440-02-0	22.1	0.12	0.036	mg/kg		J	*III, A
Potassium	7440-09-7	1850	36	11	mg/kg			
Selenium	7782-49-2	0.53	0.85	0.14	mg/kg	JV	U	B
Silver	7440-22-4	0.1	0.11	0.1	mg/kg	UBV	U	$
Sodium	7440-23-5	82.7	13	4	mg/kg		J	C
Thallium	7440-28-0	2	0.28	0.081	mg/kg		J-	Q
Vanadium	7440-62-2	16.9	0.069	0.022	mg/kg	B	J	*III, A
Zinc	7440-66-6	51.1	0.24	0.081	mg/kg		J-	Q, *III, A

Analysis Method SW846 7196

Sample Name DA1SB-059M-0201-SO **AnalysisType:** MISC

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Hexavalent Chromium	18540-29-9	1.9	6.5	1.9	mg/kg	U	UJ	C, Q

Sample Delivery Group: 81543

Analysis Method SW846 7471

Sample Name DA1SB-055M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 851518 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.012	0.008	0.0024	mg/kg			

Sample Name DA1SB-059M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.012	0.0081	0.0024	mg/kg			

Sample Name DA1SB-063M-0202-SO **AnalysisType:** INORG

Lab Sample Name: 851882 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.01	0.008	0.0024	mg/kg			

Sample Delivery Group: 81543

Analysis Method SW846 8081

Sample Name DA1SB-059M-0201-SO **AnalysisType:** ORSVO

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
4,4'-DDD	72-54-8	0.31	2.5	0.31	ug/kg	U	U	
4,4'-DDE	72-55-9	0.31	4.1	0.31	ug/kg	U	U	
4,4'-DDT	50-29-3	0.51	2.5	0.51	ug/kg	U	U	
Aldrin	309-00-2	0.51	2.5	0.51	ug/kg	U	U	
alpha-BHC	319-84-6	0.61	4.1	0.61	ug/kg	U	U	
alpha-Chlordane	5103-71-9	0.31	4.1	0.31	ug/kg	U	U	
beta-BHC	319-85-7	0.61	4.1	0.61	ug/kg	U	U	
Chlordane (Technical)	57-74-9	4.1	77	4.1	ug/kg	U	U	
delta-BHC	319-86-8	0.31	2.5	0.31	ug/kg	U	U	
Dieldrin	60-57-1	0.31	2.5	0.31	ug/kg	U	U	
Endosulfan I	959-98-8	0.72	2.5	0.72	ug/kg	U	U	
Endosulfan II	33213-65-9	0.31	2.5	0.31	ug/kg	U	U	
Endosulfan sulfate	1031-07-8	0.92	4.1	0.92	ug/kg	U	U	
Endrin	72-20-8	0.41	2.5	0.41	ug/kg	U	U	
Endrin aldehyde	7421-93-4	1.1	4.1	1.1	ug/kg	UM	UJ	Q
Endrin ketone	53494-70-5	0.82	2.5	0.82	ug/kg	UM	U	
GAMMA-BHC	58-89-9	0.51	2.5	0.51	ug/kg	U	U	
gamma-Chlordane	5103-74-2	0.31	4.1	0.31	ug/kg	U	U	
Heptachlor	76-44-8	0.41	2.5	0.41	ug/kg	U	U	
Heptachlor epoxide	1024-57-3	0.51	4.1	0.51	ug/kg	U	U	
Methoxychlor	72-43-5	0.72	2.5	0.72	ug/kg	U	U	
Toxaphene	8001-35-2	5.1	51	5.1	ug/kg	U	U	

Sample Delivery Group: 81543

Analysis Method SW846 8082

Sample Name DA1SB-059M-0201-SO **AnalysisType:** ORPPB

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aroclor 1016	12674-11-2	10	51	10	ug/kg	U	U	
Aroclor 1221	11104-28-2	20	51	20	ug/kg	U	U	
Aroclor 1232	11141-16-5	28	51	28	ug/kg	U	U	
Aroclor 1242	53469-21-9	30	51	30	ug/kg	U	U	
Aroclor 1248	12672-29-6	30	51	30	ug/kg	U	U	
Aroclor 1254	11097-69-1	23	51	23	ug/kg	U	U	
Aroclor 1260	11096-82-5	12	51	12	ug/kg	U	U	
Aroclor 1262	37324-23-5	21	51	21	ug/kg	U	U	
Aroclor 1268	11100-14-4	29	51	29	ug/kg	U	U	

Sample Delivery Group: 81543

Analysis Method SW846 8260

Sample Name DA1SB-059D-0201-SO **AnalysisType:** ORVOA

Lab Sample Name: 851867 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,1,1-Trichloroethane	71-55-6	11	53	11	ug/kg	U	U	
1,1,2,2-Tetrachloroethane	79-34-5	6.4	53	6.4	ug/kg	U	U	
1,1,2-Trichloroethane	79-00-5	8.6	53	8.6	ug/kg	U	U	
1,1-Dichloroethane	75-34-3	12	53	12	ug/kg	U	U	
1,1-Dichloroethene	75-35-4	17	53	17	ug/kg	U	U	
1,2-Dibromoethane	106-93-4	11	53	11	ug/kg	U	U	
1,2-Dichloroethane	107-06-2	13	53	13	ug/kg	U	U	
1,2-Dichloropropane	78-87-5	7.5	53	7.5	ug/kg	U	U	
2-Butanone	78-93-3	110	530	110	ug/kg	U	U	
2-Hexanone	591-78-6	73	530	73	ug/kg	U	UJ	C
4-Methyl-2-pentanone	108-10-1	88	530	88	ug/kg	U	U	
Acetone	67-64-1	67	1100	67	ug/kg	U	U	
Benzene	71-43-2	5.3	53	5.3	ug/kg	U	U	
Bromochloromethane	74-97-5	8.6	53	8.6	ug/kg	U	U	
Bromodichloromethane	75-27-4	9.6	53	9.6	ug/kg	U	U	
Bromoform	75-25-2	6.4	53	6.4	ug/kg	U	U	
Bromomethane	74-83-9	32	110	32	ug/kg	U	U	
Carbon disulfide	75-15-0	16	110	16	ug/kg	U	U	
Carbon tetrachloride	56-23-5	12	53	12	ug/kg	U	U	
Chlorobenzene	108-90-7	8.6	53	8.6	ug/kg	U	U	
Chloroethane	75-00-3	20	110	20	ug/kg	U	R	C
Chloroform	67-66-3	9.6	53	9.6	ug/kg	U	U	
Chloromethane	74-87-3	27	110	27	ug/kg	U	R	C
cis-1,2-Dichloroethene	156-59-2	11	53	11	ug/kg	U	U	
cis-1,3-Dichloropropene	10061-01-5	11	53	11	ug/kg	U	U	
Dibromochloromethane	124-48-1	8.6	53	8.6	ug/kg	U	U	
Ethylbenzene	100-41-4	8.6	53	8.6	ug/kg	U	U	

Sample Delivery Group: 81543

m,p-Xylenes	1330-20-7	19	110	19	ug/kg	U	U
Methylene chloride	75-09-2	43	110	43	ug/kg	U	U
o-Xylene	95-47-6	8.6	53	8.6	ug/kg	U	U
Styrene	100-42-5	6.4	53	6.4	ug/kg	U	U
Tetrachloroethene	127-18-4	8.6	53	8.6	ug/kg	U	U
Toluene	108-88-3	7.5	53	7.5	ug/kg	U	U
trans-1,2-Dichloroethene	156-60-5	12	53	12	ug/kg	U	U
trans-1,3-Dichloropropene	10061-02-6	7.5	110	7.5	ug/kg	U	U
Trichloroethene	79-01-6	11	53	11	ug/kg	U	U
Vinyl chloride	75-01-4	15	53	15	ug/kg	U	U

Sample Delivery Group: 81543

Analysis Method SW846 8270

Sample Name DA1SB-059M-0201-SO **AnalysisType:** ORSVO

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	410	21	ug/kg	U	UJ	H
1,2-Dichlorobenzene	95-50-1	25	410	25	ug/kg	U	UJ	H
1,3-Dichlorobenzene	541-73-1	20	410	20	ug/kg	U	UJ	H
1,4-Dichlorobenzene	106-46-7	19	410	19	ug/kg	U	UJ	H
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	UJ	H
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	UJ	H
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	UJ	H
2,4-Dimethylphenol	105-67-9	100	410	100	ug/kg	U	UJ	H
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	UJ	H, C
2,4-Dinitrotoluene	121-14-2	25	410	25	ug/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	25	410	25	ug/kg	U	UJ	H
2-Chloronaphthalene	91-58-7	23	410	23	ug/kg	U	UJ	H
2-Chlorophenol	95-57-8	350	510	350	ug/kg	U	UJ	H
2-Methyl-4,6-dinitrophenol	534-52-1	280	1000	280	ug/kg	U	UJ	H, C
2-Methylnaphthalene	91-57-6	26	410	26	ug/kg	U	UJ	H
2-Methylphenol	95-48-7	430	1000	430	ug/kg	U	UJ	H
2-Nitroaniline	88-74-4	23	410	23	ug/kg	U	UJ	H
2-Nitrophenol	88-75-5	290	510	290	ug/kg	U	UJ	H
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	UJ	H, C
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	UJ	H
4-Bromophenyl phenyl ether	101-55-3	26	410	26	ug/kg	U	UJ	H
4-Chloro-3-methylphenol	59-50-7	390	510	390	ug/kg	U	UJ	H
4-Chloroaniline	106-47-8	40	410	40	ug/kg	U	UJ	H
4-Chlorophenyl phenyl ether	7005-72-3	27	410	27	ug/kg	U	UJ	H
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	UJ	H
4-Nitroaniline	100-01-6	31	1000	31	ug/kg	U	UJ	H, C
4-Nitrophenol	100-02-7	410	1000	410	ug/kg	U	UJ	H

Sample Delivery Group: 81543

Acenaphthene	83-32-9	25	410	25	ug/kg	U	UJ	H
Acenaphthylene	208-96-8	25	410	25	ug/kg	U	UJ	H
Anthracene	120-12-7	25	410	25	ug/kg	U	UJ	H
Benzo(a)anthracene	56-55-3	26	410	26	ug/kg	U	UJ	H
Benzo(a)pyrene	50-32-8	23	410	23	ug/kg	U	UJ	H
Benzo(b)fluoranthene	205-99-2	26	410	26	ug/kg	U	UJ	H
Benzo(g,h,i)perylene	191-24-2	22	410	22	ug/kg	U	UJ	H, C
Benzo(k)fluoranthene	207-08-9	26	410	26	ug/kg	U	UJ	H
Benzoic acid	65-85-0	300	1000	300	ug/kg	U	UJ	H
Benzyl alcohol	100-51-6	85	1000	85	ug/kg	U	R	C
Bis(2-chloroethoxy)methane	111-91-1	23	410	23	ug/kg	U	UJ	H
Bis(2-chloroethyl) ether	111-44-4	26	410	26	ug/kg	U	UJ	H
Bis(2-chloroisopropyl) ether	108-60-1	31	410	31	ug/kg	U	UJ	H
Bis(2-ethylhexyl) phthalate	117-81-7	89	1000	89	ug/kg	U	UJ	H
Butylbenzyl phthalate	85-68-7	75	410	75	ug/kg	U	UJ	H
Carbazole	86-74-8	29	410	29	ug/kg	U	UJ	H
Chrysene	218-01-9	26	410	26	ug/kg	U	UJ	H
Dibenzo(a,h)anthracene	53-70-3	22	410	22	ug/kg	U	UJ	H
Dibenzofuran	132-64-9	25	410	25	ug/kg	U	UJ	H
Diethyl phthalate	84-66-2	65	410	65	ug/kg	U	UJ	H
Dimethyl phthalate	131-11-3	64	410	64	ug/kg	U	UJ	H
Di-n-butyl phthalate	84-74-2	110	410	81	ug/kg	J	J-	H
Di-n-octyl phthalate	117-84-0	60	410	60	ug/kg	U	UJ	H
Fluoranthene	206-44-0	27	410	27	ug/kg	U	UJ	H
Fluorene	86-73-7	26	410	26	ug/kg	U	UJ	H
Hexachlorobenzene	118-74-1	29	410	29	ug/kg	U	UJ	H
Hexachlorobutadiene	87-68-3	63	410	63	ug/kg	U	UJ	H
Hexachlorocyclopentadiene	77-47-4	53	410	53	ug/kg	U	R	C
Hexachloroethane	67-72-1	34	410	34	ug/kg	U	UJ	H
Indeno(1,2,3-cd)pyrene	193-39-5	23	410	23	ug/kg	U	UJ	H, C
Isophorone	78-59-1	51	410	51	ug/kg	U	UJ	H
Naphthalene	91-20-3	21	410	21	ug/kg	U	UJ	H
Nitrobenzene	98-95-3	60	410	60	ug/kg	U	UJ	H

Sample Delivery Group: 81543

N-Nitroso-di-n-propylamine	621-64-7	72	410	72	ug/kg	U	UJ	H
N-Nitrosodiphenylamine	86-30-6	51	820	51	ug/kg	U	UJ	H
Pentachlorophenol	87-86-5	250	1000	250	ug/kg	U	UJ	H
Phenanthrene	85-01-8	27	410	27	ug/kg	U	UJ	H
Phenol	108-95-2	160	510	160	ug/kg	U	UJ	H
Pyrene	129-00-0	27	410	27	ug/kg	U	UJ	H

Sample Delivery Group: 81543

Analysis Method SW846 8330B

Sample Name DA1SB-055M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 851518 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.079	0.44	0.079	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.089	0.44	0.089	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	UJ	H, Q
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	H
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.089	0.44	0.089	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.089	0.44	0.089	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H, Q
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	UJ	H
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.089	0.44	0.089	mg/kg	U	UJ	H

Sample Name DA1SB-059M-0201-SO **AnalysisType:** OREXP

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H

Sample Delivery Group: 81543

2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
Nitroguanidine	556-88-7	0.06	0.16	0.06	mg/kg	U	UJ	H, *III
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Name DA1SB-063M-0202-SO **AnalysisType:** OREXP

Lab Sample Name: 851882 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.079	0.44	0.079	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.089	0.44	0.089	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	H
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.089	0.44	0.089	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.089	0.44	0.089	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	UJ	H
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
Nitroguanidine	556-88-7	0.059	0.16	0.059	mg/kg	U	UJ	H, *III
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H

Sample Delivery Group: 81543

Tetryl	479-45-8	0.089	0.44	0.089	mg/kg	U	UJ	H

Analysis Method SW846 9012

Sample Name DA1SB-059M-0201-SO **AnalysisType:** MISC

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Cyanide	57-12-5	0.11	0.39	0.11	mg/kg	U	UJ	H

Analysis Method SW846 9056M

Sample Name DA1SB-059M-0201-SO **AnalysisType:** MISC

Lab Sample Name: 851528 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Nitrocellulose	9004-70-0	7	100	7	mg/kg	U	U	

Sample Name DA1SB-063M-0202-SO **AnalysisType:** MISC

Lab Sample Name: 851882 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Nitrocellulose	9004-70-0	7	100	7	mg/kg	U	U	

Sample Delivery Group: 81613

Analysis Method EPA 7471A

Sample Name DA1SB-068M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 852373 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.019	0.008	0.0024	mg/kg		J-	A

Sample Name DA1SB-070M-0204-SO **AnalysisType:** INORG

Lab Sample Name: 852383 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.01	0.008	0.0024	mg/kg		J-	A

Sample Name DA1SB-072M-0204-SO **AnalysisType:** INORG

Lab Sample Name: 852390 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.037	0.0079	0.0024	mg/kg		J-	A

Sample Name DA1SS-050M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 852568 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.037	0.008	0.0024	mg/kg		J-	A

Sample Delivery Group: 81613

Analysis Method SW846 6010

Sample Name DA1SB-068M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 852373 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	10900	0.24	0.081	mg/kg		J-	Q
Antimony	7440-36-0	0.49	0.55	0.16	mg/kg	JV	J-	Q
Arsenic	7440-38-2	5.4	0.91	0.26	mg/kg		J-	Q, A
Barium	7440-39-3	47.6	0.055	0.016	mg/kg	B		
Beryllium	7440-41-7	0.42	0.024	0.0081	mg/kg		J-	A
Cadmium	7440-43-9	0.096	0.043	0.012	mg/kg		J-	C, Q
Calcium	7440-70-2	420	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	49.1	0.13	0.038	mg/kg		J-	Q, A
Cobalt	7440-48-4	8	0.099	0.03	mg/kg		J-	Q, A
Copper	7440-50-8	21.2	0.4	0.12	mg/kg		J-	A
Iron	7439-89-6	24600	2	0.61	mg/kg			
Lead	7439-92-1	24.5	0.28	0.081	mg/kg		J-	A
Magnesium	7439-95-4	2590	0.81	0.24	mg/kg		J-	A
Manganese	7439-96-5	293	0.1	0.032	mg/kg		J-	Q
Nickel	7440-02-0	15.9	0.12	0.036	mg/kg		J-	Q, A
Potassium	7440-09-7	1000	36	11	mg/kg		J-	Q
Selenium	7782-49-2	0.23	0.85	0.14	mg/kg	JV	J-	Q
Silver	7440-22-4	0.1	0.11	0.1	mg/kg	UV	UJ	Q, $
Sodium	7440-23-5	45.3	13	4	mg/kg		J-	C, Q
Thallium	7440-28-0	1.5	0.28	0.081	mg/kg		J-	Q
Vanadium	7440-62-2	15.2	0.069	0.022	mg/kg		J-	Q, A
Zinc	7440-66-6	51.6	0.24	0.081	mg/kg		J-	Q, A

Sample Name DA1SB-070M-0204-SO **AnalysisType:** INORG

Lab Sample Name: 852383 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	12900	0.24	0.081	mg/kg		J-	Q

Sample Delivery Group: 81613

Antimony	7440-36-0	0.57	0.55	0.16	mg/kg		J-	Q
Arsenic	7440-38-2	10.2	0.91	0.26	mg/kg		J-	Q, A
Barium	7440-39-3	62.9	0.055	0.016	mg/kg	B		
Beryllium	7440-41-7	0.46	0.024	0.0081	mg/kg		J-	A
Cadmium	7440-43-9	0.08	0.08	0.08	mg/kg	UV	UJ	C, B, Q, $
Calcium	7440-70-2	30200	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	58.3	0.13	0.039	mg/kg		J-	Q, A
Cobalt	7440-48-4	9.8	0.099	0.03	mg/kg		J-	Q, A
Copper	7440-50-8	17.3	0.41	0.12	mg/kg		J-	A
Iron	7439-89-6	29000	2	0.61	mg/kg			
Lead	7439-92-1	10.9	0.28	0.081	mg/kg		J-	A
Magnesium	7439-95-4	8010	0.81	0.24	mg/kg		J-	A
Manganese	7439-96-5	311	0.1	0.032	mg/kg		J-	Q
Nickel	7440-02-0	24.1	0.12	0.037	mg/kg		J-	Q, A
Potassium	7440-09-7	1860	37	11	mg/kg		J-	Q
Selenium	7782-49-2	0.43	0.85	0.14	mg/kg	JV	J-	Q
Silver	7440-22-4	0.034	0.11	0.034	mg/kg	UV	UJ	Q
Sodium	7440-23-5	78.9	13	4.1	mg/kg		J-	C, Q
Thallium	7440-28-0	1.8	0.28	0.081	mg/kg	B	J-	Q
Vanadium	7440-62-2	18.9	0.069	0.022	mg/kg		J-	Q, A
Zinc	7440-66-6	51.2	0.24	0.081	mg/kg		J-	Q, A

Sample Name DA1SB-072M-0204-SO **AnalysisType:** INORG

Lab Sample Name: 852390 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	6790	0.24	0.08	mg/kg		J-	Q
Antimony	7440-36-0	7.6	0.54	0.16	mg/kg		J-	Q
Arsenic	7440-38-2	10.7	0.91	0.26	mg/kg		J-	Q, A
Barium	7440-39-3	40.2	0.054	0.016	mg/kg	B		
Beryllium	7440-41-7	0.24	0.024	0.008	mg/kg		J-	C, A
Cadmium	7440-43-9	0.2	0.2	0.2	mg/kg	UV	UJ	C, B, Q, $
Calcium	7440-70-2	1060	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	589	0.13	0.038	mg/kg		J-	Q, A

Sample Delivery Group: 81613

Cobalt	7440-48-4	5.9	0.099	0.03	mg/kg		J-	Q, A
Copper	7440-50-8	26.5	0.4	0.12	mg/kg		J-	A
Iron	7439-89-6	25500	2	0.6	mg/kg			
Lead	7439-92-1	13.9	0.28	0.08	mg/kg		J-	A
Magnesium	7439-95-4	1750	0.8	0.24	mg/kg		J-	A
Manganese	7439-96-5	342	0.1	0.032	mg/kg		J-	Q
Nickel	7440-02-0	16	0.12	0.036	mg/kg		J-	Q, A
Potassium	7440-09-7	1330	36	11	mg/kg		J-	Q
Selenium	7782-49-2	0.68	0.85	0.14	mg/kg	JV	J-	Q
Silver	7440-22-4	0.034	0.11	0.034	mg/kg	UV	UJ	Q
Sodium	7440-23-5	115	13	4	mg/kg		J-	C, Q
Thallium	7440-28-0	1.3	0.28	0.08	mg/kg	B	J-	Q
Vanadium	7440-62-2	13.3	0.068	0.022	mg/kg		J-	Q, A
Zinc	7440-66-6	63.9	0.24	0.08	mg/kg		J-	Q, A

Sample Name DA1SS-050M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 852568 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	10900	0.24	0.081	mg/kg		J-	Q
Antimony	7440-36-0	1.2	0.55	0.16	mg/kg		J-	Q
Arsenic	7440-38-2	9.1	0.92	0.26	mg/kg		J-	Q, A
Barium	7440-39-3	78.8	0.055	0.016	mg/kg	B		
Beryllium	7440-41-7	0.38	0.024	0.0081	mg/kg		J-	A
Cadmium	7440-43-9	2.6	0.043	0.012	mg/kg		J-	Q
Calcium	7440-70-2	2500	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	110	0.13	0.039	mg/kg		J-	Q, A
Cobalt	7440-48-4	7.6	0.1	0.031	mg/kg		J-	Q, A
Copper	7440-50-8	188	0.41	0.12	mg/kg		J-	A
Iron	7439-89-6	23700	2	0.61	mg/kg			
Lead	7439-92-1	23.4	0.28	0.081	mg/kg		J-	A
Magnesium	7439-95-4	2860	0.81	0.24	mg/kg		J-	A
Manganese	7439-96-5	407	0.1	0.033	mg/kg		J-	Q
Nickel	7440-02-0	18.4	0.12	0.037	mg/kg		J-	Q, A

Sample Delivery Group: 81613

Potassium	7440-09-7	814	37	11	mg/kg		J-	Q
Selenium	7782-49-2	0.75	0.85	0.14	mg/kg	JV	J-	Q
Silver	7440-22-4	0.035	0.11	0.035	mg/kg	UV	UJ	Q
Sodium	7440-23-5	31.8	13	4.1	mg/kg		J-	C, Q
Thallium	7440-28-0	1.6	0.28	0.081	mg/kg	B	J-	Q
Vanadium	7440-62-2	16.1	0.069	0.022	mg/kg		J-	Q, A
Zinc	7440-66-6	191	0.24	0.081	mg/kg		J-	Q, A

Sample Delivery Group: 81613

Analysis Method SW846 8260B

Sample Name DA1SB-068D-0201-SO **AnalysisType:** ORVOA

Lab Sample Name: 852287 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,1,1-Trichloroethane	71-55-6	10	52	10	ug/kg	U	U	
1,1,2,2-Tetrachloroethane	79-34-5	6.2	52	6.2	ug/kg	U	U	
1,1,2-Trichloroethane	79-00-5	8.3	52	8.3	ug/kg	U	U	
1,1-Dichloroethane	75-34-3	11	52	11	ug/kg	U	U	
1,1-Dichloroethene	75-35-4	17	52	17	ug/kg	U	U	
1,2-Dibromoethane	106-93-4	10	52	10	ug/kg	U	U	
1,2-Dichloroethane	107-06-2	12	52	12	ug/kg	U	U	
1,2-Dichloropropane	78-87-5	7.3	52	7.3	ug/kg	U	U	
2-Butanone	78-93-3	100	520	100	ug/kg	U	U	
2-Hexanone	591-78-6	70	520	70	ug/kg	U	R	C
4-Methyl-2-pentanone	108-10-1	85	520	85	ug/kg	U	UJ	C
Acetone	67-64-1	65	1000	65	ug/kg	U	UJ	C
Benzene	71-43-2	5.2	52	5.2	ug/kg	U	U	
Bromochloromethane	74-97-5	8.3	52	8.3	ug/kg	U	U	
Bromodichloromethane	75-27-4	9.3	52	9.3	ug/kg	U	U	
Bromoform	75-25-2	6.2	52	6.2	ug/kg	U	U	
Bromomethane	74-83-9	31	100	31	ug/kg	U	U	
Carbon disulfide	75-15-0	16	100	16	ug/kg	U	U	
Carbon tetrachloride	56-23-5	11	52	11	ug/kg	U	U	
Chlorobenzene	108-90-7	8.3	52	8.3	ug/kg	U	U	
Chloroethane	75-00-3	20	100	20	ug/kg	U	R	C
Chloroform	67-66-3	9.3	52	9.3	ug/kg	U	U	
Chloromethane	74-87-3	26	100	26	ug/kg	U	R	C
cis-1,2-Dichloroethene	156-59-2	10	52	10	ug/kg	U	U	
cis-1,3-Dichloropropene	10061-01-5	10	52	10	ug/kg	U	U	
Dibromochloromethane	124-48-1	8.3	52	8.3	ug/kg	U	U	
Ethylbenzene	100-41-4	8.3	52	8.3	ug/kg	U	U	

Sample Delivery Group: 81613

m,p-Xylenes	1330-20-7	19	100	19	ug/kg	U	UJ	C
Methylene chloride	75-09-2	41	100	41	ug/kg	U	U	
o-Xylene	95-47-6	8.3	52	8.3	ug/kg	U	U	
Styrene	100-42-5	6.2	52	6.2	ug/kg	U	U	
Tetrachloroethene	127-18-4	8.3	52	8.3	ug/kg	U	U	
Toluene	108-88-3	7.3	52	7.3	ug/kg	U	U	
trans-1,2-Dichloroethene	156-60-5	11	52	11	ug/kg	U	U	
trans-1,3-Dichloropropene	10061-02-6	7.3	100	7.3	ug/kg	U	U	
Trichloroethene	79-01-6	10	52	10	ug/kg	U	U	
Vinyl chloride	75-01-4	15	52	15	ug/kg	U	U	

Sample Name DA1SB-070D-0201-SO **AnalysisType:** ORVOA

Lab Sample Name: 852294 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,1,1-Trichloroethane	71-55-6	12	58	12	ug/kg	U	U	
1,1,2,2-Tetrachloroethane	79-34-5	6.9	58	6.9	ug/kg	U	U	
1,1,2-Trichloroethane	79-00-5	9.3	58	9.3	ug/kg	U	U	
1,1-Dichloroethane	75-34-3	13	58	13	ug/kg	U	U	
1,1-Dichloroethene	75-35-4	19	58	19	ug/kg	U	U	
1,2-Dibromoethane	106-93-4	12	58	12	ug/kg	U	U	
1,2-Dichloroethane	107-06-2	14	58	14	ug/kg	U	U	
1,2-Dichloropropane	78-87-5	8.1	58	8.1	ug/kg	U	U	
2-Butanone	78-93-3	120	580	120	ug/kg	U	UJ	Q
2-Hexanone	591-78-6	79	580	79	ug/kg	U	UJ	Q
4-Methyl-2-pentanone	108-10-1	95	580	95	ug/kg	U	U	
Acetone	67-64-1	73	1200	73	ug/kg	U	UJ	Q
Benzene	71-43-2	5.8	58	5.8	ug/kg	U	U	
Bromochloromethane	74-97-5	9.3	58	9.3	ug/kg	U	U	
Bromodichloromethane	75-27-4	10	58	10	ug/kg	U	U	
Bromoform	75-25-2	6.9	58	6.9	ug/kg	U	U	
Bromomethane	74-83-9	35	120	35	ug/kg	U	U	
Carbon disulfide	75-15-0	17	120	17	ug/kg	U	U	
Carbon tetrachloride	56-23-5	13	58	13	ug/kg	U	U	

Sample Delivery Group: 81613

Chlorobenzene	108-90-7	9.3	58	9.3	ug/kg	U	U
Chloroethane	75-00-3	22	120	22	ug/kg	U	U
Chloroform	67-66-3	10	58	10	ug/kg	U	U
Chloromethane	74-87-3	29	120	29	ug/kg	U	U
cis-1,2-Dichloroethene	156-59-2	12	58	12	ug/kg	U	U
cis-1,3-Dichloropropene	10061-01-5	12	58	12	ug/kg	U	U
Dibromochloromethane	124-48-1	9.3	58	9.3	ug/kg	U	U
Ethylbenzene	100-41-4	9.3	58	9.3	ug/kg	U	U
m,p-Xylenes	1330-20-7	21	120	21	ug/kg	U	U
Methylene chloride	75-09-2	46	120	46	ug/kg	U	U
o-Xylene	95-47-6	9.3	58	9.3	ug/kg	U	U
Styrene	100-42-5	6.9	58	6.9	ug/kg	U	U
Tetrachloroethene	127-18-4	9.3	58	9.3	ug/kg	U	U
Toluene	108-88-3	8.1	58	8.1	ug/kg	U	U
trans-1,2-Dichloroethene	156-60-5	13	58	13	ug/kg	U	U
trans-1,3-Dichloropropene	10061-02-6	8.1	120	8.1	ug/kg	U	U
Trichloroethene	79-01-6	12	58	12	ug/kg	U	U
Vinyl chloride	75-01-4	16	58	16	ug/kg	U	U

Sample Delivery Group: 81613

Analysis Method SW846 8270

Sample Name DA1SB-068M-0201-SO **AnalysisType:** ORSVO

Lab Sample Name: 852373 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	400	21	ug/kg	U	UJ	H
1,2-Dichlorobenzene	95-50-1	24	400	24	ug/kg	U	UJ	H
1,3-Dichlorobenzene	541-73-1	20	400	20	ug/kg	U	UJ	H
1,4-Dichlorobenzene	106-46-7	19	400	19	ug/kg	U	UJ	H
2,4,5-Trichlorophenol	95-95-4	130	500	130	ug/kg	U	UJ	H
2,4,6-Trichlorophenol	88-06-2	130	500	130	ug/kg	U	UJ	H
2,4-Dichlorophenol	120-83-2	120	500	120	ug/kg	U	UJ	H
2,4-Dimethylphenol	105-67-9	100	400	100	ug/kg	U	UJ	H
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	UJ	H, C
2,4-Dinitrotoluene	121-14-2	24	400	24	ug/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	24	400	24	ug/kg	U	UJ	H
2-Chloronaphthalene	91-58-7	23	400	23	ug/kg	U	UJ	H
2-Chlorophenol	95-57-8	340	500	340	ug/kg	U	UJ	H
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	UJ	H, C
2-Methylnaphthalene	91-57-6	25	400	25	ug/kg	U	UJ	H
2-Methylphenol	95-48-7	420	1000	420	ug/kg	U	UJ	H
2-Nitroaniline	88-74-4	23	400	23	ug/kg	U	UJ	H
2-Nitrophenol	88-75-5	280	500	280	ug/kg	U	UJ	H
3,3'-Dichlorobenzidine	91-94-1	150	500	150	ug/kg	U	UJ	H, C
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	UJ	H
4-Bromophenyl phenyl ether	101-55-3	25	400	25	ug/kg	U	UJ	H
4-Chloro-3-methylphenol	59-50-7	380	500	380	ug/kg	U	UJ	H
4-Chloroaniline	106-47-8	39	400	39	ug/kg	U	UJ	H
4-Chlorophenyl phenyl ether	7005-72-3	26	400	26	ug/kg	U	UJ	H
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	UJ	H
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	UJ	H, C
4-Nitrophenol	100-02-7	400	1000	400	ug/kg	U	UJ	H

Sample Delivery Group: 81613

Acenaphthene	83-32-9	24	400	24	ug/kg	U	UJ	H
Acenaphthylene	208-96-8	24	400	24	ug/kg	U	UJ	H
Anthracene	120-12-7	24	400	24	ug/kg	U	UJ	H
Benzo(a)anthracene	56-55-3	25	400	25	ug/kg	U	UJ	H
Benzo(a)pyrene	50-32-8	23	400	23	ug/kg	U	UJ	H
Benzo(b)fluoranthene	205-99-2	25	400	25	ug/kg	U	UJ	H
Benzo(g,h,i)perylene	191-24-2	22	400	22	ug/kg	U	UJ	H, C
Benzo(k)fluoranthene	207-08-9	25	400	25	ug/kg	U	UJ	H
Benzoic acid	65-85-0	290	990	290	ug/kg	U	UJ	H
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	R	C
Bis(2-chloroethoxy)methane	111-91-1	23	400	23	ug/kg	U	UJ	H
Bis(2-chloroethyl) ether	111-44-4	25	400	25	ug/kg	U	UJ	H
Bis(2-chloroisopropyl) ether	108-60-1	30	400	30	ug/kg	U	UJ	H
Bis(2-ethylhexyl) phthalate	117-81-7	88	1000	88	ug/kg	U	UJ	H
Butylbenzyl phthalate	85-68-7	74	400	74	ug/kg	U	UJ	H
Carbazole	86-74-8	28	400	28	ug/kg	U	UJ	H
Chrysene	218-01-9	25	400	25	ug/kg	U	UJ	H
Dibenzo(a,h)anthracene	53-70-3	22	400	22	ug/kg	U	UJ	H
Dibenzofuran	132-64-9	24	400	24	ug/kg	U	UJ	H
Diethyl phthalate	84-66-2	65	400	65	ug/kg	U	UJ	H
Dimethyl phthalate	131-11-3	64	400	64	ug/kg	U	UJ	H
Di-n-butyl phthalate	84-74-2	85	400	80	ug/kg	J	J-	H
Di-n-octyl phthalate	117-84-0	60	400	60	ug/kg	U	UJ	H
Fluoranthene	206-44-0	26	400	26	ug/kg	U	UJ	H
Fluorene	86-73-7	25	400	25	ug/kg	U	UJ	H
Hexachlorobenzene	118-74-1	28	400	28	ug/kg	U	UJ	H
Hexachlorobutadiene	87-68-3	63	400	63	ug/kg	U	UJ	H
Hexachlorocyclopentadiene	77-47-4	52	400	52	ug/kg	U	R	C
Hexachloroethane	67-72-1	33	400	33	ug/kg	U	UJ	H
Indeno(1,2,3-cd)pyrene	193-39-5	23	400	23	ug/kg	U	UJ	H, C
Isophorone	78-59-1	50	400	50	ug/kg	U	UJ	H
Naphthalene	91-20-3	21	400	21	ug/kg	U	UJ	H
Nitrobenzene	98-95-3	60	400	60	ug/kg	U	UJ	H

Sample Delivery Group: 81613

N-Nitroso-di-n-propylamine	621-64-7	71	400	71	ug/kg	U	UJ	H
N-Nitrosodiphenylamine	86-30-6	50	810	50	ug/kg	U	UJ	H
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	UJ	H
Phenanthrene	85-01-8	26	400	26	ug/kg	U	UJ	H
Phenol	108-95-2	160	500	160	ug/kg	U	UJ	H
Pyrene	129-00-0	26	400	26	ug/kg	U	UJ	H

Sample Delivery Group: 81613

Analysis Method SW846 8330B

Sample Name DA1SB-068M-0201-SO **AnalysisType:** OREXP

Lab Sample Name: 852373 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.091	0.44	0.091	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.091	0.44	0.091	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.091	0.44	0.091	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
Nitroguanidine	556-88-7	0.06	0.16	0.06	mg/kg	U	UJ	H, *III
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.091	0.44	0.091	mg/kg	U	UJ	H

Sample Name DA1SB-070M-0204-SO **AnalysisType:** OREXP

Lab Sample Name: 852383 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	H

Sample Delivery Group: 81613

2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H, L
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	UJ	H
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Name DA1SB-072M-0204-SO **AnalysisType:** OREXP

Lab Sample Name: 852390 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	H
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H, L
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	UJ	H
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Delivery Group: 81613

Sample Name DA1SS-050M-0201-SO **AnalysisType:** OREXP

Lab Sample Name: 852568 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	UJ	H, Q
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	H
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	UJ	H
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Analysis Method SW846 9056M

Sample Name DA1SB-068M-0201-SO **AnalysisType:** MISC

Lab Sample Name: 852373 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Nitrocellulose	9004-70-0	7	100	7	mg/kg	U	U	

Sample Name DA1SB-070M-0204-SO **AnalysisType:** MISC

Lab Sample Name: 852383 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Nitrocellulose	9004-70-0	7	23	7	mg/kg	U	U	

Sample Delivery Group: 82400

Analysis Method SW846 6010

Sample Name DA1SB-074M-0202-SO **AnalysisType:** INORG

Lab Sample Name: 871039 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	5440	0.24	0.081	mg/kg		J-	Q, A
Antimony	7440-36-0	2.7	1.4	0.4	mg/kg		J-	C, E, Q, *III
Arsenic	7440-38-2	6	0.91	0.26	mg/kg		J-	Q
Barium	7440-39-3	31.5	0.054	0.016	mg/kg		J-	A
Beryllium	7440-41-7	0.24	0.024	0.0081	mg/kg		J	C
Cadmium	7440-43-9	0.31	0.11	0.03	mg/kg		J-	C, E, Q, A
Calcium	7440-70-2	387	1	0.12	mg/kg			
Chromium	7440-47-3	176	0.13	0.038	mg/kg		J-	A
Cobalt	7440-48-4	6.8	0.25	0.076	mg/kg		J-	Q, *III, A
Copper	7440-50-8	12.2	1	0.3	mg/kg		J-	E, A
Iron	7439-89-6	13300	2	0.6	mg/kg		J-	Q, A
Lead	7439-92-1	7.2	0.28	0.081	mg/kg		J-	Q, *III, A
Magnesium	7439-95-4	1790	0.81	0.24	mg/kg		J-	Q, A
Manganese	7439-96-5	148	0.1	0.032	mg/kg		J-	A
Nickel	7440-02-0	16.8	0.12	0.036	mg/kg		J-	Q, A
Potassium	7440-09-7	770	36	11	mg/kg			
Selenium	7782-49-2	0.14	0.85	0.14	mg/kg	UV	UJ	B, Q
Silver	7440-22-4	0.086	0.28	0.086	mg/kg	UV	UJ	Q
Sodium	7440-23-5	59.2	13	4	mg/kg		J	C, E
Thallium	7440-28-0	0.65	0.7	0.2	mg/kg	J	J-	B, Q
Vanadium	7440-62-2	10.4	0.068	0.022	mg/kg	B	J-	A
Zinc	7440-66-6	33	0.24	0.081	mg/kg		J	Q, A

Sample Name DA1SS-054M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 871020 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code

Sample Delivery Group: 82400

Aluminum	7429-90-5	8490	0.25	0.082	mg/kg		J-	Q, A
Antimony	7440-36-0	0.92	0.55	0.16	mg/kg		J-	E, Q, *III
Arsenic	7440-38-2	8.4	0.92	0.27	mg/kg		J-	Q
Barium	7440-39-3	52.7	0.055	0.016	mg/kg	B	J-	A
Beryllium	7440-41-7	0.4	0.025	0.0082	mg/kg			
Cadmium	7440-43-9	0.52	0.043	0.012	mg/kg		J-	E, Q, A
Calcium	7440-70-2	552	1	0.12	mg/kg			
Chromium	7440-47-3	56.2	0.13	0.039	mg/kg	B	J-	A
Cobalt	7440-48-4	8.9	0.1	0.031	mg/kg		J-	Q, *III, A
Copper	7440-50-8	16.4	0.41	0.12	mg/kg		J-	E, A
Iron	7439-89-6	19400	2	0.61	mg/kg		J-	Q, A
Lead	7439-92-1	11.6	0.29	0.082	mg/kg		J-	Q, *III, A
Magnesium	7439-95-4	1940	0.82	0.25	mg/kg		J-	Q, A
Manganese	7439-96-5	398	0.1	0.033	mg/kg	B	J-	A
Nickel	7440-02-0	16.7	0.12	0.037	mg/kg		J-	Q, A
Potassium	7440-09-7	879	37	11	mg/kg			
Selenium	7782-49-2	2.4	0.86	0.14	mg/kg		J	C, Q
Silver	7440-22-4	0.035	0.11	0.035	mg/kg	UV	UJ	Q
Sodium	7440-23-5	62.1	13	4.1	mg/kg		J	C, E
Thallium	7440-28-0	0.38	0.29	0.082	mg/kg		J-	B, Q
Vanadium	7440-62-2	15.6	0.07	0.022	mg/kg		J-	A
Zinc	7440-66-6	121	0.25	0.082	mg/kg		J	Q, A

Sample Delivery Group: 82400

Analysis Method SW846 7471A

Sample Name DA1SB-074M-0202-SO **AnalysisType:** INORG

Lab Sample Name: 871039 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.01	0.008	0.0024	mg/kg		J-	B, E, A

Sample Name DA1SS-054M-0201-SO **AnalysisType:** INORG

Lab Sample Name: 871020 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.032	0.0081	0.0025	mg/kg		J-	E, A

Sample Delivery Group: 82400

Analysis Method SW846 8330B

Sample Name DA1SB-074M-0202-SO **AnalysisType:** OREXP

Lab Sample Name: 871039 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.091	0.44	0.091	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	UJ	H, C
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	H, C
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.091	0.44	0.091	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.091	0.44	0.091	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	UJ	H
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H, C
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.091	0.44	0.091	mg/kg	U	UJ	H

Sample Name DA1SS-054M-0201-SO **AnalysisType:** OREXP

Lab Sample Name: 871020 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	U	
1,3-Dinitrobenzene	99-65-0	0.081	0.44	0.081	mg/kg	U	U	
2,4,6-Trinitrotoluene	118-96-7	0.091	0.44	0.091	mg/kg	U	U	
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	U	
2,6-Dinitrotoluene	606-20-2	0.071	0.51	0.071	mg/kg	U	UJ	C
2-Amino-4,6-dinitrotoluene	35572-78-2	0.051	0.44	0.051	mg/kg	U	U	

Sample Delivery Group: 82400

2-Nitrotoluene	88-72-2	0.091	0.44	0.091	mg/kg	U	U
3,5-Dinitroaniline	618-87-1	0.091	0.44	0.091	mg/kg	U	U
3-Nitrotoluene	99-08-1	0.071	0.44	0.071	mg/kg	U	U
4-Amino-2,6-dinitrotoluene	19406-51-0	0.071	0.44	0.071	mg/kg	U	U
4-Nitrotoluene	99-99-0	0.071	0.51	0.071	mg/kg	U	U
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	U
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	U
Nitroglycerin	55-63-0	0.51	1.5	0.51	mg/kg	U	U
PETN	78-11-5	0.51	1.5	0.51	mg/kg	U	U
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	U
Tetryl	479-45-8	0.091	0.44	0.091	mg/kg	U	U

Sand Creek

Validated Sample Result Forms for Area: Sand

Sample Delivery Group: 81543

Analysis Method SW846 6010

Sample Name SCSB-037M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 851488 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	14800	0.49	0.16	mg/kg		J-	Q, A
Antimony	7440-36-0	0.93	1.1	0.32	mg/kg	JV	J-	Q, A
Arsenic	7440-38-2	182	1.8	0.53	mg/kg		J-	Q, *III, A
Barium	7440-39-3	932	0.11	0.032	mg/kg		J-	A
Beryllium	7440-41-7	3.9	0.049	0.016	mg/kg		J-	A
Cadmium	7440-43-9	1.6	0.085	0.024	mg/kg		J-	Q, *III
Calcium	7440-70-2	13900	2	0.24	mg/kg		J-	A
Chromium	7440-47-3	112	0.26	0.077	mg/kg		J-	Q, A
Cobalt	7440-48-4	9	0.2	0.061	mg/kg		J-	Q, *III, A
Copper	7440-50-8	95.7	0.81	0.24	mg/kg		J-	Q, *III, A
Iron	7439-89-6	41500	4.1	1.2	mg/kg		J-	A
Lead	7439-92-1	325	0.57	0.16	mg/kg		J-	Q, *III, A
Magnesium	7439-95-4	3050	1.6	0.49	mg/kg		J-	Q, A
Manganese	7439-96-5	743	0.2	0.065	mg/kg		J-	Q, A
Nickel	7440-02-0	35.7	0.25	0.073	mg/kg		J-	Q, *III, A
Potassium	7440-09-7	1020	37	11	mg/kg		J-	Q
Selenium	7782-49-2	3.1	1.7	0.28	mg/kg		J-	Q
Silver	7440-22-4	1.2	0.23	0.069	mg/kg			
Sodium	7440-23-5	178	13	4.1	mg/kg		J-	Q
Thallium	7440-28-0	5.5	0.57	0.16	mg/kg		J-	Q, *III, E
Vanadium	7440-62-2	41	0.14	0.045	mg/kg		J-	Q, A, E
Zinc	7440-66-6	298	0.49	0.16	mg/kg		J-	Q, *III, A

Sample Delivery Group: 81543

Sample Name SCSB-038M-0005-SO **AnalysisType:** INORG

Lab Sample Name: 851510 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	10900	0.24	0.08	mg/kg		J-	Q, A
Antimony	7440-36-0	0.63	0.54	0.16	mg/kg		J-	Q, A
Arsenic	7440-38-2	6.1	0.91	0.26	mg/kg		J-	Q, *III, A
Barium	7440-39-3	43.8	0.054	0.016	mg/kg		J-	A
Beryllium	7440-41-7	0.38	0.024	0.008	mg/kg		J-	A
Cadmium	7440-43-9	0.012	0.042	0.012	mg/kg	UV	UJ	C, Q, *III
Calcium	7440-70-2	10900	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	156	0.13	0.038	mg/kg		J-	Q, A
Cobalt	7440-48-4	9	0.099	0.03	mg/kg		J-	Q, *III, A
Copper	7440-50-8	18.6	0.4	0.12	mg/kg		J-	Q, *III, A
Iron	7439-89-6	29600	2	0.6	mg/kg		J-	A
Lead	7439-92-1	5.3	0.28	0.08	mg/kg		J-	Q, *III, A
Magnesium	7439-95-4	6840	0.8	0.24	mg/kg		J-	Q, A
Manganese	7439-96-5	369	0.1	0.032	mg/kg		J-	Q, A
Nickel	7440-02-0	20.4	0.12	0.036	mg/kg		J-	Q, *III, A
Potassium	7440-09-7	2020	36	11	mg/kg		J-	Q
Selenium	7782-49-2	0.6	0.85	0.14	mg/kg	JV	J-	Q
Silver	7440-22-4	0.034	0.11	0.034	mg/kg	UV	U	
Sodium	7440-23-5	134	13	4	mg/kg		J-	Q
Thallium	7440-28-0	1.7	0.28	0.08	mg/kg		J-	Q, *III, E, E
Vanadium	7440-62-2	14.3	0.068	0.022	mg/kg		J-	Q, A, E
Zinc	7440-66-6	48.1	0.24	0.08	mg/kg		J-	Q, *III, A

Sample Name SCSB-042M-0003-SO **AnalysisType:** INORG

Lab Sample Name: 851552 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	14000	0.61	0.2	mg/kg	B	J-	Q, A
Antimony	7440-36-0	0.4	1.4	0.4	mg/kg	UV	R	Q

Sample Delivery Group: 81543

Arsenic	7440-38-2	15.4	2.3	0.66	mg/kg		J-	Q, *III, A
Barium	7440-39-3	69.3	0.14	0.04	mg/kg		J-	A
Beryllium	7440-41-7	0.49	0.061	0.02	mg/kg		J-	C, A
Cadmium	7440-43-9	0.03	0.11	0.03	mg/kg	UV	UJ	C, Q, *III
Calcium	7440-70-2	5360	2.5	0.3	mg/kg		J-	A
Chromium	7440-47-3	19.8	0.32	0.096	mg/kg		J-	Q, A
Cobalt	7440-48-4	13	0.25	0.076	mg/kg		J-	Q, *III, A
Copper	7440-50-8	21	1	0.3	mg/kg		J-	Q, *III, A
Iron	7439-89-6	35600	5.1	1.5	mg/kg	B	J-	A
Lead	7439-92-1	11.2	0.71	0.2	mg/kg		J-	Q, *III, A
Magnesium	7439-95-4	5490	2	0.61	mg/kg	B	J-	Q, A
Manganese	7439-96-5	451	0.25	0.081	mg/kg		J-	Q, A
Nickel	7440-02-0	30.7	0.31	0.091	mg/kg		J-	Q, *III, A
Potassium	7440-09-7	1880	36	11	mg/kg		J-	Q
Selenium	7782-49-2	0.35	2.1	0.35	mg/kg	UV	UJ	Q
Silver	7440-22-4	0.086	0.28	0.086	mg/kg	UV	U	
Sodium	7440-23-5	92	13	4	mg/kg		J-	C, Q
Thallium	7440-28-0	2.1	0.71	0.2	mg/kg		J-	C, Q, *III, E
Vanadium	7440-62-2	20.5	0.17	0.056	mg/kg	B	J-	Q, A, E
Zinc	7440-66-6	67	0.61	0.2	mg/kg		J-	Q, *III, A

Sample Name SCSS-068M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 850426 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	9150	0.12	0.041	mg/kg		J-	Q, A
Antimony	7440-36-0	0.082	0.28	0.082	mg/kg	U	R	Q
Arsenic	7440-38-2	11.2	0.46	0.13	mg/kg		J-	Q, *III, A
Barium	7440-39-3	49.7	0.028	0.0082	mg/kg		J-	A
Beryllium	7440-41-7	0.41	0.024	0.0082	mg/kg		J-	A
Cadmium	7440-43-9	0.057	0.021	0.0061	mg/kg		J-	C, Q, *III
Calcium	7440-70-2	1650	0.51	0.061	mg/kg		J-	A
Chromium	7440-47-3	24.2	0.064	0.019	mg/kg		J-	Q, A

Sample Delivery Group: 81543

Cobalt	7440-48-4	7.6	0.05	0.015	mg/kg		J-	Q, *III, A
Copper	7440-50-8	11	0.2	0.061	mg/kg		J-	Q, *III, A
Iron	7439-89-6	22500	1	0.31	mg/kg		J-	A
Lead	7439-92-1	29.8	0.14	0.041	mg/kg		J-	Q, *III, A
Magnesium	7439-95-4	2320	0.41	0.12	mg/kg		J-	Q, A
Manganese	7439-96-5	395	0.051	0.016	mg/kg		J-	Q, A
Nickel	7440-02-0	20.9	0.062	0.018	mg/kg		J-	Q, *III, A
Potassium	7440-09-7	693	37	11	mg/kg		J-	Q
Selenium	7782-49-2	0.24	0.43	0.071	mg/kg	J	J-	Q
Silver	7440-22-4	0.017	0.057	0.017	mg/kg	UB	U	
Sodium	7440-23-5	20.5	13	4.1	mg/kg		J-	C, Q
Thallium	7440-28-0	0.62	0.29	0.082	mg/kg		J-	Q, *III, E
Vanadium	7440-62-2	14.8	0.035	0.011	mg/kg		J-	Q, A, E
Zinc	7440-66-6	48.2	0.12	0.041	mg/kg		J-	Q, *III, A

Sample Delivery Group: 81543

Analysis Method SW846 7471

Sample Name SCSB-037M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 851488 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.24	0.008	0.0024	mg/kg		J-	A

Sample Name SCSB-038M-0005-SO **AnalysisType:** INORG

Lab Sample Name: 851510 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.0079	0.0079	0.0024	mg/kg		J-	A

Sample Name SCSB-042M-0003-SO **AnalysisType:** INORG

Lab Sample Name: 851552 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.008	0.008	0.0024	mg/kg		J-	A

Sample Name SCSS-068M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 850426 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.031	0.0081	0.0024	mg/kg		J-	A

Sample Delivery Group: 81543

Analysis Method SW846 8270

Sample Name SCSB-037M-0001-SO **AnalysisType:** ORSVO

Lab Sample Name: 851488 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	400	21	ug/kg	U	U	
1,2-Dichlorobenzene	95-50-1	49	400	24	ug/kg	J	J	
1,3-Dichlorobenzene	541-73-1	20	400	20	ug/kg	U	U	
1,4-Dichlorobenzene	106-46-7	19	400	19	ug/kg	U	U	
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	U	
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	U	
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	U	
2,4-Dimethylphenol	105-67-9	100	400	100	ug/kg	U	U	
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	UJ	C
2,4-Dinitrotoluene	121-14-2	24	400	24	ug/kg	U	U	
2,6-Dinitrotoluene	606-20-2	24	400	24	ug/kg	U	U	
2-Chloronaphthalene	91-58-7	23	400	23	ug/kg	U	U	
2-Chlorophenol	95-57-8	340	510	340	ug/kg	U	U	
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	U	
2-Methylnaphthalene	91-57-6	260	400	25	ug/kg	J	J	
2-Methylphenol	95-48-7	420	1000	420	ug/kg	U	U	
2-Nitroaniline	88-74-4	23	400	23	ug/kg	U	U	
2-Nitrophenol	88-75-5	280	510	280	ug/kg	U	U	
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	UJ	C
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	U	
4-Bromophenyl phenyl ether	101-55-3	25	400	25	ug/kg	U	U	
4-Chloro-3-methylphenol	59-50-7	380	510	380	ug/kg	U	U	
4-Chloroaniline	106-47-8	39	400	39	ug/kg	U	U	
4-Chlorophenyl phenyl ether	7005-72-3	26	400	26	ug/kg	U	U	
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	U	
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	U	
4-Nitrophenol	100-02-7	400	1000	400	ug/kg	U	U	

Sample Delivery Group: 81543

Acenaphthene	83-32-9	24	400	24	ug/kg	U	U	
Acenaphthylene	208-96-8	24	400	24	ug/kg	U	U	
Anthracene	120-12-7	32	400	24	ug/kg	J	J	
Benzo(a)anthracene	56-55-3	120	400	25	ug/kg	J	J	
Benzo(a)pyrene	50-32-8	140	400	23	ug/kg	J	J	
Benzo(b)fluoranthene	205-99-2	260	400	25	ug/kg	J	J	
Benzo(g,h,i)perylene	191-24-2	120	400	22	ug/kg	J	J	
Benzo(k)fluoranthene	207-08-9	69	400	25	ug/kg	J	J	
Benzoic acid	65-85-0	290	990	290	ug/kg	U	U	
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	UJ	C
Bis(2-chloroethoxy)methane	111-91-1	23	400	23	ug/kg	U	U	
Bis(2-chloroethyl) ether	111-44-4	25	400	25	ug/kg	U	U	
Bis(2-chloroisopropyl) ether	108-60-1	30	400	30	ug/kg	U	U	
Bis(2-ethylhexyl) phthalate	117-81-7	88	1000	88	ug/kg	J	U	B
Butylbenzyl phthalate	85-68-7	74	400	74	ug/kg	U	U	
Carbazole	86-74-8	33	400	28	ug/kg	J	J	
Chrysene	218-01-9	160	400	25	ug/kg	J	J	
Dibenzo(a,h)anthracene	53-70-3	32	400	22	ug/kg	J	J	
Dibenzofuran	132-64-9	69	400	24	ug/kg	J	J	
Diethyl phthalate	84-66-2	65	400	65	ug/kg	U	U	
Dimethyl phthalate	131-11-3	64	400	64	ug/kg	U	U	
Di-n-butyl phthalate	84-74-2	120	400	80	ug/kg	J	J	
Di-n-octyl phthalate	117-84-0	60	400	60	ug/kg	U	U	
Fluoranthene	206-44-0	360	400	26	ug/kg	J	J	
Fluorene	86-73-7	25	400	25	ug/kg	U	U	
Hexachlorobenzene	118-74-1	28	400	28	ug/kg	U	U	
Hexachlorobutadiene	87-68-3	63	400	63	ug/kg	U	U	
Hexachlorocyclopentadiene	77-47-4	53	400	53	ug/kg	U	UJ	C
Hexachloroethane	67-72-1	33	400	33	ug/kg	U	U	
Indeno(1,2,3-cd)pyrene	193-39-5	93	400	23	ug/kg	J	J	
Isophorone	78-59-1	500	400	51	ug/kg			
Naphthalene	91-20-3	150	400	21	ug/kg	J	J	
Nitrobenzene	98-95-3	60	400	60	ug/kg	U	U	

Sample Delivery Group: 81543

N-Nitroso-di-n-propylamine	621-64-7	71	400	71	ug/kg	U	U	
N-Nitrosodiphenylamine	86-30-6	51	810	51	ug/kg	U	U	
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	U	
Phenanthrene	85-01-8	280	400	26	ug/kg	J	J	
Phenol	108-95-2	160	510	160	ug/kg	U	U	
Pyrene	129-00-0	280	400	26	ug/kg	J	J	

Sample Name SCSB-038M-0005-SO **AnalysisType:** ORSVO

Lab Sample Name: 851510 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	400	21	ug/kg	U	U	
1,2-Dichlorobenzene	95-50-1	24	400	24	ug/kg	U	U	
1,3-Dichlorobenzene	541-73-1	20	400	20	ug/kg	U	U	
1,4-Dichlorobenzene	106-46-7	19	400	19	ug/kg	U	U	
2,4,5-Trichlorophenol	95-95-4	130	500	130	ug/kg	U	U	
2,4,6-Trichlorophenol	88-06-2	130	500	130	ug/kg	U	U	
2,4-Dichlorophenol	120-83-2	120	500	120	ug/kg	U	U	
2,4-Dimethylphenol	105-67-9	100	400	100	ug/kg	U	U	
2,4-Dinitrophenol	51-28-5	690	2000	690	ug/kg	U	UJ	C
2,4-Dinitrotoluene	121-14-2	24	400	24	ug/kg	U	U	
2,6-Dinitrotoluene	606-20-2	24	400	24	ug/kg	U	U	
2-Chloronaphthalene	91-58-7	23	400	23	ug/kg	U	U	
2-Chlorophenol	95-57-8	340	500	340	ug/kg	U	U	
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	U	
2-Methylnaphthalene	91-57-6	35	400	25	ug/kg	J	J	
2-Methylphenol	95-48-7	420	1000	420	ug/kg	U	U	
2-Nitroaniline	88-74-4	23	400	23	ug/kg	U	U	
2-Nitrophenol	88-75-5	280	500	280	ug/kg	U	U	
3,3'-Dichlorobenzidine	91-94-1	150	500	150	ug/kg	U	UJ	C
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	U	
4-Bromophenyl phenyl ether	101-55-3	25	400	25	ug/kg	U	U	
4-Chloro-3-methylphenol	59-50-7	380	500	380	ug/kg	U	U	
4-Chloroaniline	106-47-8	39	400	39	ug/kg	U	U	

Sample Delivery Group: 81543

4-Chlorophenyl phenyl ether	7005-72-3	26	400	26	ug/kg	U	U	
4-Methylphenol	1319-77-3	650	2000	650	ug/kg	U	U	
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	U	
4-Nitrophenol	100-02-7	400	1000	400	ug/kg	U	U	
Acenaphthene	83-32-9	24	400	24	ug/kg	U	U	
Acenaphthylene	208-96-8	24	400	24	ug/kg	U	U	
Anthracene	120-12-7	24	400	24	ug/kg	U	U	
Benzo(a)anthracene	56-55-3	25	400	25	ug/kg	U	U	
Benzo(a)pyrene	50-32-8	23	400	23	ug/kg	U	U	
Benzo(b)fluoranthene	205-99-2	25	400	25	ug/kg	U	U	
Benzo(g,h,i)perylene	191-24-2	22	400	22	ug/kg	U	U	
Benzo(k)fluoranthene	207-08-9	25	400	25	ug/kg	U	U	
Benzoic acid	65-85-0	290	990	290	ug/kg	U	U	
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	UJ	C
Bis(2-chloroethoxy)methane	111-91-1	23	400	23	ug/kg	U	U	
Bis(2-chloroethyl) ether	111-44-4	25	400	25	ug/kg	U	U	
Bis(2-chloroisopropyl) ether	108-60-1	30	400	30	ug/kg	U	U	
Bis(2-ethylhexyl) phthalate	117-81-7	88	1000	88	ug/kg	U	U	
Butylbenzyl phthalate	85-68-7	74	400	74	ug/kg	U	U	
Carbazole	86-74-8	28	400	28	ug/kg	U	U	
Chrysene	218-01-9	25	400	25	ug/kg	U	U	
Dibenzo(a,h)anthracene	53-70-3	22	400	22	ug/kg	U	U	
Dibenzofuran	132-64-9	24	400	24	ug/kg	U	U	
Diethyl phthalate	84-66-2	64	400	64	ug/kg	U	U	
Dimethyl phthalate	131-11-3	63	400	63	ug/kg	U	U	
Di-n-butyl phthalate	84-74-2	110	400	80	ug/kg	J	J	
Di-n-octyl phthalate	117-84-0	59	400	59	ug/kg	U	U	
Fluoranthene	206-44-0	26	400	26	ug/kg	U	U	
Fluorene	86-73-7	25	400	25	ug/kg	U	U	
Hexachlorobenzene	118-74-1	28	400	28	ug/kg	U	U	
Hexachlorobutadiene	87-68-3	62	400	62	ug/kg	U	U	
Hexachlorocyclopentadiene	77-47-4	52	400	52	ug/kg	U	UJ	C
Hexachloroethane	67-72-1	33	400	33	ug/kg	U	U	

Sample Delivery Group: 81543

Indeno(1,2,3-cd)pyrene	193-39-5	23	400	23	ug/kg	U	U
Isophorone	78-59-1	50	400	50	ug/kg	U	U
Naphthalene	91-20-3	21	400	21	ug/kg	U	U
Nitrobenzene	98-95-3	59	400	59	ug/kg	U	U
N-Nitroso-di-n-propylamine	621-64-7	70	400	70	ug/kg	U	U
N-Nitrosodiphenylamine	86-30-6	50	810	50	ug/kg	U	U
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	U
Phenanthrene	85-01-8	26	400	26	ug/kg	U	U
Phenol	108-95-2	160	500	160	ug/kg	U	U
Pyrene	129-00-0	26	400	26	ug/kg	U	U

Sample Name SCSB-042M-0003-SO **AnalysisType:** ORSVO

Lab Sample Name: 851552 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	400	21	ug/kg	U	UJ	H
1,2-Dichlorobenzene	95-50-1	24	400	24	ug/kg	U	UJ	H
1,3-Dichlorobenzene	541-73-1	20	400	20	ug/kg	U	UJ	H
1,4-Dichlorobenzene	106-46-7	19	400	19	ug/kg	U	UJ	H
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	UJ	H
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	UJ	H
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	UJ	H
2,4-Dimethylphenol	105-67-9	100	400	100	ug/kg	U	UJ	H
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	24	400	24	ug/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	24	400	24	ug/kg	U	UJ	H
2-Chloronaphthalene	91-58-7	23	400	23	ug/kg	U	UJ	H
2-Chlorophenol	95-57-8	340	510	340	ug/kg	U	UJ	H
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	UJ	H
2-Methylnaphthalene	91-57-6	49	400	25	ug/kg	J	J-	H
2-Methylphenol	95-48-7	420	1000	420	ug/kg	U	UJ	H
2-Nitroaniline	88-74-4	23	400	23	ug/kg	U	UJ	H
2-Nitrophenol	88-75-5	280	510	280	ug/kg	U	UJ	H
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	UJ	H

Sample Delivery Group: 81543

3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	UJ	H
4-Bromophenyl phenyl ether	101-55-3	25	400	25	ug/kg	U	UJ	H
4-Chloro-3-methylphenol	59-50-7	380	510	380	ug/kg	U	UJ	H
4-Chloroaniline	106-47-8	39	400	39	ug/kg	U	UJ	H
4-Chlorophenyl phenyl ether	7005-72-3	26	400	26	ug/kg	U	UJ	H
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	UJ	H
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	UJ	H, C
4-Nitrophenol	100-02-7	400	1000	400	ug/kg	U	UJ	H
Acenaphthene	83-32-9	24	400	24	ug/kg	U	UJ	H
Acenaphthylene	208-96-8	24	400	24	ug/kg	U	UJ	H
Anthracene	120-12-7	24	400	24	ug/kg	U	UJ	H
Benzo(a)anthracene	56-55-3	25	400	25	ug/kg	U	UJ	H
Benzo(a)pyrene	50-32-8	23	400	23	ug/kg	U	UJ	H
Benzo(b)fluoranthene	205-99-2	25	400	25	ug/kg	U	UJ	H
Benzo(g,h,i)perylene	191-24-2	22	400	22	ug/kg	U	UJ	H
Benzo(k)fluoranthene	207-08-9	25	400	25	ug/kg	U	UJ	H
Benzoic acid	65-85-0	290	990	290	ug/kg	U	UJ	H
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	UJ	H, C
Bis(2-chloroethoxy)methane	111-91-1	23	400	23	ug/kg	U	UJ	H
Bis(2-chloroethyl) ether	111-44-4	25	400	25	ug/kg	U	UJ	H
Bis(2-chloroisopropyl) ether	108-60-1	30	400	30	ug/kg	U	UJ	H
Bis(2-ethylhexyl) phthalate	117-81-7	88	1000	88	ug/kg	U	UJ	H
Butylbenzyl phthalate	85-68-7	74	400	74	ug/kg	U	UJ	H
Carbazole	86-74-8	28	400	28	ug/kg	U	UJ	H
Chrysene	218-01-9	25	400	25	ug/kg	U	UJ	H
Dibenzo(a,h)anthracene	53-70-3	22	400	22	ug/kg	U	UJ	H
Dibenzofuran	132-64-9	24	400	24	ug/kg	U	UJ	H
Diethyl phthalate	84-66-2	65	400	65	ug/kg	U	UJ	H
Dimethyl phthalate	131-11-3	64	400	64	ug/kg	U	UJ	H
Di-n-butyl phthalate	84-74-2	100	400	80	ug/kg	J	J-	H
Di-n-octyl phthalate	117-84-0	60	400	60	ug/kg	U	UJ	H
Fluoranthene	206-44-0	26	400	26	ug/kg	U	UJ	H
Fluorene	86-73-7	25	400	25	ug/kg	U	UJ	H

Sample Delivery Group: 81543

Hexachlorobenzene	118-74-1	28	400	28	ug/kg	U	UJ	H
Hexachlorobutadiene	87-68-3	63	400	63	ug/kg	U	UJ	H
Hexachlorocyclopentadiene	77-47-4	53	400	53	ug/kg	U	UJ	H
Hexachloroethane	67-72-1	33	400	33	ug/kg	U	UJ	H
Indeno(1,2,3-cd)pyrene	193-39-5	23	400	23	ug/kg	U	UJ	H
Isophorone	78-59-1	51	400	51	ug/kg	U	UJ	H
Naphthalene	91-20-3	35	400	21	ug/kg	J	J-	H
Nitrobenzene	98-95-3	60	400	60	ug/kg	U	UJ	H
N-Nitroso-di-n-propylamine	621-64-7	71	400	71	ug/kg	U	UJ	H
N-Nitrosodiphenylamine	86-30-6	51	810	51	ug/kg	U	UJ	H
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	UJ	H
Phenanthrene	85-01-8	34	400	26	ug/kg	J	J-	H
Phenol	108-95-2	160	510	160	ug/kg	U	UJ	H
Pyrene	129-00-0	26	400	26	ug/kg	U	UJ	H

Sample Name SCSS-068M-0001-SO **AnalysisType:** ORSVO

Lab Sample Name: 850426 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	410	21	ug/kg	U	U	
1,2-Dichlorobenzene	95-50-1	24	410	24	ug/kg	U	U	
1,3-Dichlorobenzene	541-73-1	20	410	20	ug/kg	U	U	
1,4-Dichlorobenzene	106-46-7	19	410	19	ug/kg	U	U	
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	U	
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	U	
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	U	
2,4-Dimethylphenol	105-67-9	100	410	100	ug/kg	U	U	
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	U	
2,4-Dinitrotoluene	121-14-2	24	410	24	ug/kg	U	U	
2,6-Dinitrotoluene	606-20-2	24	410	24	ug/kg	U	U	
2-Chloronaphthalene	91-58-7	23	410	23	ug/kg	U	U	
2-Chlorophenol	95-57-8	340	510	340	ug/kg	U	U	
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	U	
2-Methylnaphthalene	91-57-6	25	410	25	ug/kg	U	U	

Sample Delivery Group: 81543

2-Methylphenol	95-48-7	430	1000	430	ug/kg	U	U	
2-Nitroaniline	88-74-4	23	410	23	ug/kg	U	U	
2-Nitrophenol	88-75-5	280	510	280	ug/kg	U	U	
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	U	
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	U	
4-Bromophenyl phenyl ether	101-55-3	25	410	25	ug/kg	U	U	
4-Chloro-3-methylphenol	59-50-7	390	510	390	ug/kg	U	U	
4-Chloroaniline	106-47-8	40	410	40	ug/kg	U	U	
4-Chlorophenyl phenyl ether	7005-72-3	26	410	26	ug/kg	U	U	
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	U	
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	U	
4-Nitrophenol	100-02-7	410	1000	410	ug/kg	U	U	
Acenaphthene	83-32-9	24	410	24	ug/kg	U	U	
Acenaphthylene	208-96-8	24	410	24	ug/kg	U	U	
Anthracene	120-12-7	24	410	24	ug/kg	U	U	
Benzo(a)anthracene	56-55-3	25	410	25	ug/kg	U	U	
Benzo(a)pyrene	50-32-8	23	410	23	ug/kg	U	U	
Benzo(b)fluoranthene	205-99-2	25	410	25	ug/kg	U	U	
Benzo(g,h,i)perylene	191-24-2	22	410	22	ug/kg	U	U	
Benzo(k)fluoranthene	207-08-9	25	410	25	ug/kg	U	U	
Benzoic acid	65-85-0	290	990	290	ug/kg	U	U	
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	U	
Bis(2-chloroethoxy)methane	111-91-1	23	410	23	ug/kg	U	U	
Bis(2-chloroethyl) ether	111-44-4	25	410	25	ug/kg	U	U	
Bis(2-chloroisopropyl) ether	108-60-1	30	410	30	ug/kg	U	U	
Bis(2-ethylhexyl) phthalate	117-81-7	100	1000	88	ug/kg	J	U	B
Butylbenzyl phthalate	85-68-7	74	410	74	ug/kg	U	U	
Carbazole	86-74-8	28	410	28	ug/kg	U	U	
Chrysene	218-01-9	25	410	25	ug/kg	U	U	
Dibenzo(a,h)anthracene	53-70-3	22	410	22	ug/kg	U	U	
Dibenzofuran	132-64-9	24	410	24	ug/kg	U	U	
Diethyl phthalate	84-66-2	65	410	65	ug/kg	U	U	
Dimethyl phthalate	131-11-3	64	410	64	ug/kg	U	U	

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Di-n-butyl phthalate	84-74-2	88	410	80	ug/kg	J	J	
Di-n-octyl phthalate	117-84-0	60	410	60	ug/kg	U	U	
Fluoranthene	206-44-0	26	410	26	ug/kg	U	U	
Fluorene	86-73-7	25	410	25	ug/kg	U	U	
Hexachlorobenzene	118-74-1	28	410	28	ug/kg	U	U	
Hexachlorobutadiene	87-68-3	63	410	63	ug/kg	U	U	
Hexachlorocyclopentadiene	77-47-4	53	410	53	ug/kg	U	UJ	C
Hexachloroethane	67-72-1	33	410	33	ug/kg	U	U	
Indeno(1,2,3-cd)pyrene	193-39-5	23	410	23	ug/kg	U	U	
Isophorone	78-59-1	51	410	51	ug/kg	J	J	
Naphthalene	91-20-3	21	410	21	ug/kg	U	U	
Nitrobenzene	98-95-3	60	410	60	ug/kg	U	U	
N-Nitroso-di-n-propylamine	621-64-7	71	410	71	ug/kg	U	U	
N-Nitrosodiphenylamine	86-30-6	51	810	51	ug/kg	U	U	
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	U	
Phenanthrene	85-01-8	26	410	26	ug/kg	U	U	
Phenol	108-95-2	160	510	160	ug/kg	U	U	
Pyrene	129-00-0	26	410	26	ug/kg	U	U	

Sample Delivery Group: 81543

Analysis Method SW846 8330B

Sample Name SCSB-037M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 851488 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.081	0.44	0.081	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.091	0.44	0.091	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.071	0.51	0.071	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.051	0.44	0.051	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.091	0.44	0.091	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.091	0.44	0.091	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.071	0.44	0.071	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.071	0.44	0.071	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.071	0.51	0.071	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.51	1.5	0.51	mg/kg	U	UJ	H
PETN	78-11-5	0.51	1.5	0.51	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.091	0.44	0.091	mg/kg	U	UJ	H

Sample Name SCSB-038M-0005-SO **AnalysisType:** OREXP

Lab Sample Name: 851510 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H

Sample Delivery Group: 81543

2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Name SCSB-042M-0003-SO **AnalysisType:** OREXP

Lab Sample Name: 851552 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H, C
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Delivery Group: 81543

Sample Name SCSS-068M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 850426 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	U	
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	U	
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	U	
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	U	
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	U	
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	U	
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	U	
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	U	
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	U	
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	U	
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	U	
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	U	
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	U	
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	U	

Sample Delivery Group: 81613

Analysis Method EPA 7471A

Sample Name SCSB-048M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.046	0.008	0.0024	mg/kg			

Sample Name SCSD-070M-0001-SD **AnalysisType:** INORG

Lab Sample Name: 854000 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.3	0.008	0.0024	mg/kg			

Sample Name SCSS-058M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 852322 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	11.1	0.81	0.24	mg/kg			

Sample Delivery Group: 81613

Analysis Method SW846 6010

Sample Name SCSB-048M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	13000	0.24	0.081	mg/kg		J-	Q, A
Antimony	7440-36-0	1.5	0.55	0.16	mg/kg		J-	Q, *III
Arsenic	7440-38-2	15	0.91	0.26	mg/kg		J	E
Barium	7440-39-3	137	0.055	0.016	mg/kg		J-	A
Beryllium	7440-41-7	1.5	0.024	0.0081	mg/kg			
Cadmium	7440-43-9	0.012	0.043	0.012	mg/kg	UV	UJ	C, Q, *III
Calcium	7440-70-2	37100	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	109	0.13	0.038	mg/kg		J-	A
Cobalt	7440-48-4	6	0.099	0.03	mg/kg		J-	Q
Copper	7440-50-8	44.8	0.4	0.12	mg/kg		J-	Q
Iron	7439-89-6	22800	2	0.61	mg/kg			
Lead	7439-92-1	34.5	0.28	0.081	mg/kg		J+	Q, *III
Magnesium	7439-95-4	3580	0.81	0.24	mg/kg		J-	A
Manganese	7439-96-5	1150	0.1	0.032	mg/kg		J-	A
Nickel	7440-02-0	88.1	0.12	0.036	mg/kg		J-	Q, A
Potassium	7440-09-7	1020	36	11	mg/kg			
Selenium	7782-49-2	1.1	0.85	0.14	mg/kg			
Silver	7440-22-4	0.5	0.11	0.034	mg/kg			
Sodium	7440-23-5	227	13	4	mg/kg			
Thallium	7440-28-0	1.6	0.28	0.081	mg/kg	B	J-	E, Q
Vanadium	7440-62-2	13.3	0.069	0.022	mg/kg			
Zinc	7440-66-6	41.3	0.24	0.081	mg/kg		J-	Q, A

Sample Name SCSD-070M-0001-SD **AnalysisType:** INORG

Lab Sample Name: 854000 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	7240	0.61	0.2	mg/kg	B	J-	Q, A

Sample Delivery Group: 81613

Antimony	7440-36-0	8.4	1.4	0.41	mg/kg		J-	Q, *III
Arsenic	7440-38-2	9.4	2.3	0.66	mg/kg		J	E
Barium	7440-39-3	231	0.14	0.041	mg/kg	B	J-	A
Beryllium	7440-41-7	0.41	0.061	0.02	mg/kg			
Cadmium	7440-43-9	2.7	0.11	0.031	mg/kg		J-	C, Q, *III
Calcium	7440-70-2	3240	2.5	0.31	mg/kg		J-	A
Chromium	7440-47-3	40.9	0.32	0.097	mg/kg		J-	A
Cobalt	7440-48-4	7.8	0.25	0.076	mg/kg		J-	Q
Copper	7440-50-8	53.7	1	0.31	mg/kg		J-	Q
Iron	7439-89-6	23800	5.1	1.5	mg/kg	B		
Lead	7439-92-1	104	0.71	0.2	mg/kg		J+	Q, *III
Magnesium	7439-95-4	2840	2	0.61	mg/kg	B	J-	A
Manganese	7439-96-5	512	0.25	0.081	mg/kg		J-	A
Nickel	7440-02-0	21.1	0.31	0.092	mg/kg		J-	Q, A
Potassium	7440-09-7	1070	37	11	mg/kg			
Selenium	7782-49-2	1.4	2.1	0.36	mg/kg	JV	J	
Silver	7440-22-4	116	57	17	mg/kg			
Sodium	7440-23-5	221	13	4.1	mg/kg			
Thallium	7440-28-0	1.2	0.71	0.2	mg/kg		J-	E, Q
Vanadium	7440-62-2	11.5	0.17	0.056	mg/kg			
Zinc	7440-66-6	108	0.61	0.2	mg/kg		J-	Q, A

Sample Name SCSS-058M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 852322 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	10400	0.24	0.082	mg/kg		J-	Q, A
Antimony	7440-36-0	3.1	0.55	0.16	mg/kg		J-	Q, *III
Arsenic	7440-38-2	4.5	0.92	0.27	mg/kg		J	E
Barium	7440-39-3	127	0.055	0.016	mg/kg	B	J-	A
Beryllium	7440-41-7	0.66	0.024	0.0082	mg/kg			
Cadmium	7440-43-9	1.9	0.043	0.012	mg/kg		J-	Q, *III
Calcium	7440-70-2	21500	1	0.12	mg/kg		J-	A
Chromium	7440-47-3	143	0.13	0.039	mg/kg		J-	A

Sample Delivery Group: 81613

Cobalt	7440-48-4	6.7	0.1	0.031	mg/kg		J-	Q
Copper	7440-50-8	33.7	0.41	0.12	mg/kg		J-	Q
Iron	7439-89-6	27100	2	0.61	mg/kg			
Lead	7439-92-1	139	0.29	0.082	mg/kg		J+	Q, *III
Magnesium	7439-95-4	3930	0.82	0.24	mg/kg		J-	A
Manganese	7439-96-5	729	0.1	0.033	mg/kg		J-	A
Nickel	7440-02-0	21.7	0.12	0.037	mg/kg		J-	Q, A
Potassium	7440-09-7	1180	37	11	mg/kg			
Selenium	7782-49-2	0.83	0.86	0.14	mg/kg	JV	J	
Silver	7440-22-4	3.8	0.11	0.035	mg/kg			
Sodium	7440-23-5	99.6	13	4.1	mg/kg		J	C
Thallium	7440-28-0	1.7	0.29	0.082	mg/kg		J-	E, Q
Vanadium	7440-62-2	14.8	0.069	0.022	mg/kg			
Zinc	7440-66-6	269	0.24	0.082	mg/kg		J-	Q, A

Analysis Method SW846 7196

Sample Name SCSB-048M-0001-SO **AnalysisType:** MISC

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Hexavalent Chromium	18540-29-9	1.9	6.5	1.9	mg/kg	U	UJ	C, Q

Sample Name SCSD-070M-0001-SD **AnalysisType:** MISC

Lab Sample Name: 854000 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Hexavalent Chromium	18540-29-9	1.9	6.5	1.9	mg/kg	U	UJ	C, Q

Sample Delivery Group: 81613

Analysis Method SW846 8081

Sample Name SCSB-048M-0001-SO **AnalysisType:** ORSVO

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
4,4'-DDD	72-54-8	1.5	12	1.5	ug/kg	UV	U	
4,4'-DDE	72-55-9	5.1	20	1.5	ug/kg	JV	J	
4,4'-DDT	50-29-3	13	12	2.5	ug/kg	V		
Aldrin	309-00-2	2.5	12	2.5	ug/kg	UV	U	
alpha-BHC	319-84-6	3.1	20	3.1	ug/kg	UV	U	
alpha-Chlordane	5103-71-9	1.5	20	1.5	ug/kg	UV	U	
beta-BHC	319-85-7	3.1	20	3.1	ug/kg	UV	U	
Chlordane (Technical)	57-74-9	20	380	20	ug/kg	UV	U	
delta-BHC	319-86-8	1.5	12	1.5	ug/kg	UV	U	
Dieldrin	60-57-1	1.5	12	1.5	ug/kg	UV	U	
Endosulfan I	959-98-8	3.6	12	3.6	ug/kg	UV	U	
Endosulfan II	33213-65-9	3.6	12	1.5	ug/kg	JV	J	
Endosulfan sulfate	1031-07-8	4.6	20	4.6	ug/kg	UV	U	
Endrin	72-20-8	2	12	2	ug/kg	UV	UJ	C
Endrin aldehyde	7421-93-4	5.6	20	5.6	ug/kg	UV	U	
Endrin ketone	53494-70-5	4.1	12	4.1	ug/kg	UV	U	
GAMMA-BHC	58-89-9	2.5	12	2.5	ug/kg	UV	U	
gamma-Chlordane	5103-74-2	1.5	20	1.5	ug/kg	UV	U	
Heptachlor	76-44-8	2	12	2	ug/kg	UV	U	
Heptachlor epoxide	1024-57-3	2.5	20	2.5	ug/kg	UV	U	
Methoxychlor	72-43-5	3.6	12	3.6	ug/kg	UV	U	
Toxaphene	8001-35-2	25	250	25	ug/kg	UV	U	

Sample Delivery Group: 81613

Analysis Method SW846 8082

Sample Name SCSB-048M-0001-SO **AnalysisType:** ORPPB

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aroclor 1016	12674-11-2	10	51	10	ug/kg	U	U	
Aroclor 1221	11104-28-2	20	51	20	ug/kg	U	U	
Aroclor 1232	11141-16-5	27	51	27	ug/kg	U	U	
Aroclor 1242	53469-21-9	29	51	29	ug/kg	U	U	
Aroclor 1248	12672-29-6	29	51	29	ug/kg	U	U	
Aroclor 1254	11097-69-1	23	51	23	ug/kg	U	U	
Aroclor 1260	11096-82-5	12	51	12	ug/kg	U	U	
Aroclor 1262	37324-23-5	21	51	21	ug/kg	U	U	
Aroclor 1268	11100-14-4	28	51	28	ug/kg	U	U	

Sample Delivery Group: 81613

Analysis Method SW846 8260B

Sample Name SCSB-048D-0001-SO **AnalysisType:** ORVOA

Lab Sample Name: 854012 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,1,1-Trichloroethane	71-55-6	11	53	11	ug/kg	U	U	
1,1,2,2-Tetrachloroethane	79-34-5	6.3	53	6.3	ug/kg	U	U	
1,1,2-Trichloroethane	79-00-5	8.5	53	8.5	ug/kg	U	U	
1,1-Dichloroethane	75-34-3	12	53	12	ug/kg	U	U	
1,1-Dichloroethene	75-35-4	17	53	17	ug/kg	U	U	
1,2-Dibromoethane	106-93-4	11	53	11	ug/kg	U	U	
1,2-Dichloroethane	107-06-2	13	53	13	ug/kg	U	U	
1,2-Dichloropropane	78-87-5	7.4	53	7.4	ug/kg	U	U	
2-Butanone	78-93-3	110	530	110	ug/kg	U	U	
2-Hexanone	591-78-6	72	530	72	ug/kg	U	U	
4-Methyl-2-pentanone	108-10-1	87	530	87	ug/kg	U	U	
Acetone	67-64-1	67	1100	67	ug/kg	U	U	
Benzene	71-43-2	60	53	5.3	ug/kg			
Bromochloromethane	74-97-5	8.5	53	8.5	ug/kg	U	U	
Bromodichloromethane	75-27-4	9.5	53	9.5	ug/kg	U	U	
Bromoform	75-25-2	6.3	53	6.3	ug/kg	U	U	
Bromomethane	74-83-9	32	110	32	ug/kg	U	U	
Carbon disulfide	75-15-0	16	110	16	ug/kg	U	UJ	C
Carbon tetrachloride	56-23-5	12	53	12	ug/kg	U	U	
Chlorobenzene	108-90-7	8.5	53	8.5	ug/kg	U	U	
Chloroethane	75-00-3	20	110	20	ug/kg	U	U	
Chloroform	67-66-3	9.5	53	9.5	ug/kg	U	U	
Chloromethane	74-87-3	26	110	26	ug/kg	U	U	
cis-1,2-Dichloroethene	156-59-2	11	53	11	ug/kg	U	U	
cis-1,3-Dichloropropene	10061-01-5	11	53	11	ug/kg	U	U	
Dibromochloromethane	124-48-1	8.5	53	8.5	ug/kg	U	UJ	C
Ethylbenzene	100-41-4	150	53	8.5	ug/kg			

Sample Delivery Group: 81613

m,p-Xylenes	1330-20-7	360	110	19	ug/kg			
Methylene chloride	75-09-2	42	110	42	ug/kg	U	U	
o-Xylene	95-47-6	350	53	8.5	ug/kg			
Styrene	100-42-5	6.3	53	6.3	ug/kg	U	U	
Tetrachloroethene	127-18-4	8.5	53	8.5	ug/kg	U	U	
Toluene	108-88-3	310	53	7.4	ug/kg			
trans-1,2-Dichloroethene	156-60-5	12	53	12	ug/kg	U	U	
trans-1,3-Dichloropropene	10061-02-6	7.4	110	7.4	ug/kg	U	UJ	C
Trichloroethene	79-01-6	11	53	11	ug/kg	U	U	
Vinyl chloride	75-01-4	15	53	15	ug/kg	U	U	

Sample Delivery Group: 81613

Analysis Method SW846 8270

Sample Name SCSB-048M-0001-SO **AnalysisType:** ORSVO

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	400	21	ug/kg	U	UJ	H
1,2-Dichlorobenzene	95-50-1	24	400	24	ug/kg	U	UJ	H
1,3-Dichlorobenzene	541-73-1	20	400	20	ug/kg	U	UJ	H
1,4-Dichlorobenzene	106-46-7	19	400	19	ug/kg	U	UJ	H
2,4,5-Trichlorophenol	95-95-4	130	500	130	ug/kg	U	UJ	H, C
2,4,6-Trichlorophenol	88-06-2	130	500	130	ug/kg	U	UJ	H
2,4-Dichlorophenol	120-83-2	120	500	120	ug/kg	U	UJ	H
2,4-Dimethylphenol	105-67-9	100	400	100	ug/kg	U	UJ	H
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	R	C
2,4-Dinitrotoluene	121-14-2	24	400	24	ug/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	24	400	24	ug/kg	U	UJ	H
2-Chloronaphthalene	91-58-7	23	400	23	ug/kg	U	UJ	H
2-Chlorophenol	95-57-8	340	500	340	ug/kg	U	UJ	H
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	R	C
2-Methylnaphthalene	91-57-6	490	400	25	ug/kg		J-	H
2-Methylphenol	95-48-7	420	1000	420	ug/kg	U	UJ	H
2-Nitroaniline	88-74-4	23	400	23	ug/kg	U	UJ	H
2-Nitrophenol	88-75-5	280	500	280	ug/kg	U	UJ	H, C
3,3'-Dichlorobenzidine	91-94-1	150	500	150	ug/kg	U	UJ	H
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	UJ	H
4-Bromophenyl phenyl ether	101-55-3	25	400	25	ug/kg	U	UJ	H
4-Chloro-3-methylphenol	59-50-7	380	500	380	ug/kg	U	UJ	H
4-Chloroaniline	106-47-8	39	400	39	ug/kg	U	UJ	H
4-Chlorophenyl phenyl ether	7005-72-3	26	400	26	ug/kg	U	UJ	H
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	UJ	H
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	UJ	H
4-Nitrophenol	100-02-7	400	1000	400	ug/kg	U	UJ	H, C

Sample Delivery Group: 81613

Acenaphthene	83-32-9	24	400	24	ug/kg	U	UJ	H
Acenaphthylene	208-96-8	34	400	24	ug/kg	J	J-	H
Anthracene	120-12-7	65	400	24	ug/kg	J	J-	H
Benzo(a)anthracene	56-55-3	120	400	25	ug/kg	J	J-	H
Benzo(a)pyrene	50-32-8	150	400	23	ug/kg	JS	J-	H, I
Benzo(b)fluoranthene	205-99-2	410	400	25	ug/kg	S	J-	H, I
Benzo(g,h,i)perylene	191-24-2	22	400	22	ug/kg	US	UJ	H, C, I
Benzo(k)fluoranthene	207-08-9	160	400	25	ug/kg	JS	J	H, C, I
Benzoic acid	65-85-0	290	2000	290	ug/kg	U	UJ	H
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	UJ	H, C
Bis(2-chloroethoxy)methane	111-91-1	23	400	23	ug/kg	U	UJ	H
Bis(2-chloroethyl) ether	111-44-4	25	400	25	ug/kg	U	UJ	H
Bis(2-chloroisopropyl) ether	108-60-1	30	400	30	ug/kg	U	UJ	H
Bis(2-ethylhexyl) phthalate	117-81-7	88	1000	88	ug/kg	U	UJ	H
Butylbenzyl phthalate	85-68-7	74	400	74	ug/kg	U	UJ	H
Carbazole	86-74-8	35	400	28	ug/kg	J	J-	H
Chrysene	218-01-9	180	400	25	ug/kg	J	J-	H
Dibenzo(a,h)anthracene	53-70-3	22	400	22	ug/kg	US	UJ	H, C, I
Dibenzofuran	132-64-9	93	400	24	ug/kg	J	J-	H
Diethyl phthalate	84-66-2	65	400	65	ug/kg	U	UJ	H
Dimethyl phthalate	131-11-3	64	400	64	ug/kg	U	UJ	H
Di-n-butyl phthalate	84-74-2	120	400	80	ug/kg	J	J-	H
Di-n-octyl phthalate	117-84-0	60	400	60	ug/kg	U	UJ	H
Fluoranthene	206-44-0	240	400	26	ug/kg	J	J-	H
Fluorene	86-73-7	41	400	25	ug/kg	J	J-	H
Hexachlorobenzene	118-74-1	28	400	28	ug/kg	U	UJ	H
Hexachlorobutadiene	87-68-3	63	400	63	ug/kg	U	UJ	H
Hexachlorocyclopentadiene	77-47-4	52	400	52	ug/kg	U	R	C
Hexachloroethane	67-72-1	33	400	33	ug/kg	U	UJ	H
Indeno(1,2,3-cd)pyrene	193-39-5	49	400	23	ug/kg	JS	J-	H, C, I
Isophorone	78-59-1	50	400	50	ug/kg	U	UJ	H
Naphthalene	91-20-3	330	400	21	ug/kg	J	J-	H
Nitrobenzene	98-95-3	60	400	60	ug/kg	U	UJ	H

Sample Delivery Group: 81613

N-Nitroso-di-n-propylamine	621-64-7	71	400	71	ug/kg	U	UJ	H
N-Nitrosodiphenylamine	86-30-6	50	810	50	ug/kg	U	UJ	H
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	UJ	H
Phenanthrene	85-01-8	280	400	26	ug/kg	J	J-	H
Phenol	108-95-2	160	500	160	ug/kg	U	UJ	H
Pyrene	129-00-0	240	400	26	ug/kg	J	J-	H

Sample Name SCSD-070M-0001-SD **AnalysisType:** ORSVO

Lab Sample Name: 854000 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	400	21	ug/kg	U	UJ	H
1,2-Dichlorobenzene	95-50-1	44	400	24	ug/kg	J	J-	H
1,3-Dichlorobenzene	541-73-1	20	400	20	ug/kg	U	UJ	H
1,4-Dichlorobenzene	106-46-7	40	400	19	ug/kg	J	J-	H
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	UJ	H, C
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	UJ	H
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	UJ	H
2,4-Dimethylphenol	105-67-9	100	400	100	ug/kg	U	UJ	H
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	R	C
2,4-Dinitrotoluene	121-14-2	24	400	24	ug/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	24	400	24	ug/kg	U	UJ	H
2-Chloronaphthalene	91-58-7	23	400	23	ug/kg	U	UJ	H
2-Chlorophenol	95-57-8	340	510	340	ug/kg	U	UJ	H
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	R	C
2-Methylnaphthalene	91-57-6	43	400	25	ug/kg	J	J-	H
2-Methylphenol	95-48-7	420	1000	420	ug/kg	U	UJ	H
2-Nitroaniline	88-74-4	23	400	23	ug/kg	U	UJ	H
2-Nitrophenol	88-75-5	280	510	280	ug/kg	U	UJ	H, C
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	UJ	H
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	UJ	H, C
4-Bromophenyl phenyl ether	101-55-3	25	400	25	ug/kg	U	UJ	H
4-Chloro-3-methylphenol	59-50-7	380	510	380	ug/kg	U	UJ	H
4-Chloroaniline	106-47-8	39	400	39	ug/kg	U	UJ	H

Sample Delivery Group: 81613

4-Chlorophenyl phenyl ether	7005-72-3	26	400	26	ug/kg	U	UJ	H
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	UJ	H
4-Nitroaniline	100-01-6	30	1000	30	ug/kg	U	UJ	H
4-Nitrophenol	100-02-7	400	1000	400	ug/kg	U	UJ	H, C
Acenaphthene	83-32-9	24	400	24	ug/kg	U	UJ	H
Acenaphthylene	208-96-8	24	400	24	ug/kg	U	UJ	H
Anthracene	120-12-7	24	400	24	ug/kg	U	UJ	H
Benzo(a)anthracene	56-55-3	57	400	25	ug/kg	J	J-	H
Benzo(a)pyrene	50-32-8	67	400	23	ug/kg	J	J-	H
Benzo(b)fluoranthene	205-99-2	110	400	25	ug/kg	J	J-	H
Benzo(g,h,i)perylene	191-24-2	26	400	22	ug/kg	J	J-	H, C
Benzo(k)fluoranthene	207-08-9	47	400	25	ug/kg	J	J	H, C
Benzoic acid	65-85-0	290	2000	290	ug/kg	U	UJ	H
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	UJ	H, C
Bis(2-chloroethoxy)methane	111-91-1	23	400	23	ug/kg	U	UJ	H
Bis(2-chloroethyl) ether	111-44-4	25	400	25	ug/kg	U	UJ	H
Bis(2-chloroisopropyl) ether	108-60-1	30	400	30	ug/kg	U	UJ	H
Bis(2-ethylhexyl) phthalate	117-81-7	88	1000	88	ug/kg	U	UJ	H
Butylbenzyl phthalate	85-68-7	74	400	74	ug/kg	U	UJ	H
Carbazole	86-74-8	28	400	28	ug/kg	U	UJ	H
Chrysene	218-01-9	70	400	25	ug/kg	J	J-	H
Dibenzo(a,h)anthracene	53-70-3	22	400	22	ug/kg	U	UJ	H, C
Dibenzofuran	132-64-9	24	400	24	ug/kg	U	UJ	H
Diethyl phthalate	84-66-2	65	400	65	ug/kg	U	UJ	H
Dimethyl phthalate	131-11-3	64	400	64	ug/kg	U	UJ	H
Di-n-butyl phthalate	84-74-2	300	400	80	ug/kg	J	J-	H
Di-n-octyl phthalate	117-84-0	60	400	60	ug/kg	U	UJ	H
Fluoranthene	206-44-0	89	400	26	ug/kg	J	J-	H
Fluorene	86-73-7	25	400	25	ug/kg	U	UJ	H
Hexachlorobenzene	118-74-1	28	400	28	ug/kg	U	UJ	H
Hexachlorobutadiene	87-68-3	63	400	63	ug/kg	U	UJ	H
Hexachlorocyclopentadiene	77-47-4	53	400	53	ug/kg	U	R	C
Hexachloroethane	67-72-1	33	400	33	ug/kg	U	UJ	H

Sample Delivery Group: 81613

Indeno(1,2,3-cd)pyrene	193-39-5	26	400	23	ug/kg	J	J-	H, C
Isophorone	78-59-1	51	400	51	ug/kg	U	UJ	H
Naphthalene	91-20-3	29	400	21	ug/kg	J	J-	H
Nitrobenzene	98-95-3	60	400	60	ug/kg	U	UJ	H
N-Nitroso-di-n-propylamine	621-64-7	71	400	71	ug/kg	U	UJ	H
N-Nitrosodiphenylamine	86-30-6	51	810	51	ug/kg	U	UJ	H
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	UJ	H
Phenanthrene	85-01-8	53	400	26	ug/kg	J	J-	H
Phenol	108-95-2	160	510	160	ug/kg	U	UJ	H
Pyrene	129-00-0	89	400	26	ug/kg	J	J-	H

Sample Name SCSS-058M-0001-SO **AnalysisType:** ORSVO

Lab Sample Name: 852322 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	410	21	ug/kg	U	UJ	H
1,2-Dichlorobenzene	95-50-1	24	410	24	ug/kg	U	UJ	H
1,3-Dichlorobenzene	541-73-1	20	410	20	ug/kg	U	UJ	H
1,4-Dichlorobenzene	106-46-7	22	410	19	ug/kg	J	J-	H
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	UJ	H
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	UJ	H
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	UJ	H
2,4-Dimethylphenol	105-67-9	100	410	100	ug/kg	U	UJ	H
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	UJ	H, C
2,4-Dinitrotoluene	121-14-2	24	410	24	ug/kg	U	UJ	H
2,6-Dinitrotoluene	606-20-2	24	410	24	ug/kg	U	UJ	H
2-Chloronaphthalene	91-58-7	23	410	23	ug/kg	U	UJ	H
2-Chlorophenol	95-57-8	350	510	350	ug/kg	U	UJ	H
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	UJ	H, C
2-Methylnaphthalene	91-57-6	370	410	25	ug/kg	J	J-	H
2-Methylphenol	95-48-7	430	1000	430	ug/kg	U	UJ	H
2-Nitroaniline	88-74-4	23	410	23	ug/kg	U	UJ	H
2-Nitrophenol	88-75-5	280	510	280	ug/kg	U	UJ	H
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	UJ	H

Sample Delivery Group: 81613

3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	UJ	H
4-Bromophenyl phenyl ether	101-55-3	25	410	25	ug/kg	U	UJ	H
4-Chloro-3-methylphenol	59-50-7	390	510	390	ug/kg	U	UJ	H
4-Chloroaniline	106-47-8	40	410	40	ug/kg	U	UJ	H
4-Chlorophenyl phenyl ether	7005-72-3	26	410	26	ug/kg	U	UJ	H
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	UJ	H
4-Nitroaniline	100-01-6	31	1000	31	ug/kg	U	UJ	H, C
4-Nitrophenol	100-02-7	410	1000	410	ug/kg	U	UJ	H
Acenaphthene	83-32-9	43	410	24	ug/kg	J	J-	H
Acenaphthylene	208-96-8	160	410	24	ug/kg	J	J-	H
Anthracene	120-12-7	300	410	24	ug/kg	J	J-	H
Benzo(a)anthracene	56-55-3	740	410	25	ug/kg		J-	H
Benzo(a)pyrene	50-32-8	590	410	23	ug/kg		J-	H
Benzo(b)fluoranthene	205-99-2	1000	410	25	ug/kg		J-	H
Benzo(g,h,i)perylene	191-24-2	170	410	22	ug/kg	J	J-	H, C
Benzo(k)fluoranthene	207-08-9	330	410	25	ug/kg	J	J-	H
Benzoic acid	65-85-0	300	1000	300	ug/kg	U	UJ	H
Benzyl alcohol	100-51-6	84	1000	84	ug/kg	U	R	C
Bis(2-chloroethoxy)methane	111-91-1	23	410	23	ug/kg	U	UJ	H
Bis(2-chloroethyl) ether	111-44-4	25	410	25	ug/kg	U	UJ	H
Bis(2-chloroisopropyl) ether	108-60-1	31	410	31	ug/kg	U	UJ	H
Bis(2-ethylhexyl) phthalate	117-81-7	89	1000	89	ug/kg	U	UJ	H
Butylbenzyl phthalate	85-68-7	74	410	74	ug/kg	U	UJ	H
Carbazole	86-74-8	78	410	28	ug/kg	J	J-	H
Chrysene	218-01-9	700	410	25	ug/kg		J-	H
Dibenzo(a,h)anthracene	53-70-3	75	410	22	ug/kg	J	J-	H
Dibenzofuran	132-64-9	140	410	24	ug/kg	J	J-	H
Diethyl phthalate	84-66-2	65	410	65	ug/kg	U	UJ	H
Dimethyl phthalate	131-11-3	64	410	64	ug/kg	U	UJ	H
Di-n-butyl phthalate	84-74-2	120	410	80	ug/kg	J	J-	H
Di-n-octyl phthalate	117-84-0	60	410	60	ug/kg	U	UJ	H
Fluoranthene	206-44-0	1800	410	26	ug/kg		J-	H
Fluorene	86-73-7	190	410	25	ug/kg	J	J-	H

Sample Delivery Group: 81613

Hexachlorobenzene	118-74-1	28	410	28	ug/kg	U	UJ	H
Hexachlorobutadiene	87-68-3	63	410	63	ug/kg	U	UJ	H
Hexachlorocyclopentadiene	77-47-4	53	410	53	ug/kg	U	R	C
Hexachloroethane	67-72-1	34	410	34	ug/kg	U	UJ	H
Indeno(1,2,3-cd)pyrene	193-39-5	180	410	23	ug/kg	J	J-	H, C
Isophorone	78-59-1	110	410	51	ug/kg	J	J-	H
Naphthalene	91-20-3	240	410	21	ug/kg	J	J-	H
Nitrobenzene	98-95-3	60	410	60	ug/kg	U	UJ	H
N-Nitroso-di-n-propylamine	621-64-7	71	410	71	ug/kg	U	UJ	H
N-Nitrosodiphenylamine	86-30-6	51	810	51	ug/kg	U	UJ	H
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	UJ	H
Phenanthrene	85-01-8	1200	410	26	ug/kg		J-	H
Phenol	108-95-2	160	510	160	ug/kg	U	UJ	H
Pyrene	129-00-0	1300	410	26	ug/kg		J-	H

Sample Delivery Group: 81613

Analysis Method SW846 8330B

Sample Name SCSB-048M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.09	0.44	0.09	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
Nitroguanidine	556-88-7	0.059	0.16	0.059	mg/kg	U	UJ	H, *III
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Name SCSD-070M-0001-SD **AnalysisType:** OREXP

Lab Sample Name: 854000 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.079	0.44	0.079	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.089	0.44	0.089	mg/kg	U	UJ	H
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.069	0.5	0.069	mg/kg	U	R	D

Sample Delivery Group: 81613

2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.089	0.44	0.089	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.089	0.44	0.089	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.069	0.44	0.069	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.069	0.44	0.069	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.069	0.5	0.069	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.089	0.44	0.089	mg/kg	U	UJ	H

Sample Name SCSS-058M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 852322 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	UJ	H
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	UJ	H
2,4,6-Trinitrotoluene	118-96-7	0.26	0.44	0.09	mg/kg	JP	J-	H, *III
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	UJ	H
2-Nitrotoluene	88-72-2	0.09	0.44	0.09	mg/kg	U	UJ	H
3,5-Dinitroaniline	618-87-1	0.09	0.44	0.09	mg/kg	U	UJ	H
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	UJ	H
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	UJ	H
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	UJ	H
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	UJ	H
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	UJ	H
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	UJ	H
Tetryl	479-45-8	0.09	0.44	0.09	mg/kg	U	UJ	H

Sample Delivery Group: 81613

Analysis Method SW846 9012A

Sample Name SCSD-070M-0001-SD **AnalysisType:** MISC

Lab Sample Name: 854000 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Cyanide	57-12-5	0.36	0.39	0.11	mg/kg	J	J-	H

Analysis Method SW846 9056M

Sample Name SCSB-048M-0001-SO **AnalysisType:** MISC

Lab Sample Name: 854011 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Nitrocellulose	9004-70-0	7	23	7	mg/kg	U	U	

Sample Delivery Group: 82400

Analysis Method SW846 6010

Sample Name SCSS-073M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 869558 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	9480	0.24	0.082	mg/kg	B		
Antimony	7440-36-0	2.9	0.55	0.16	mg/kg		J+	C
Arsenic	7440-38-2	21.8	0.92	0.27	mg/kg			
Barium	7440-39-3	94.3	0.055	0.016	mg/kg	B		
Beryllium	7440-41-7	0.77	0.024	0.0082	mg/kg			
Cadmium	7440-43-9	0.63	0.043	0.012	mg/kg			
Calcium	7440-70-2	10300	1	0.12	mg/kg			
Chromium	7440-47-3	130	0.13	0.039	mg/kg	B		
Cobalt	7440-48-4	10.8	0.1	0.031	mg/kg			
Copper	7440-50-8	24.3	0.41	0.12	mg/kg			
Iron	7439-89-6	24800	2	0.61	mg/kg			
Lead	7439-92-1	50.3	0.29	0.082	mg/kg			
Magnesium	7439-95-4	3040	0.82	0.24	mg/kg			
Manganese	7439-96-5	576	0.1	0.033	mg/kg	B		
Nickel	7440-02-0	32.7	0.12	0.037	mg/kg			
Potassium	7440-09-7	1350	37	11	mg/kg			
Selenium	7782-49-2	2.4	0.86	0.14	mg/kg		J+	C
Silver	7440-22-4	2	0.11	0.035	mg/kg			
Sodium	7440-23-5	101	13	4.1	mg/kg		J	C
Thallium	7440-28-0	0.082	0.29	0.082	mg/kg	UV	U	B
Vanadium	7440-62-2	19.8	0.069	0.022	mg/kg			
Zinc	7440-66-6	86.1	0.24	0.082	mg/kg			

Sample Name SCSS-076M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 869562 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Aluminum	7429-90-5	7990	0.25	0.082	mg/kg			

Sample Delivery Group: 82400

Antimony	7440-36-0	3.1	0.55	0.16	mg/kg			
Arsenic	7440-38-2	10.3	0.92	0.27	mg/kg			
Barium	7440-39-3	74.8	0.055	0.016	mg/kg	B		
Beryllium	7440-41-7	0.48	0.025	0.0082	mg/kg			
Cadmium	7440-43-9	0.65	0.043	0.012	mg/kg			
Calcium	7440-70-2	18500	1	0.12	mg/kg			
Chromium	7440-47-3	188	0.13	0.039	mg/kg			
Cobalt	7440-48-4	8.7	0.1	0.031	mg/kg			
Copper	7440-50-8	10.1	0.41	0.12	mg/kg			
Iron	7439-89-6	19000	2	0.61	mg/kg			
Lead	7439-92-1	18.2	0.29	0.082	mg/kg			
Magnesium	7439-95-4	1750	0.82	0.25	mg/kg	B		
Manganese	7439-96-5	661	0.1	0.033	mg/kg	B		
Nickel	7440-02-0	25.3	0.13	0.037	mg/kg			
Potassium	7440-09-7	845	37	11	mg/kg			
Selenium	7782-49-2	2.2	0.86	0.14	mg/kg		J-	C
Silver	7440-22-4	0.11	0.11	0.035	mg/kg	V,B		
Sodium	7440-23-5	68.1	13	4.1	mg/kg		J	C
Thallium	7440-28-0	0.73	0.29	0.082	mg/kg		J-	B
Vanadium	7440-62-2	15.9	0.07	0.023	mg/kg	B		
Zinc	7440-66-6	46.9	0.25	0.082	mg/kg			

Analysis Method SW846 7471A

Sample Name SCSS-073M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 869558 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.27	0.0081	0.0024	mg/kg			

Sample Name SCSS-076M-0001-SO **AnalysisType:** INORG

Lab Sample Name: 869562 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
Mercury	7439-97-6	0.049	0.0081	0.0025	mg/kg		J-	C

Sample Delivery Group: 82400

Analysis Method SW846 8270

Sample Name SCSS-073M-0001-SO **AnalysisType:** ORSVO

Lab Sample Name: 869558 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,2,4-Trichlorobenzene	120-82-1	21	410	21	ug/kg	U	U	
1,2-Dichlorobenzene	95-50-1	39	410	24	ug/kg	J	J	
1,3-Dichlorobenzene	541-73-1	20	410	20	ug/kg	U	U	
1,4-Dichlorobenzene	106-46-7	19	410	19	ug/kg	U	U	
2,4,5-Trichlorophenol	95-95-4	130	510	130	ug/kg	U	U	
2,4,6-Trichlorophenol	88-06-2	130	510	130	ug/kg	U	U	
2,4-Dichlorophenol	120-83-2	120	510	120	ug/kg	U	U	
2,4-Dimethylphenol	105-67-9	100	410	100	ug/kg	U	U	
2,4-Dinitrophenol	51-28-5	700	2000	700	ug/kg	U	U	
2,4-Dinitrotoluene	121-14-2	24	410	24	ug/kg	U	U	
2,6-Dinitrotoluene	606-20-2	24	410	24	ug/kg	U	U	
2-Chloronaphthalene	91-58-7	23	410	23	ug/kg	U	U	
2-Chlorophenol	95-57-8	350	510	350	ug/kg	U	U	
2-Methyl-4,6-dinitrophenol	534-52-1	270	1000	270	ug/kg	U	U	
2-Methylnaphthalene	91-57-6	240	410	25	ug/kg	J	J	
2-Methylphenol	95-48-7	430	1000	430	ug/kg	U	U	
2-Nitroaniline	88-74-4	23	410	23	ug/kg	U	U	
2-Nitrophenol	88-75-5	290	510	290	ug/kg	U	U	
3,3'-Dichlorobenzidine	91-94-1	150	510	150	ug/kg	U	U	
3-Nitroaniline	99-09-2	22	1000	22	ug/kg	U	U	
4-Bromophenyl phenyl ether	101-55-3	25	410	25	ug/kg	U	U	
4-Chloro-3-methylphenol	59-50-7	390	510	390	ug/kg	U	U	
4-Chloroaniline	106-47-8	40	410	40	ug/kg	U	U	
4-Chlorophenyl phenyl ether	7005-72-3	26	410	26	ug/kg	U	U	
4-Methylphenol	1319-77-3	660	2000	660	ug/kg	U	U	
4-Nitroaniline	100-01-6	31	1000	31	ug/kg	U	U	
4-Nitrophenol	100-02-7	410	1000	410	ug/kg	U	UJ	C

Sample Delivery Group: 82400

Acenaphthene	83-32-9	35	410	24	ug/kg	J	J
Acenaphthylene	208-96-8	29	410	24	ug/kg	J	J
Anthracene	120-12-7	93	410	24	ug/kg	J	J
Benzo(a)anthracene	56-55-3	370	410	25	ug/kg	J	J
Benzo(a)pyrene	50-32-8	350	410	23	ug/kg	J	J
Benzo(b)fluoranthene	205-99-2	580	410	25	ug/kg		
Benzo(g,h,i)perylene	191-24-2	190	410	22	ug/kg	J	J
Benzo(k)fluoranthene	207-08-9	200	410	25	ug/kg	J	J
Benzoic acid	65-85-0	300	2000	300	ug/kg	U	U
Benzyl alcohol	100-51-6	85	1000	85	ug/kg	U	U
Bis(2-chloroethoxy)methane	111-91-1	23	410	23	ug/kg	U	U
Bis(2-chloroethyl) ether	111-44-4	25	410	25	ug/kg	U	U
Bis(2-chloroisopropyl) ether	108-60-1	31	410	31	ug/kg	U	U
Bis(2-ethylhexyl) phthalate	117-81-7	190	1000	89	ug/kg	J	J
Butylbenzyl phthalate	85-68-7	74	410	74	ug/kg	U	U
Carbazole	86-74-8	58	410	29	ug/kg	J	J
Chrysene	218-01-9	400	410	25	ug/kg	J	J
Dibenzo(a,h)anthracene	53-70-3	69	410	22	ug/kg	J	J
Dibenzofuran	132-64-9	72	410	24	ug/kg	J	J
Diethyl phthalate	84-66-2	65	410	65	ug/kg	U	U
Dimethyl phthalate	131-11-3	64	410	64	ug/kg	U	U
Di-n-butyl phthalate	84-74-2	140	410	80	ug/kg	J	J
Di-n-octyl phthalate	117-84-0	60	410	60	ug/kg	U	U
Fluoranthene	206-44-0	760	410	26	ug/kg		
Fluorene	86-73-7	33	410	25	ug/kg	J	J
Hexachlorobenzene	118-74-1	29	410	29	ug/kg	U	U
Hexachlorobutadiene	87-68-3	63	410	63	ug/kg	U	U
Hexachlorocyclopentadiene	77-47-4	53	410	53	ug/kg	U	U
Hexachloroethane	67-72-1	34	410	34	ug/kg	U	U
Indeno(1,2,3-cd)pyrene	193-39-5	170	410	23	ug/kg	J	J
Isophorone	78-59-1	51	410	51	ug/kg	U	U
Naphthalene	91-20-3	170	410	21	ug/kg	J	J
Nitrobenzene	98-95-3	60	410	60	ug/kg	U	U

Sample Delivery Group: 82400

N-Nitroso-di-n-propylamine	621-64-7	71	410	71	ug/kg	U	U
N-Nitrosodiphenylamine	86-30-6	51	810	51	ug/kg	U	U
Pentachlorophenol	87-86-5	240	1000	240	ug/kg	U	U
Phenanthrene	85-01-8	450	410	26	ug/kg		
Phenol	108-95-2	160	510	160	ug/kg	U	U
Pyrene	129-00-0	620	410	26	ug/kg		

Sample Delivery Group: 82400

Analysis Method SW846 8330B

Sample Name SCSS-073M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 869558 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	U	
1,3-Dinitrobenzene	99-65-0	0.081	0.44	0.081	mg/kg	U	U	
2,4,6-Trinitrotoluene	118-96-7	0.091	0.44	0.091	mg/kg	U	U	
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	R	D
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	R	D
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	U	
2-Nitrotoluene	88-72-2	0.091	0.44	0.091	mg/kg	U	U	
3,5-Dinitroaniline	618-87-1	0.091	0.44	0.091	mg/kg	U	U	
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	U	
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	U	
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	U	
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	U	
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	R	D
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	U	
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	U	
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	U	
Tetryl	479-45-8	0.091	0.44	0.091	mg/kg	U	U	

Sample Name SCSS-076M-0001-SO **AnalysisType:** OREXP

Lab Sample Name: 869562 **Validation Level:** IV

	CAS No	Result Value	LOQ	DL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Code
1,3,5-Trinitrobenzene	99-35-4	0.13	0.44	0.13	mg/kg	U	U	
1,3-Dinitrobenzene	99-65-0	0.08	0.44	0.08	mg/kg	U	U	
2,4,6-Trinitrotoluene	118-96-7	0.091	0.44	0.091	mg/kg	U	U	
2,4-Dinitrotoluene	121-14-2	0.2	0.44	0.2	mg/kg	U	U	
2,6-Dinitrotoluene	606-20-2	0.07	0.5	0.07	mg/kg	U	UJ	C
2-Amino-4,6-dinitrotoluene	35572-78-2	0.05	0.44	0.05	mg/kg	U	U	

Sample Delivery Group: 82400

2-Nitrotoluene	88-72-2	0.091	0.44	0.091	mg/kg	U	U
3,5-Dinitroaniline	618-87-1	0.091	0.44	0.091	mg/kg	U	U
3-Nitrotoluene	99-08-1	0.07	0.44	0.07	mg/kg	U	U
4-Amino-2,6-dinitrotoluene	19406-51-0	0.07	0.44	0.07	mg/kg	U	U
4-Nitrotoluene	99-99-0	0.07	0.5	0.07	mg/kg	U	U
HMX	2691-41-0	0.12	0.44	0.12	mg/kg	U	U
Nitrobenzene	98-95-3	0.04	0.44	0.04	mg/kg	U	U
Nitroglycerin	55-63-0	0.5	1.5	0.5	mg/kg	U	U
PETN	78-11-5	0.5	1.5	0.5	mg/kg	U	U
RDX	121-82-4	0.16	0.44	0.16	mg/kg	U	U
Tetryl	479-45-8	0.091	0.44	0.091	mg/kg	U	U

APPENDIX B

Sample Qualification Summary

Open Demolition Area 1

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-055M-0001-SO	Antimony	0.16	0.55	0.16	mg/kg	R	Q
DA1SB-055M-0001-SO	Barium	73.4	0.055	0.016	mg/kg	J	*III, A
DA1SB-055M-0001-SO	Beryllium	0.53	0.024	0.0081	mg/kg	J	*III, A
DA1SB-055M-0001-SO	Cadmium	0.26	0.26	0.26	mg/kg	UJ	C, $
DA1SB-055M-0001-SO	Calcium	18700	1	0.12	mg/kg	J	*III, A
DA1SB-055M-0001-SO	Chromium	31.6	0.13	0.038	mg/kg	J-	Q, *III, A
DA1SB-055M-0001-SO	Cobalt	10.8	0.099	0.03	mg/kg	J-	Q, *III, A
DA1SB-055M-0001-SO	Copper	19.1	0.4	0.12	mg/kg	J-	Q, *III, A
DA1SB-055M-0001-SO	Lead	21	0.28	0.081	mg/kg	J	*III, A
DA1SB-055M-0001-SO	Manganese	387	0.1	0.032	mg/kg	J-	Q
DA1SB-055M-0001-SO	Nickel	26.3	0.12	0.036	mg/kg	J	*III, A
DA1SB-055M-0001-SO	Selenium	0.32	0.85	0.14	mg/kg	UJ	B, Q
DA1SB-055M-0001-SO	Silver	0.08	0.11	0.08	mg/kg	U	$
DA1SB-055M-0001-SO	Sodium	61.2	13	4	mg/kg	J	C
DA1SB-055M-0001-SO	Thallium	2.1	0.28	0.081	mg/kg	J-	Q
DA1SB-055M-0001-SO	Vanadium	19.4	0.069	0.022	mg/kg	J	*III, A
DA1SB-055M-0001-SO	Zinc	55.2	0.24	0.081	mg/kg	J-	Q, *III, A
DA1SB-055M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-055M-0001-SO	1,3-Dinitrobenzene	0.079	0.44	0.079	mg/kg	UJ	H
DA1SB-055M-0001-SO	2,4,6-Trinitrotoluene	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-055M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	UJ	H, Q
DA1SB-055M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-055M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-055M-0001-SO	2-Nitrotoluene	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-055M-0001-SO	3,5-Dinitroaniline	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-055M-0001-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-055M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H, Q
DA1SB-055M-0001-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-055M-0001-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-055M-0001-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	UJ	H
DA1SB-055M-0001-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-055M-0001-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-055M-0001-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-055M-0001-SO	Tetryl	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-059D-0201-SO	2-Hexanone	73	530	73	ug/kg	UJ	C
DA1SB-059D-0201-SO	Chloroethane	20	110	20	ug/kg	R	C
DA1SB-059D-0201-SO	Chloromethane	27	110	27	ug/kg	R	C
DA1SB-059M-0201-SO	Aluminum	12200	0.61	0.2	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Antimony	20.5	1.4	0.41	mg/kg	J-	Q
DA1SB-059M-0201-SO	Barium	869	0.14	0.041	mg/kg	J	*III, A
DA1SB-059M-0201-SO	Beryllium	0.95	0.061	0.02	mg/kg	J	*III, A
DA1SB-059M-0201-SO	Cadmium	18.4	0.11	0.031	mg/kg	J-	Q
DA1SB-059M-0201-SO	Calcium	18800	2.6	0.31	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Chromium	101	0.32	0.097	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Cobalt	10.1	0.25	0.077	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Copper	222	1	0.31	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Lead	416	0.71	0.2	mg/kg	J	*III, A
DA1SB-059M-0201-SO	Magnesium	3470	2	0.61	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Manganese	1100	0.26	0.082	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Nickel	40.7	0.31	0.092	mg/kg	J	*III, A
DA1SB-059M-0201-SO	Selenium	2.1	2.1	0.36	mg/kg	J-	Q
DA1SB-059M-0201-SO	Sodium	84.2	13	4.1	mg/kg	J	C
DA1SB-059M-0201-SO	Thallium	2	0.71	0.2	mg/kg	J-	C, Q

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-059M-0201-SO	Vanadium	16.5	0.17	0.056	mg/kg	J	*III, A
DA1SB-059M-0201-SO	Zinc	364	0.61	0.2	mg/kg	J-	Q, *III, A
DA1SB-059M-0201-SO	Hexavalent Chromium	1.9	6.5	1.9	mg/kg	UJ	C, Q
DA1SB-059M-0201-SO	Endrin aldehyde	1.1	4.1	1.1	ug/kg	UJ	Q
DA1SB-059M-0201-SO	1,2,4-Trichlorobenzene	21	410	21	ug/kg	UJ	H
DA1SB-059M-0201-SO	1,2-Dichlorobenzene	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	1,3-Dichlorobenzene	20	410	20	ug/kg	UJ	H
DA1SB-059M-0201-SO	1,4-Dichlorobenzene	19	410	19	ug/kg	UJ	H
DA1SB-059M-0201-SO	2,4,5-Trichlorophenol	130	510	130	ug/kg	UJ	H
DA1SB-059M-0201-SO	2,4,6-Trichlorophenol	130	510	130	ug/kg	UJ	H
DA1SB-059M-0201-SO	2,4-Dichlorophenol	120	510	120	ug/kg	UJ	H
DA1SB-059M-0201-SO	2,4-Dimethylphenol	100	410	100	ug/kg	UJ	H
DA1SB-059M-0201-SO	2,4-Dinitrophenol	700	2000	700	ug/kg	UJ	H, C
DA1SB-059M-0201-SO	2,4-Dinitrotoluene	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	2,6-Dinitrotoluene	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	2-Chloronaphthalene	23	410	23	ug/kg	UJ	H
DA1SB-059M-0201-SO	2-Chlorophenol	350	510	350	ug/kg	UJ	H
DA1SB-059M-0201-SO	2-Methyl-4,6-dinitrophenol	280	1000	280	ug/kg	UJ	H, C
DA1SB-059M-0201-SO	2-Methylnaphthalene	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	2-Methylphenol	430	1000	430	ug/kg	UJ	H
DA1SB-059M-0201-SO	2-Nitroaniline	23	410	23	ug/kg	UJ	H
DA1SB-059M-0201-SO	2-Nitrophenol	290	510	290	ug/kg	UJ	H
DA1SB-059M-0201-SO	3,3'-Dichlorobenzidine	150	510	150	ug/kg	UJ	H, C
DA1SB-059M-0201-SO	3-Nitroaniline	22	1000	22	ug/kg	UJ	H
DA1SB-059M-0201-SO	4-Bromophenyl phenyl ether	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	4-Chloro-3-methylphenol	390	510	390	ug/kg	UJ	H
DA1SB-059M-0201-SO	4-Chloroaniline	40	410	40	ug/kg	UJ	H
DA1SB-059M-0201-SO	4-Chlorophenyl phenyl ether	27	410	27	ug/kg	UJ	H
DA1SB-059M-0201-SO	4-Methylphenol	660	2000	660	ug/kg	UJ	H
DA1SB-059M-0201-SO	4-Nitroaniline	31	1000	31	ug/kg	UJ	H, C
DA1SB-059M-0201-SO	4-Nitrophenol	410	1000	410	ug/kg	UJ	H
DA1SB-059M-0201-SO	Acenaphthene	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	Acenaphthylene	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	Anthracene	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	Benzo(a)anthracene	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	Benzo(a)pyrene	23	410	23	ug/kg	UJ	H
DA1SB-059M-0201-SO	Benzo(b)fluoranthene	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	Benzo(g,h,i)perylene	22	410	22	ug/kg	UJ	H, C
DA1SB-059M-0201-SO	Benzo(k)fluoranthene	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	Benzoic acid	300	1000	300	ug/kg	UJ	H
DA1SB-059M-0201-SO	Benzyl alcohol	85	1000	85	ug/kg	R	C
DA1SB-059M-0201-SO	Bis(2-chloroethoxy)methane	23	410	23	ug/kg	UJ	H
DA1SB-059M-0201-SO	Bis(2-chloroethyl) ether	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	Bis(2-chloroisopropyl) ether	31	410	31	ug/kg	UJ	H
DA1SB-059M-0201-SO	Bis(2-ethylhexyl) phthalate	89	1000	89	ug/kg	UJ	H
DA1SB-059M-0201-SO	Butylbenzyl phthalate	75	410	75	ug/kg	UJ	H
DA1SB-059M-0201-SO	Carbazole	29	410	29	ug/kg	UJ	H
DA1SB-059M-0201-SO	Chrysene	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	Dibenzo(a,h)anthracene	22	410	22	ug/kg	UJ	H
DA1SB-059M-0201-SO	Dibenzofuran	25	410	25	ug/kg	UJ	H
DA1SB-059M-0201-SO	Diethyl phthalate	65	410	65	ug/kg	UJ	H
DA1SB-059M-0201-SO	Dimethyl phthalate	64	410	64	ug/kg	UJ	H
DA1SB-059M-0201-SO	Di-n-butyl phthalate	110	410	81	ug/kg	J-	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-059M-0201-SO	Di-n-octyl phthalate	60	410	60	ug/kg	UJ	H
DA1SB-059M-0201-SO	Fluoranthene	27	410	27	ug/kg	UJ	H
DA1SB-059M-0201-SO	Fluorene	26	410	26	ug/kg	UJ	H
DA1SB-059M-0201-SO	Hexachlorobenzene	29	410	29	ug/kg	UJ	H
DA1SB-059M-0201-SO	Hexachlorobutadiene	63	410	63	ug/kg	UJ	H
DA1SB-059M-0201-SO	Hexachlorocyclopentadiene	53	410	53	ug/kg	R	C
DA1SB-059M-0201-SO	Hexachloroethane	34	410	34	ug/kg	UJ	H
DA1SB-059M-0201-SO	Indeno(1,2,3-cd)pyrene	23	410	23	ug/kg	UJ	H, C
DA1SB-059M-0201-SO	Isophorone	51	410	51	ug/kg	UJ	H
DA1SB-059M-0201-SO	Naphthalene	21	410	21	ug/kg	UJ	H
DA1SB-059M-0201-SO	Nitrobenzene	60	410	60	ug/kg	UJ	H
DA1SB-059M-0201-SO	N-Nitroso-di-n-propylamine	72	410	72	ug/kg	UJ	H
DA1SB-059M-0201-SO	N-Nitrosodiphenylamine	51	820	51	ug/kg	UJ	H
DA1SB-059M-0201-SO	Pentachlorophenol	250	1000	250	ug/kg	UJ	H
DA1SB-059M-0201-SO	Phenanthrene	27	410	27	ug/kg	UJ	H
DA1SB-059M-0201-SO	Phenol	160	510	160	ug/kg	UJ	H
DA1SB-059M-0201-SO	Pyrene	27	410	27	ug/kg	UJ	H
DA1SB-059M-0201-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-059M-0201-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
DA1SB-059M-0201-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-059M-0201-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
DA1SB-059M-0201-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
DA1SB-059M-0201-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-059M-0201-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-059M-0201-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-059M-0201-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-059M-0201-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-059M-0201-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-059M-0201-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-059M-0201-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
DA1SB-059M-0201-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-059M-0201-SO	Nitroguanidine	0.06	0.16	0.06	mg/kg	UJ	H, *III
DA1SB-059M-0201-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-059M-0201-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-059M-0201-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-059M-0201-SO	Cyanide	0.11	0.39	0.11	mg/kg	UJ	H
DA1SB-063M-0202-SO	Aluminum	13300	0.24	0.081	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Antimony	0.16	0.55	0.16	mg/kg	R	Q
DA1SB-063M-0202-SO	Barium	56.6	0.055	0.016	mg/kg	J	*III, A
DA1SB-063M-0202-SO	Beryllium	0.43	0.024	0.0081	mg/kg	J	*III, A
DA1SB-063M-0202-SO	Cadmium	0.2	0.2	0.2	mg/kg	UJ	C, Q, $
DA1SB-063M-0202-SO	Calcium	27500	1	0.12	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Chromium	22.6	0.13	0.038	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Cobalt	9.4	0.099	0.03	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Copper	16.8	0.4	0.12	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Magnesium	7180	0.81	0.24	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Manganese	299	0.1	0.032	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	Nickel	22.1	0.12	0.036	mg/kg	J	*III, A
DA1SB-063M-0202-SO	Selenium	0.53	0.85	0.14	mg/kg	U	B
DA1SB-063M-0202-SO	Silver	0.1	0.11	0.1	mg/kg	U	$
DA1SB-063M-0202-SO	Sodium	82.7	13	4	mg/kg	J	C
DA1SB-063M-0202-SO	Thallium	2	0.28	0.081	mg/kg	J-	Q
DA1SB-063M-0202-SO	Vanadium	16.9	0.069	0.022	mg/kg	J	*III, A

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-063M-0202-SO	Zinc	51.1	0.24	0.081	mg/kg	J-	Q, *III, A
DA1SB-063M-0202-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-063M-0202-SO	1,3-Dinitrobenzene	0.079	0.44	0.079	mg/kg	UJ	H
DA1SB-063M-0202-SO	2,4,6-Trinitrotoluene	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-063M-0202-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	UJ	H
DA1SB-063M-0202-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-063M-0202-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-063M-0202-SO	2-Nitrotoluene	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-063M-0202-SO	3,5-Dinitroaniline	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-063M-0202-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-063M-0202-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-063M-0202-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-063M-0202-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-063M-0202-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	UJ	H
DA1SB-063M-0202-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-063M-0202-SO	Nitroguanidine	0.059	0.16	0.059	mg/kg	UJ	H, *III
DA1SB-063M-0202-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-063M-0202-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-063M-0202-SO	Tetryl	0.089	0.44	0.089	mg/kg	UJ	H
DA1SB-068D-0201-SO	2-Hexanone	70	520	70	ug/kg	R	C
DA1SB-068D-0201-SO	4-Methyl-2-pentanone	85	520	85	ug/kg	UJ	C
DA1SB-068D-0201-SO	Acetone	65	1000	65	ug/kg	UJ	C
DA1SB-068D-0201-SO	Chloroethane	20	100	20	ug/kg	R	C
DA1SB-068D-0201-SO	Chloromethane	26	100	26	ug/kg	R	C
DA1SB-068D-0201-SO	m,p-Xylenes	19	100	19	ug/kg	UJ	C
DA1SB-068M-0201-SO	Mercury	0.019	0.008	0.0024	mg/kg	J-	A
DA1SB-068M-0201-SO	Aluminum	10900	0.24	0.081	mg/kg	J-	Q
DA1SB-068M-0201-SO	Antimony	0.49	0.55	0.16	mg/kg	J-	Q
DA1SB-068M-0201-SO	Arsenic	5.4	0.91	0.26	mg/kg	J-	Q, A
DA1SB-068M-0201-SO	Beryllium	0.42	0.024	0.0081	mg/kg	J-	A
DA1SB-068M-0201-SO	Cadmium	0.096	0.043	0.012	mg/kg	J-	C, Q
DA1SB-068M-0201-SO	Calcium	420	1	0.12	mg/kg	J-	A
DA1SB-068M-0201-SO	Chromium	49.1	0.13	0.038	mg/kg	J-	Q, A
DA1SB-068M-0201-SO	Cobalt	8	0.099	0.03	mg/kg	J-	Q, A
DA1SB-068M-0201-SO	Copper	21.2	0.4	0.12	mg/kg	J-	A
DA1SB-068M-0201-SO	Lead	24.5	0.28	0.081	mg/kg	J-	A
DA1SB-068M-0201-SO	Magnesium	2590	0.81	0.24	mg/kg	J-	A
DA1SB-068M-0201-SO	Manganese	293	0.1	0.032	mg/kg	J-	Q
DA1SB-068M-0201-SO	Nickel	15.9	0.12	0.036	mg/kg	J-	Q, A
DA1SB-068M-0201-SO	Potassium	1000	36	11	mg/kg	J-	Q
DA1SB-068M-0201-SO	Selenium	0.23	0.85	0.14	mg/kg	J-	Q
DA1SB-068M-0201-SO	Silver	0.1	0.11	0.1	mg/kg	UJ	Q, $
DA1SB-068M-0201-SO	Sodium	45.3	13	4	mg/kg	J-	C, Q
DA1SB-068M-0201-SO	Thallium	1.5	0.28	0.081	mg/kg	J-	Q
DA1SB-068M-0201-SO	Vanadium	15.2	0.069	0.022	mg/kg	J-	Q, A
DA1SB-068M-0201-SO	Zinc	51.6	0.24	0.081	mg/kg	J-	Q, A
DA1SB-068M-0201-SO	1,2,4-Trichlorobenzene	21	400	21	ug/kg	UJ	H
DA1SB-068M-0201-SO	1,2-Dichlorobenzene	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	1,3-Dichlorobenzene	20	400	20	ug/kg	UJ	H
DA1SB-068M-0201-SO	1,4-Dichlorobenzene	19	400	19	ug/kg	UJ	H
DA1SB-068M-0201-SO	2,4,5-Trichlorophenol	130	500	130	ug/kg	UJ	H
DA1SB-068M-0201-SO	2,4,6-Trichlorophenol	130	500	130	ug/kg	UJ	H
DA1SB-068M-0201-SO	2,4-Dichlorophenol	120	500	120	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-068M-0201-SO	2,4-Dimethylphenol	100	400	100	ug/kg	UJ	H
DA1SB-068M-0201-SO	2,4-Dinitrophenol	700	2000	700	ug/kg	UJ	H, C
DA1SB-068M-0201-SO	2,4-Dinitrotoluene	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	2,6-Dinitrotoluene	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	2-Chloronaphthalene	23	400	23	ug/kg	UJ	H
DA1SB-068M-0201-SO	2-Chlorophenol	340	500	340	ug/kg	UJ	H
DA1SB-068M-0201-SO	2-Methyl-4,6-dinitrophenol	270	1000	270	ug/kg	UJ	H, C
DA1SB-068M-0201-SO	2-Methylnaphthalene	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	2-Methylphenol	420	1000	420	ug/kg	UJ	H
DA1SB-068M-0201-SO	2-Nitroaniline	23	400	23	ug/kg	UJ	H
DA1SB-068M-0201-SO	2-Nitrophenol	280	500	280	ug/kg	UJ	H
DA1SB-068M-0201-SO	3,3'-Dichlorobenzidine	150	500	150	ug/kg	UJ	H, C
DA1SB-068M-0201-SO	3-Nitroaniline	22	1000	22	ug/kg	UJ	H
DA1SB-068M-0201-SO	4-Bromophenyl phenyl ether	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	4-Chloro-3-methylphenol	380	500	380	ug/kg	UJ	H
DA1SB-068M-0201-SO	4-Chloroaniline	39	400	39	ug/kg	UJ	H
DA1SB-068M-0201-SO	4-Chlorophenyl phenyl ether	26	400	26	ug/kg	UJ	H
DA1SB-068M-0201-SO	4-Methylphenol	660	2000	660	ug/kg	UJ	H
DA1SB-068M-0201-SO	4-Nitroaniline	30	1000	30	ug/kg	UJ	H, C
DA1SB-068M-0201-SO	4-Nitrophenol	400	1000	400	ug/kg	UJ	H
DA1SB-068M-0201-SO	Acenaphthene	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	Acenaphthylene	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	Anthracene	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	Benzo(a)anthracene	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	Benzo(a)pyrene	23	400	23	ug/kg	UJ	H
DA1SB-068M-0201-SO	Benzo(b)fluoranthene	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	Benzo(g,h,i)perylene	22	400	22	ug/kg	UJ	H, C
DA1SB-068M-0201-SO	Benzo(k)fluoranthene	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	Benzoic acid	290	990	290	ug/kg	UJ	H
DA1SB-068M-0201-SO	Benzyl alcohol	84	1000	84	ug/kg	R	C
DA1SB-068M-0201-SO	Bis(2-chloroethoxy)methane	23	400	23	ug/kg	UJ	H
DA1SB-068M-0201-SO	Bis(2-chloroethyl) ether	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	Bis(2-chloroisopropyl) ether	30	400	30	ug/kg	UJ	H
DA1SB-068M-0201-SO	Bis(2-ethylhexyl) phthalate	88	1000	88	ug/kg	UJ	H
DA1SB-068M-0201-SO	Butylbenzyl phthalate	74	400	74	ug/kg	UJ	H
DA1SB-068M-0201-SO	Carbazole	28	400	28	ug/kg	UJ	H
DA1SB-068M-0201-SO	Chrysene	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	Dibenzo(a,h)anthracene	22	400	22	ug/kg	UJ	H
DA1SB-068M-0201-SO	Dibenzofuran	24	400	24	ug/kg	UJ	H
DA1SB-068M-0201-SO	Diethyl phthalate	65	400	65	ug/kg	UJ	H
DA1SB-068M-0201-SO	Dimethyl phthalate	64	400	64	ug/kg	UJ	H
DA1SB-068M-0201-SO	Di-n-butyl phthalate	85	400	80	ug/kg	J-	H
DA1SB-068M-0201-SO	Di-n-octyl phthalate	60	400	60	ug/kg	UJ	H
DA1SB-068M-0201-SO	Fluoranthene	26	400	26	ug/kg	UJ	H
DA1SB-068M-0201-SO	Fluorene	25	400	25	ug/kg	UJ	H
DA1SB-068M-0201-SO	Hexachlorobenzene	28	400	28	ug/kg	UJ	H
DA1SB-068M-0201-SO	Hexachlorobutadiene	63	400	63	ug/kg	UJ	H
DA1SB-068M-0201-SO	Hexachlorocyclopentadiene	52	400	52	ug/kg	R	C
DA1SB-068M-0201-SO	Hexachloroethane	33	400	33	ug/kg	UJ	H
DA1SB-068M-0201-SO	Indeno(1,2,3-cd)pyrene	23	400	23	ug/kg	UJ	H, C
DA1SB-068M-0201-SO	Isophorone	50	400	50	ug/kg	UJ	H
DA1SB-068M-0201-SO	Naphthalene	21	400	21	ug/kg	UJ	H
DA1SB-068M-0201-SO	Nitrobenzene	60	400	60	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-068M-0201-SO	N-Nitroso-di-n-propylamine	71	400	71	ug/kg	UJ	H
DA1SB-068M-0201-SO	N-Nitrosodiphenylamine	50	810	50	ug/kg	UJ	H
DA1SB-068M-0201-SO	Pentachlorophenol	240	1000	240	ug/kg	UJ	H
DA1SB-068M-0201-SO	Phenanthrene	26	400	26	ug/kg	UJ	H
DA1SB-068M-0201-SO	Phenol	160	500	160	ug/kg	UJ	H
DA1SB-068M-0201-SO	Pyrene	26	400	26	ug/kg	UJ	H
DA1SB-068M-0201-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-068M-0201-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
DA1SB-068M-0201-SO	2,4,6-Trinitrotoluene	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-068M-0201-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
DA1SB-068M-0201-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
DA1SB-068M-0201-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-068M-0201-SO	2-Nitrotoluene	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-068M-0201-SO	3,5-Dinitroaniline	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-068M-0201-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-068M-0201-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-068M-0201-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-068M-0201-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-068M-0201-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
DA1SB-068M-0201-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-068M-0201-SO	Nitroguanidine	0.06	0.16	0.06	mg/kg	UJ	H, *III
DA1SB-068M-0201-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-068M-0201-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-068M-0201-SO	Tetryl	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-070D-0201-SO	2-Butanone	120	580	120	ug/kg	UJ	Q
DA1SB-070D-0201-SO	2-Hexanone	79	580	79	ug/kg	UJ	Q
DA1SB-070D-0201-SO	Acetone	73	1200	73	ug/kg	UJ	Q
DA1SB-070M-0204-SO	Mercury	0.01	0.008	0.0024	mg/kg	J-	A
DA1SB-070M-0204-SO	Aluminum	12900	0.24	0.081	mg/kg	J-	Q
DA1SB-070M-0204-SO	Antimony	0.57	0.55	0.16	mg/kg	J-	Q
DA1SB-070M-0204-SO	Arsenic	10.2	0.91	0.26	mg/kg	J-	Q, A
DA1SB-070M-0204-SO	Beryllium	0.46	0.024	0.0081	mg/kg	J-	A
DA1SB-070M-0204-SO	Cadmium	0.08	0.08	0.08	mg/kg	UJ	C, B, Q, $
DA1SB-070M-0204-SO	Calcium	30200	1	0.12	mg/kg	J-	A
DA1SB-070M-0204-SO	Chromium	58.3	0.13	0.039	mg/kg	J-	Q, A
DA1SB-070M-0204-SO	Cobalt	9.8	0.099	0.03	mg/kg	J-	Q, A
DA1SB-070M-0204-SO	Copper	17.3	0.41	0.12	mg/kg	J-	A
DA1SB-070M-0204-SO	Lead	10.9	0.28	0.081	mg/kg	J-	A
DA1SB-070M-0204-SO	Magnesium	8010	0.81	0.24	mg/kg	J-	A
DA1SB-070M-0204-SO	Manganese	311	0.1	0.032	mg/kg	J-	Q
DA1SB-070M-0204-SO	Nickel	24.1	0.12	0.037	mg/kg	J-	Q, A
DA1SB-070M-0204-SO	Potassium	1860	37	11	mg/kg	J-	Q
DA1SB-070M-0204-SO	Selenium	0.43	0.85	0.14	mg/kg	J-	Q
DA1SB-070M-0204-SO	Silver	0.034	0.11	0.034	mg/kg	UJ	Q
DA1SB-070M-0204-SO	Sodium	78.9	13	4.1	mg/kg	J-	C, Q
DA1SB-070M-0204-SO	Thallium	1.8	0.28	0.081	mg/kg	J-	Q
DA1SB-070M-0204-SO	Vanadium	18.9	0.069	0.022	mg/kg	J-	Q, A
DA1SB-070M-0204-SO	Zinc	51.2	0.24	0.081	mg/kg	J-	Q, A
DA1SB-070M-0204-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-070M-0204-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
DA1SB-070M-0204-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-070M-0204-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	UJ	H
DA1SB-070M-0204-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-070M-0204-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-070M-0204-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-070M-0204-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-070M-0204-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-070M-0204-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H, L
DA1SB-070M-0204-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-070M-0204-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-070M-0204-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	UJ	H
DA1SB-070M-0204-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-070M-0204-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-070M-0204-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-070M-0204-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-072M-0204-SO	Mercury	0.037	0.0079	0.0024	mg/kg	J-	A
DA1SB-072M-0204-SO	Aluminum	6790	0.24	0.08	mg/kg	J-	Q
DA1SB-072M-0204-SO	Antimony	7.6	0.54	0.16	mg/kg	J-	Q
DA1SB-072M-0204-SO	Arsenic	10.7	0.91	0.26	mg/kg	J-	Q, A
DA1SB-072M-0204-SO	Beryllium	0.24	0.024	0.008	mg/kg	J-	C, A
DA1SB-072M-0204-SO	Cadmium	0.2	0.2	0.2	mg/kg	UJ	C, B, Q, $
DA1SB-072M-0204-SO	Calcium	1060	1	0.12	mg/kg	J-	A
DA1SB-072M-0204-SO	Chromium	589	0.13	0.038	mg/kg	J-	Q, A
DA1SB-072M-0204-SO	Cobalt	5.9	0.099	0.03	mg/kg	J-	Q, A
DA1SB-072M-0204-SO	Copper	26.5	0.4	0.12	mg/kg	J-	A
DA1SB-072M-0204-SO	Lead	13.9	0.28	0.08	mg/kg	J-	A
DA1SB-072M-0204-SO	Magnesium	1750	0.8	0.24	mg/kg	J-	A
DA1SB-072M-0204-SO	Manganese	342	0.1	0.032	mg/kg	J-	Q
DA1SB-072M-0204-SO	Nickel	16	0.12	0.036	mg/kg	J-	Q, A
DA1SB-072M-0204-SO	Potassium	1330	36	11	mg/kg	J-	Q
DA1SB-072M-0204-SO	Selenium	0.68	0.85	0.14	mg/kg	J-	Q
DA1SB-072M-0204-SO	Silver	0.034	0.11	0.034	mg/kg	UJ	Q
DA1SB-072M-0204-SO	Sodium	115	13	4	mg/kg	J-	C, Q
DA1SB-072M-0204-SO	Thallium	1.3	0.28	0.08	mg/kg	J-	Q
DA1SB-072M-0204-SO	Vanadium	13.3	0.068	0.022	mg/kg	J-	Q, A
DA1SB-072M-0204-SO	Zinc	63.9	0.24	0.08	mg/kg	J-	Q, A
DA1SB-072M-0204-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-072M-0204-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
DA1SB-072M-0204-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-072M-0204-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	UJ	H
DA1SB-072M-0204-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-072M-0204-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-072M-0204-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-072M-0204-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-072M-0204-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-072M-0204-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H, L
DA1SB-072M-0204-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-072M-0204-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-072M-0204-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	UJ	H
DA1SB-072M-0204-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-072M-0204-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-072M-0204-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-072M-0204-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
DA1SB-074M-0202-SO	Aluminum	5440	0.24	0.081	mg/kg	J-	Q, A
DA1SB-074M-0202-SO	Antimony	2.7	1.4	0.4	mg/kg	J-	C, E, Q, *III
DA1SB-074M-0202-SO	Arsenic	6	0.91	0.26	mg/kg	J-	Q

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SB-074M-0202-SO	Barium	31.5	0.054	0.016	mg/kg	J-	A
DA1SB-074M-0202-SO	Beryllium	0.24	0.024	0.0081	mg/kg	J	C
DA1SB-074M-0202-SO	Cadmium	0.31	0.11	0.03	mg/kg	J-	C, E, Q, A
DA1SB-074M-0202-SO	Chromium	176	0.13	0.038	mg/kg	J-	A
DA1SB-074M-0202-SO	Cobalt	6.8	0.25	0.076	mg/kg	J-	Q, *III, A
DA1SB-074M-0202-SO	Copper	12.2	1	0.3	mg/kg	J-	E, A
DA1SB-074M-0202-SO	Iron	13300	2	0.6	mg/kg	J-	Q, A
DA1SB-074M-0202-SO	Lead	7.2	0.28	0.081	mg/kg	J-	Q, *III, A
DA1SB-074M-0202-SO	Magnesium	1790	0.81	0.24	mg/kg	J-	Q, A
DA1SB-074M-0202-SO	Manganese	148	0.1	0.032	mg/kg	J-	A
DA1SB-074M-0202-SO	Nickel	16.8	0.12	0.036	mg/kg	J-	Q, A
DA1SB-074M-0202-SO	Selenium	0.14	0.85	0.14	mg/kg	UJ	B, Q
DA1SB-074M-0202-SO	Silver	0.086	0.28	0.086	mg/kg	UJ	Q
DA1SB-074M-0202-SO	Sodium	59.2	13	4	mg/kg	J	C, E
DA1SB-074M-0202-SO	Thallium	0.65	0.7	0.2	mg/kg	J-	B, Q
DA1SB-074M-0202-SO	Vanadium	10.4	0.068	0.022	mg/kg	J-	A
DA1SB-074M-0202-SO	Zinc	33	0.24	0.081	mg/kg	J	Q, A
DA1SB-074M-0202-SO	Mercury	0.01	0.008	0.0024	mg/kg	J-	B, E, A
DA1SB-074M-0202-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SB-074M-0202-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
DA1SB-074M-0202-SO	2,4,6-Trinitrotoluene	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-074M-0202-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	UJ	H, C
DA1SB-074M-0202-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H, C
DA1SB-074M-0202-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SB-074M-0202-SO	2-Nitrotoluene	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-074M-0202-SO	3,5-Dinitroaniline	0.091	0.44	0.091	mg/kg	UJ	H
DA1SB-074M-0202-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-074M-0202-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SB-074M-0202-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SB-074M-0202-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SB-074M-0202-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	UJ	H
DA1SB-074M-0202-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H, C
DA1SB-074M-0202-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SB-074M-0202-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SB-074M-0202-SO	Tetryl	0.091	0.44	0.091	mg/kg	UJ	H
DA1SS-050M-0201-SO	Mercury	0.037	0.008	0.0024	mg/kg	J-	A
DA1SS-050M-0201-SO	Aluminum	10900	0.24	0.081	mg/kg	J-	Q
DA1SS-050M-0201-SO	Antimony	1.2	0.55	0.16	mg/kg	J-	Q
DA1SS-050M-0201-SO	Arsenic	9.1	0.92	0.26	mg/kg	J-	Q, A
DA1SS-050M-0201-SO	Beryllium	0.38	0.024	0.0081	mg/kg	J-	A
DA1SS-050M-0201-SO	Cadmium	2.6	0.043	0.012	mg/kg	J-	Q
DA1SS-050M-0201-SO	Calcium	2500	1	0.12	mg/kg	J-	A
DA1SS-050M-0201-SO	Chromium	110	0.13	0.039	mg/kg	J-	Q, A
DA1SS-050M-0201-SO	Cobalt	7.6	0.1	0.031	mg/kg	J-	Q, A
DA1SS-050M-0201-SO	Copper	188	0.41	0.12	mg/kg	J-	A
DA1SS-050M-0201-SO	Lead	23.4	0.28	0.081	mg/kg	J-	A
DA1SS-050M-0201-SO	Magnesium	2860	0.81	0.24	mg/kg	J-	A
DA1SS-050M-0201-SO	Manganese	407	0.1	0.033	mg/kg	J-	Q
DA1SS-050M-0201-SO	Nickel	18.4	0.12	0.037	mg/kg	J-	Q, A
DA1SS-050M-0201-SO	Potassium	814	37	11	mg/kg	J-	Q
DA1SS-050M-0201-SO	Selenium	0.75	0.85	0.14	mg/kg	J-	Q
DA1SS-050M-0201-SO	Silver	0.035	0.11	0.035	mg/kg	UJ	Q
DA1SS-050M-0201-SO	Sodium	31.8	13	4.1	mg/kg	J-	C, Q

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
DA1SS-050M-0201-SO	Thallium	1.6	0.28	0.081	mg/kg	J-	Q
DA1SS-050M-0201-SO	Vanadium	16.1	0.069	0.022	mg/kg	J-	Q, A
DA1SS-050M-0201-SO	Zinc	191	0.24	0.081	mg/kg	J-	Q, A
DA1SS-050M-0201-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
DA1SS-050M-0201-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
DA1SS-050M-0201-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SS-050M-0201-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	UJ	H, Q
DA1SS-050M-0201-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SS-050M-0201-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
DA1SS-050M-0201-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
DA1SS-050M-0201-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
DA1SS-050M-0201-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SS-050M-0201-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
DA1SS-050M-0201-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
DA1SS-050M-0201-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
DA1SS-050M-0201-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	UJ	H
DA1SS-050M-0201-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
DA1SS-050M-0201-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
DA1SS-050M-0201-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
DA1SS-050M-0201-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
DA1SS-054M-0201-SO	Aluminum	8490	0.25	0.082	mg/kg	J-	Q, A
DA1SS-054M-0201-SO	Antimony	0.92	0.55	0.16	mg/kg	J-	E, Q, *III
DA1SS-054M-0201-SO	Arsenic	8.4	0.92	0.27	mg/kg	J-	Q
DA1SS-054M-0201-SO	Barium	52.7	0.055	0.016	mg/kg	J-	A
DA1SS-054M-0201-SO	Cadmium	0.52	0.043	0.012	mg/kg	J-	E, Q, A
DA1SS-054M-0201-SO	Chromium	56.2	0.13	0.039	mg/kg	J-	A
DA1SS-054M-0201-SO	Cobalt	8.9	0.1	0.031	mg/kg	J-	Q, *III, A
DA1SS-054M-0201-SO	Copper	16.4	0.41	0.12	mg/kg	J-	E, A
DA1SS-054M-0201-SO	Iron	19400	2	0.61	mg/kg	J-	Q, A
DA1SS-054M-0201-SO	Lead	11.6	0.29	0.082	mg/kg	J-	Q, *III, A
DA1SS-054M-0201-SO	Magnesium	1940	0.82	0.25	mg/kg	J-	Q, A
DA1SS-054M-0201-SO	Manganese	398	0.1	0.033	mg/kg	J-	A
DA1SS-054M-0201-SO	Nickel	16.7	0.12	0.037	mg/kg	J-	Q, A
DA1SS-054M-0201-SO	Selenium	2.4	0.86	0.14	mg/kg	J	C, Q
DA1SS-054M-0201-SO	Silver	0.035	0.11	0.035	mg/kg	UJ	Q
DA1SS-054M-0201-SO	Sodium	62.1	13	4.1	mg/kg	J	C, E
DA1SS-054M-0201-SO	Thallium	0.38	0.29	0.082	mg/kg	J-	B, Q
DA1SS-054M-0201-SO	Vanadium	15.6	0.07	0.022	mg/kg	J-	A
DA1SS-054M-0201-SO	Zinc	121	0.25	0.082	mg/kg	J	Q, A
DA1SS-054M-0201-SO	Mercury	0.032	0.0081	0.0025	mg/kg	J-	E, A
DA1SS-054M-0201-SO	2,6-Dinitrotoluene	0.071	0.51	0.071	mg/kg	UJ	C
SCSB-037M-0001-SO	Aluminum	14800	0.49	0.16	mg/kg	J-	Q, A

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Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSB-037M-0001-SO	Antimony	0.93	1.1	0.32	mg/kg	J-	Q, A
SCSB-037M-0001-SO	Arsenic	182	1.8	0.53	mg/kg	J-	Q, *III, A
SCSB-037M-0001-SO	Barium	932	0.11	0.032	mg/kg	J-	A
SCSB-037M-0001-SO	Beryllium	3.9	0.049	0.016	mg/kg	J-	A
SCSB-037M-0001-SO	Cadmium	1.6	0.085	0.024	mg/kg	J-	Q, *III
SCSB-037M-0001-SO	Calcium	13900	2	0.24	mg/kg	J-	A
SCSB-037M-0001-SO	Chromium	112	0.26	0.077	mg/kg	J-	Q, A
SCSB-037M-0001-SO	Cobalt	9	0.2	0.061	mg/kg	J-	Q, *III, A
SCSB-037M-0001-SO	Copper	95.7	0.81	0.24	mg/kg	J-	Q, *III, A
SCSB-037M-0001-SO	Iron	41500	4.1	1.2	mg/kg	J-	A
SCSB-037M-0001-SO	Lead	325	0.57	0.16	mg/kg	J-	Q, *III, A
SCSB-037M-0001-SO	Magnesium	3050	1.6	0.49	mg/kg	J-	Q, A
SCSB-037M-0001-SO	Manganese	743	0.2	0.065	mg/kg	J-	Q, A
SCSB-037M-0001-SO	Nickel	35.7	0.25	0.073	mg/kg	J-	Q, *III, A
SCSB-037M-0001-SO	Potassium	1020	37	11	mg/kg	J-	Q
SCSB-037M-0001-SO	Selenium	3.1	1.7	0.28	mg/kg	J-	Q
SCSB-037M-0001-SO	Sodium	178	13	4.1	mg/kg	J-	Q
SCSB-037M-0001-SO	Thallium	5.5	0.57	0.16	mg/kg	J-	Q, *III, E
SCSB-037M-0001-SO	Vanadium	41	0.14	0.045	mg/kg	J-	Q, A, E
SCSB-037M-0001-SO	Zinc	298	0.49	0.16	mg/kg	J-	Q, *III, A
SCSB-037M-0001-SO	Mercury	0.24	0.008	0.0024	mg/kg	J-	A
SCSB-037M-0001-SO	2,4-Dinitrophenol	700	2000	700	ug/kg	UJ	C
SCSB-037M-0001-SO	3,3'-Dichlorobenzidine	150	510	150	ug/kg	UJ	C
SCSB-037M-0001-SO	Benzyl alcohol	84	1000	84	ug/kg	UJ	C
SCSB-037M-0001-SO	Bis(2-ethylhexyl) phthalate	88	1000	88	ug/kg	U	B
SCSB-037M-0001-SO	Hexachlorocyclopentadiene	53	400	53	ug/kg	UJ	C
SCSB-037M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
SCSB-037M-0001-SO	1,3-Dinitrobenzene	0.081	0.44	0.081	mg/kg	UJ	H
SCSB-037M-0001-SO	2,4,6-Trinitrotoluene	0.091	0.44	0.091	mg/kg	UJ	H
SCSB-037M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSB-037M-0001-SO	2,6-Dinitrotoluene	0.071	0.51	0.071	mg/kg	R	D
SCSB-037M-0001-SO	2-Amino-4,6-dinitrotoluene	0.051	0.44	0.051	mg/kg	UJ	H
SCSB-037M-0001-SO	2-Nitrotoluene	0.091	0.44	0.091	mg/kg	UJ	H
SCSB-037M-0001-SO	3,5-Dinitroaniline	0.091	0.44	0.091	mg/kg	UJ	H
SCSB-037M-0001-SO	3-Nitrotoluene	0.071	0.44	0.071	mg/kg	UJ	H
SCSB-037M-0001-SO	4-Amino-2,6-dinitrotoluene	0.071	0.44	0.071	mg/kg	UJ	H
SCSB-037M-0001-SO	4-Nitrotoluene	0.071	0.51	0.071	mg/kg	UJ	H
SCSB-037M-0001-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
SCSB-037M-0001-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSB-037M-0001-SO	Nitroglycerin	0.51	1.5	0.51	mg/kg	UJ	H
SCSB-037M-0001-SO	PETN	0.51	1.5	0.51	mg/kg	UJ	H
SCSB-037M-0001-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
SCSB-037M-0001-SO	Tetryl	0.091	0.44	0.091	mg/kg	UJ	H
SCSB-038M-0005-SO	Aluminum	10900	0.24	0.08	mg/kg	J-	Q, A
SCSB-038M-0005-SO	Antimony	0.63	0.54	0.16	mg/kg	J-	Q, A
SCSB-038M-0005-SO	Arsenic	6.1	0.91	0.26	mg/kg	J-	Q, *III, A
SCSB-038M-0005-SO	Barium	43.8	0.054	0.016	mg/kg	J-	A
SCSB-038M-0005-SO	Beryllium	0.38	0.024	0.008	mg/kg	J-	A
SCSB-038M-0005-SO	Cadmium	0.012	0.042	0.012	mg/kg	UJ	C, Q, *III
SCSB-038M-0005-SO	Calcium	10900	1	0.12	mg/kg	J-	A
SCSB-038M-0005-SO	Chromium	156	0.13	0.038	mg/kg	J-	Q, A
SCSB-038M-0005-SO	Cobalt	9	0.099	0.03	mg/kg	J-	Q, *III, A
SCSB-038M-0005-SO	Copper	18.6	0.4	0.12	mg/kg	J-	Q, *III, A

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSB-038M-0005-SO	Iron	29600	2	0.6	mg/kg	J-	A
SCSB-038M-0005-SO	Lead	5.3	0.28	0.08	mg/kg	J-	Q, *III, A
SCSB-038M-0005-SO	Magnesium	6840	0.8	0.24	mg/kg	J-	Q, A
SCSB-038M-0005-SO	Manganese	369	0.1	0.032	mg/kg	J-	Q, A
SCSB-038M-0005-SO	Nickel	20.4	0.12	0.036	mg/kg	J-	Q, *III, A
SCSB-038M-0005-SO	Potassium	2020	36	11	mg/kg	J-	Q
SCSB-038M-0005-SO	Selenium	0.6	0.85	0.14	mg/kg	J-	Q
SCSB-038M-0005-SO	Sodium	134	13	4	mg/kg	J-	Q
SCSB-038M-0005-SO	Thallium	1.7	0.28	0.08	mg/kg	J-	Q, *III, E, E
SCSB-038M-0005-SO	Vanadium	14.3	0.068	0.022	mg/kg	J-	Q, A, E
SCSB-038M-0005-SO	Zinc	48.1	0.24	0.08	mg/kg	J-	Q, *III, A
SCSB-038M-0005-SO	Mercury	0.0079	0.0079	0.0024	mg/kg	J-	A
SCSB-038M-0005-SO	2,4-Dinitrophenol	690	2000	690	ug/kg	UJ	C
SCSB-038M-0005-SO	3,3'-Dichlorobenzidine	150	500	150	ug/kg	UJ	C
SCSB-038M-0005-SO	Benzyl alcohol	84	1000	84	ug/kg	UJ	C
SCSB-038M-0005-SO	Hexachlorocyclopentadiene	52	400	52	ug/kg	UJ	C
SCSB-038M-0005-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
SCSB-038M-0005-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
SCSB-038M-0005-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-038M-0005-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSB-038M-0005-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
SCSB-038M-0005-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
SCSB-038M-0005-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-038M-0005-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-038M-0005-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSB-038M-0005-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSB-038M-0005-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
SCSB-038M-0005-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
SCSB-038M-0005-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSB-038M-0005-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
SCSB-038M-0005-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
SCSB-038M-0005-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
SCSB-038M-0005-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-042M-0003-SO	Aluminum	14000	0.61	0.2	mg/kg	J-	Q, A
SCSB-042M-0003-SO	Antimony	0.4	1.4	0.4	mg/kg	R	Q
SCSB-042M-0003-SO	Arsenic	15.4	2.3	0.66	mg/kg	J-	Q, *III, A
SCSB-042M-0003-SO	Barium	69.3	0.14	0.04	mg/kg	J-	A
SCSB-042M-0003-SO	Beryllium	0.49	0.061	0.02	mg/kg	J-	C, A
SCSB-042M-0003-SO	Cadmium	0.03	0.11	0.03	mg/kg	UJ	C, Q, *III
SCSB-042M-0003-SO	Calcium	5360	2.5	0.3	mg/kg	J-	A
SCSB-042M-0003-SO	Chromium	19.8	0.32	0.096	mg/kg	J-	Q, A
SCSB-042M-0003-SO	Cobalt	13	0.25	0.076	mg/kg	J-	Q, *III, A
SCSB-042M-0003-SO	Copper	21	1	0.3	mg/kg	J-	Q, *III, A
SCSB-042M-0003-SO	Iron	35600	5.1	1.5	mg/kg	J-	A
SCSB-042M-0003-SO	Lead	11.2	0.71	0.2	mg/kg	J-	Q, *III, A
SCSB-042M-0003-SO	Magnesium	5490	2	0.61	mg/kg	J-	Q, A
SCSB-042M-0003-SO	Manganese	451	0.25	0.081	mg/kg	J-	Q, A
SCSB-042M-0003-SO	Nickel	30.7	0.31	0.091	mg/kg	J-	Q, *III, A
SCSB-042M-0003-SO	Potassium	1880	36	11	mg/kg	J-	Q
SCSB-042M-0003-SO	Selenium	0.35	2.1	0.35	mg/kg	UJ	Q
SCSB-042M-0003-SO	Sodium	92	13	4	mg/kg	J-	C, Q
SCSB-042M-0003-SO	Thallium	2.1	0.71	0.2	mg/kg	J-	C, Q, *III, E
SCSB-042M-0003-SO	Vanadium	20.5	0.17	0.056	mg/kg	J-	Q, A, E

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSB-042M-0003-SO	Zinc	67	0.61	0.2	mg/kg	J-	Q, *III, A
SCSB-042M-0003-SO	Mercury	0.008	0.008	0.0024	mg/kg	J-	A
SCSB-042M-0003-SO	1,2,4-Trichlorobenzene	21	400	21	ug/kg	UJ	H
SCSB-042M-0003-SO	1,2-Dichlorobenzene	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	1,3-Dichlorobenzene	20	400	20	ug/kg	UJ	H
SCSB-042M-0003-SO	1,4-Dichlorobenzene	19	400	19	ug/kg	UJ	H
SCSB-042M-0003-SO	2,4,5-Trichlorophenol	130	510	130	ug/kg	UJ	H
SCSB-042M-0003-SO	2,4,6-Trichlorophenol	130	510	130	ug/kg	UJ	H
SCSB-042M-0003-SO	2,4-Dichlorophenol	120	510	120	ug/kg	UJ	H
SCSB-042M-0003-SO	2,4-Dimethylphenol	100	400	100	ug/kg	UJ	H
SCSB-042M-0003-SO	2,4-Dinitrophenol	700	2000	700	ug/kg	UJ	H
SCSB-042M-0003-SO	2,4-Dinitrotoluene	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	2,6-Dinitrotoluene	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	2-Chloronaphthalene	23	400	23	ug/kg	UJ	H
SCSB-042M-0003-SO	2-Chlorophenol	340	510	340	ug/kg	UJ	H
SCSB-042M-0003-SO	2-Methyl-4,6-dinitrophenol	270	1000	270	ug/kg	UJ	H
SCSB-042M-0003-SO	2-Methylnaphthalene	49	400	25	ug/kg	J-	H
SCSB-042M-0003-SO	2-Methylphenol	420	1000	420	ug/kg	UJ	H
SCSB-042M-0003-SO	2-Nitroaniline	23	400	23	ug/kg	UJ	H
SCSB-042M-0003-SO	2-Nitrophenol	280	510	280	ug/kg	UJ	H
SCSB-042M-0003-SO	3,3'-Dichlorobenzidine	150	510	150	ug/kg	UJ	H
SCSB-042M-0003-SO	3-Nitroaniline	22	1000	22	ug/kg	UJ	H
SCSB-042M-0003-SO	4-Bromophenyl phenyl ether	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	4-Chloro-3-methylphenol	380	510	380	ug/kg	UJ	H
SCSB-042M-0003-SO	4-Chloroaniline	39	400	39	ug/kg	UJ	H
SCSB-042M-0003-SO	4-Chlorophenyl phenyl ether	26	400	26	ug/kg	UJ	H
SCSB-042M-0003-SO	4-Methylphenol	660	2000	660	ug/kg	UJ	H
SCSB-042M-0003-SO	4-Nitroaniline	30	1000	30	ug/kg	UJ	H, C
SCSB-042M-0003-SO	4-Nitrophenol	400	1000	400	ug/kg	UJ	H
SCSB-042M-0003-SO	Acenaphthene	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	Acenaphthylene	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	Anthracene	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzo(a)anthracene	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzo(a)pyrene	23	400	23	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzo(b)fluoranthene	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzo(g,h,i)perylene	22	400	22	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzo(k)fluoranthene	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzoic acid	290	990	290	ug/kg	UJ	H
SCSB-042M-0003-SO	Benzyl alcohol	84	1000	84	ug/kg	UJ	H, C
SCSB-042M-0003-SO	Bis(2-chloroethoxy)methane	23	400	23	ug/kg	UJ	H
SCSB-042M-0003-SO	Bis(2-chloroethyl) ether	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	Bis(2-chloroisopropyl) ether	30	400	30	ug/kg	UJ	H
SCSB-042M-0003-SO	Bis(2-ethylhexyl) phthalate	88	1000	88	ug/kg	UJ	H
SCSB-042M-0003-SO	Butylbenzyl phthalate	74	400	74	ug/kg	UJ	H
SCSB-042M-0003-SO	Carbazole	28	400	28	ug/kg	UJ	H
SCSB-042M-0003-SO	Chrysene	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	Dibenzo(a,h)anthracene	22	400	22	ug/kg	UJ	H
SCSB-042M-0003-SO	Dibenzofuran	24	400	24	ug/kg	UJ	H
SCSB-042M-0003-SO	Diethyl phthalate	65	400	65	ug/kg	UJ	H
SCSB-042M-0003-SO	Dimethyl phthalate	64	400	64	ug/kg	UJ	H
SCSB-042M-0003-SO	Di-n-butyl phthalate	100	400	80	ug/kg	J-	H
SCSB-042M-0003-SO	Di-n-octyl phthalate	60	400	60	ug/kg	UJ	H
SCSB-042M-0003-SO	Fluoranthene	26	400	26	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSB-042M-0003-SO	Fluorene	25	400	25	ug/kg	UJ	H
SCSB-042M-0003-SO	Hexachlorobenzene	28	400	28	ug/kg	UJ	H
SCSB-042M-0003-SO	Hexachlorobutadiene	63	400	63	ug/kg	UJ	H
SCSB-042M-0003-SO	Hexachlorocyclopentadiene	53	400	53	ug/kg	UJ	H
SCSB-042M-0003-SO	Hexachloroethane	33	400	33	ug/kg	UJ	H
SCSB-042M-0003-SO	Indeno(1,2,3-cd)pyrene	23	400	23	ug/kg	UJ	H
SCSB-042M-0003-SO	Isophorone	51	400	51	ug/kg	UJ	H
SCSB-042M-0003-SO	Naphthalene	35	400	21	ug/kg	J-	H
SCSB-042M-0003-SO	Nitrobenzene	60	400	60	ug/kg	UJ	H
SCSB-042M-0003-SO	N-Nitroso-di-n-propylamine	71	400	71	ug/kg	UJ	H
SCSB-042M-0003-SO	N-Nitrosodiphenylamine	51	810	51	ug/kg	UJ	H
SCSB-042M-0003-SO	Pentachlorophenol	240	1000	240	ug/kg	UJ	H
SCSB-042M-0003-SO	Phenanthrene	34	400	26	ug/kg	J-	H
SCSB-042M-0003-SO	Phenol	160	510	160	ug/kg	UJ	H
SCSB-042M-0003-SO	Pyrene	26	400	26	ug/kg	UJ	H
SCSB-042M-0003-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
SCSB-042M-0003-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
SCSB-042M-0003-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-042M-0003-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSB-042M-0003-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
SCSB-042M-0003-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
SCSB-042M-0003-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-042M-0003-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-042M-0003-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSB-042M-0003-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H, C
SCSB-042M-0003-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
SCSB-042M-0003-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
SCSB-042M-0003-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSB-042M-0003-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
SCSB-042M-0003-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
SCSB-042M-0003-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
SCSB-042M-0003-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-048D-0001-SO	Carbon disulfide	16	110	16	ug/kg	UJ	C
SCSB-048D-0001-SO	Dibromochloromethane	8.5	53	8.5	ug/kg	UJ	C
SCSB-048D-0001-SO	trans-1,3-Dichloropropene	7.4	110	7.4	ug/kg	UJ	C
SCSB-048M-0001-SO	Aluminum	13000	0.24	0.081	mg/kg	J-	Q, A
SCSB-048M-0001-SO	Antimony	1.5	0.55	0.16	mg/kg	J-	Q, *III
SCSB-048M-0001-SO	Arsenic	15	0.91	0.26	mg/kg	J	E
SCSB-048M-0001-SO	Barium	137	0.055	0.016	mg/kg	J-	A
SCSB-048M-0001-SO	Cadmium	0.012	0.043	0.012	mg/kg	UJ	C, Q, *III
SCSB-048M-0001-SO	Calcium	37100	1	0.12	mg/kg	J-	A
SCSB-048M-0001-SO	Chromium	109	0.13	0.038	mg/kg	J-	A
SCSB-048M-0001-SO	Cobalt	6	0.099	0.03	mg/kg	J-	Q
SCSB-048M-0001-SO	Copper	44.8	0.4	0.12	mg/kg	J-	Q
SCSB-048M-0001-SO	Lead	34.5	0.28	0.081	mg/kg	J+	Q, *III
SCSB-048M-0001-SO	Magnesium	3580	0.81	0.24	mg/kg	J-	A
SCSB-048M-0001-SO	Manganese	1150	0.1	0.032	mg/kg	J-	A
SCSB-048M-0001-SO	Nickel	88.1	0.12	0.036	mg/kg	J-	Q, A
SCSB-048M-0001-SO	Thallium	1.6	0.28	0.081	mg/kg	J-	E, Q
SCSB-048M-0001-SO	Zinc	41.3	0.24	0.081	mg/kg	J-	Q, A
SCSB-048M-0001-SO	Hexavalent Chromium	1.9	6.5	1.9	mg/kg	UJ	C, Q
SCSB-048M-0001-SO	Endrin	2	12	2	ug/kg	UJ	C
SCSB-048M-0001-SO	1,2,4-Trichlorobenzene	21	400	21	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSB-048M-0001-SO	1,2-Dichlorobenzene	24	400	24	ug/kg	UJ	H
SCSB-048M-0001-SO	1,3-Dichlorobenzene	20	400	20	ug/kg	UJ	H
SCSB-048M-0001-SO	1,4-Dichlorobenzene	19	400	19	ug/kg	UJ	H
SCSB-048M-0001-SO	2,4,5-Trichlorophenol	130	500	130	ug/kg	UJ	H, C
SCSB-048M-0001-SO	2,4,6-Trichlorophenol	130	500	130	ug/kg	UJ	H
SCSB-048M-0001-SO	2,4-Dichlorophenol	120	500	120	ug/kg	UJ	H
SCSB-048M-0001-SO	2,4-Dimethylphenol	100	400	100	ug/kg	UJ	H
SCSB-048M-0001-SO	2,4-Dinitrophenol	700	2000	700	ug/kg	R	C
SCSB-048M-0001-SO	2,4-Dinitrotoluene	24	400	24	ug/kg	UJ	H
SCSB-048M-0001-SO	2,6-Dinitrotoluene	24	400	24	ug/kg	UJ	H
SCSB-048M-0001-SO	2-Chloronaphthalene	23	400	23	ug/kg	UJ	H
SCSB-048M-0001-SO	2-Chlorophenol	340	500	340	ug/kg	UJ	H
SCSB-048M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	270	ug/kg	R	C
SCSB-048M-0001-SO	2-Methylnaphthalene	490	400	25	ug/kg	J-	H
SCSB-048M-0001-SO	2-Methylphenol	420	1000	420	ug/kg	UJ	H
SCSB-048M-0001-SO	2-Nitroaniline	23	400	23	ug/kg	UJ	H
SCSB-048M-0001-SO	2-Nitrophenol	280	500	280	ug/kg	UJ	H, C
SCSB-048M-0001-SO	3,3'-Dichlorobenzidine	150	500	150	ug/kg	UJ	H
SCSB-048M-0001-SO	3-Nitroaniline	22	1000	22	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Bromophenyl phenyl ether	25	400	25	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Chloro-3-methylphenol	380	500	380	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Chloroaniline	39	400	39	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Chlorophenyl phenyl ether	26	400	26	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Methylphenol	660	2000	660	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Nitroaniline	30	1000	30	ug/kg	UJ	H
SCSB-048M-0001-SO	4-Nitrophenol	400	1000	400	ug/kg	UJ	H, C
SCSB-048M-0001-SO	Acenaphthene	24	400	24	ug/kg	UJ	H
SCSB-048M-0001-SO	Acenaphthylene	34	400	24	ug/kg	J-	H
SCSB-048M-0001-SO	Anthracene	65	400	24	ug/kg	J-	H
SCSB-048M-0001-SO	Benzo(a)anthracene	120	400	25	ug/kg	J-	H
SCSB-048M-0001-SO	Benzo(a)pyrene	150	400	23	ug/kg	J-	H, I
SCSB-048M-0001-SO	Benzo(b)fluoranthene	410	400	25	ug/kg	J-	H, I
SCSB-048M-0001-SO	Benzo(g,h,i)perylene	22	400	22	ug/kg	UJ	H, C, I
SCSB-048M-0001-SO	Benzo(k)fluoranthene	160	400	25	ug/kg	J	H, C, I
SCSB-048M-0001-SO	Benzoic acid	290	2000	290	ug/kg	UJ	H
SCSB-048M-0001-SO	Benzyl alcohol	84	1000	84	ug/kg	UJ	H, C
SCSB-048M-0001-SO	Bis(2-chloroethoxy)methane	23	400	23	ug/kg	UJ	H
SCSB-048M-0001-SO	Bis(2-chloroethyl) ether	25	400	25	ug/kg	UJ	H
SCSB-048M-0001-SO	Bis(2-chloroisopropyl) ether	30	400	30	ug/kg	UJ	H
SCSB-048M-0001-SO	Bis(2-ethylhexyl) phthalate	88	1000	88	ug/kg	UJ	H
SCSB-048M-0001-SO	Butylbenzyl phthalate	74	400	74	ug/kg	UJ	H
SCSB-048M-0001-SO	Carbazole	35	400	28	ug/kg	J-	H
SCSB-048M-0001-SO	Chrysene	180	400	25	ug/kg	J-	H
SCSB-048M-0001-SO	Dibenzo(a,h)anthracene	22	400	22	ug/kg	UJ	H, C, I
SCSB-048M-0001-SO	Dibenzofuran	93	400	24	ug/kg	J-	H
SCSB-048M-0001-SO	Diethyl phthalate	65	400	65	ug/kg	UJ	H
SCSB-048M-0001-SO	Dimethyl phthalate	64	400	64	ug/kg	UJ	H
SCSB-048M-0001-SO	Di-n-butyl phthalate	120	400	80	ug/kg	J-	H
SCSB-048M-0001-SO	Di-n-octyl phthalate	60	400	60	ug/kg	UJ	H
SCSB-048M-0001-SO	Fluoranthene	240	400	26	ug/kg	J-	H
SCSB-048M-0001-SO	Fluorene	41	400	25	ug/kg	J-	H
SCSB-048M-0001-SO	Hexachlorobenzene	28	400	28	ug/kg	UJ	H
SCSB-048M-0001-SO	Hexachlorobutadiene	63	400	63	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSB-048M-0001-SO	Hexachlorocyclopentadiene	52	400	52	ug/kg	R	C
SCSB-048M-0001-SO	Hexachloroethane	33	400	33	ug/kg	UJ	H
SCSB-048M-0001-SO	Indeno(1,2,3-cd)pyrene	49	400	23	ug/kg	J-	H, C, I
SCSB-048M-0001-SO	Isophorone	50	400	50	ug/kg	UJ	H
SCSB-048M-0001-SO	Naphthalene	330	400	21	ug/kg	J-	H
SCSB-048M-0001-SO	Nitrobenzene	60	400	60	ug/kg	UJ	H
SCSB-048M-0001-SO	N-Nitroso-di-n-propylamine	71	400	71	ug/kg	UJ	H
SCSB-048M-0001-SO	N-Nitrosodiphenylamine	50	810	50	ug/kg	UJ	H
SCSB-048M-0001-SO	Pentachlorophenol	240	1000	240	ug/kg	UJ	H
SCSB-048M-0001-SO	Phenanthrene	280	400	26	ug/kg	J-	H
SCSB-048M-0001-SO	Phenol	160	500	160	ug/kg	UJ	H
SCSB-048M-0001-SO	Pyrene	240	400	26	ug/kg	J-	H
SCSB-048M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
SCSB-048M-0001-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
SCSB-048M-0001-SO	2,4,6-Trinitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-048M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSB-048M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
SCSB-048M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
SCSB-048M-0001-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-048M-0001-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
SCSB-048M-0001-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSB-048M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSB-048M-0001-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
SCSB-048M-0001-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
SCSB-048M-0001-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSB-048M-0001-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
SCSB-048M-0001-SO	Nitroguanidine	0.059	0.16	0.059	mg/kg	UJ	H, *III
SCSB-048M-0001-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
SCSB-048M-0001-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
SCSB-048M-0001-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
SCSD-070M-0001-SD	Aluminum	7240	0.61	0.2	mg/kg	J-	Q, A
SCSD-070M-0001-SD	Antimony	8.4	1.4	0.41	mg/kg	J-	Q, *III
SCSD-070M-0001-SD	Arsenic	9.4	2.3	0.66	mg/kg	J	E
SCSD-070M-0001-SD	Barium	231	0.14	0.041	mg/kg	J-	A
SCSD-070M-0001-SD	Cadmium	2.7	0.11	0.031	mg/kg	J-	C, Q, *III
SCSD-070M-0001-SD	Calcium	3240	2.5	0.31	mg/kg	J-	A
SCSD-070M-0001-SD	Chromium	40.9	0.32	0.097	mg/kg	J-	A
SCSD-070M-0001-SD	Cobalt	7.8	0.25	0.076	mg/kg	J-	Q
SCSD-070M-0001-SD	Copper	53.7	1	0.31	mg/kg	J-	Q
SCSD-070M-0001-SD	Lead	104	0.71	0.2	mg/kg	J+	Q, *III
SCSD-070M-0001-SD	Magnesium	2840	2	0.61	mg/kg	J-	A
SCSD-070M-0001-SD	Manganese	512	0.25	0.081	mg/kg	J-	A
SCSD-070M-0001-SD	Nickel	21.1	0.31	0.092	mg/kg	J-	Q, A
SCSD-070M-0001-SD	Thallium	1.2	0.71	0.2	mg/kg	J-	E, Q
SCSD-070M-0001-SD	Zinc	108	0.61	0.2	mg/kg	J-	Q, A
SCSD-070M-0001-SD	Hexavalent Chromium	1.9	6.5	1.9	mg/kg	UJ	C, Q
SCSD-070M-0001-SD	1,2,4-Trichlorobenzene	21	400	21	ug/kg	UJ	H
SCSD-070M-0001-SD	1,2-Dichlorobenzene	44	400	24	ug/kg	J-	H
SCSD-070M-0001-SD	1,3-Dichlorobenzene	20	400	20	ug/kg	UJ	H
SCSD-070M-0001-SD	1,4-Dichlorobenzene	40	400	19	ug/kg	J-	H
SCSD-070M-0001-SD	2,4,5-Trichlorophenol	130	510	130	ug/kg	UJ	H, C
SCSD-070M-0001-SD	2,4,6-Trichlorophenol	130	510	130	ug/kg	UJ	H
SCSD-070M-0001-SD	2,4-Dichlorophenol	120	510	120	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSD-070M-0001-SD	2,4-Dimethylphenol	100	400	100	ug/kg	UJ	H
SCSD-070M-0001-SD	2,4-Dinitrophenol	700	2000	700	ug/kg	R	C
SCSD-070M-0001-SD	2,4-Dinitrotoluene	24	400	24	ug/kg	UJ	H
SCSD-070M-0001-SD	2,6-Dinitrotoluene	24	400	24	ug/kg	UJ	H
SCSD-070M-0001-SD	2-Chloronaphthalene	23	400	23	ug/kg	UJ	H
SCSD-070M-0001-SD	2-Chlorophenol	340	510	340	ug/kg	UJ	H
SCSD-070M-0001-SD	2-Methyl-4,6-dinitrophenol	270	1000	270	ug/kg	R	C
SCSD-070M-0001-SD	2-Methylnaphthalene	43	400	25	ug/kg	J-	H
SCSD-070M-0001-SD	2-Methylphenol	420	1000	420	ug/kg	UJ	H
SCSD-070M-0001-SD	2-Nitroaniline	23	400	23	ug/kg	UJ	H
SCSD-070M-0001-SD	2-Nitrophenol	280	510	280	ug/kg	UJ	H, C
SCSD-070M-0001-SD	3,3'-Dichlorobenzidine	150	510	150	ug/kg	UJ	H
SCSD-070M-0001-SD	3-Nitroaniline	22	1000	22	ug/kg	UJ	H, C
SCSD-070M-0001-SD	4-Bromophenyl phenyl ether	25	400	25	ug/kg	UJ	H
SCSD-070M-0001-SD	4-Chloro-3-methylphenol	380	510	380	ug/kg	UJ	H
SCSD-070M-0001-SD	4-Chloroaniline	39	400	39	ug/kg	UJ	H
SCSD-070M-0001-SD	4-Chlorophenyl phenyl ether	26	400	26	ug/kg	UJ	H
SCSD-070M-0001-SD	4-Methylphenol	660	2000	660	ug/kg	UJ	H
SCSD-070M-0001-SD	4-Nitroaniline	30	1000	30	ug/kg	UJ	H
SCSD-070M-0001-SD	4-Nitrophenol	400	1000	400	ug/kg	UJ	H, C
SCSD-070M-0001-SD	Acenaphthene	24	400	24	ug/kg	UJ	H
SCSD-070M-0001-SD	Acenaphthylene	24	400	24	ug/kg	UJ	H
SCSD-070M-0001-SD	Anthracene	24	400	24	ug/kg	UJ	H
SCSD-070M-0001-SD	Benzo(a)anthracene	57	400	25	ug/kg	J-	H
SCSD-070M-0001-SD	Benzo(a)pyrene	67	400	23	ug/kg	J-	H
SCSD-070M-0001-SD	Benzo(b)fluoranthene	110	400	25	ug/kg	J-	H
SCSD-070M-0001-SD	Benzo(g,h,i)perylene	26	400	22	ug/kg	J-	H, C
SCSD-070M-0001-SD	Benzo(k)fluoranthene	47	400	25	ug/kg	J	H, C
SCSD-070M-0001-SD	Benzoic acid	290	2000	290	ug/kg	UJ	H
SCSD-070M-0001-SD	Benzyl alcohol	84	1000	84	ug/kg	UJ	H, C
SCSD-070M-0001-SD	Bis(2-chloroethoxy)methane	23	400	23	ug/kg	UJ	H
SCSD-070M-0001-SD	Bis(2-chloroethyl) ether	25	400	25	ug/kg	UJ	H
SCSD-070M-0001-SD	Bis(2-chloroisopropyl) ether	30	400	30	ug/kg	UJ	H
SCSD-070M-0001-SD	Bis(2-ethylhexyl) phthalate	88	1000	88	ug/kg	UJ	H
SCSD-070M-0001-SD	Butylbenzyl phthalate	74	400	74	ug/kg	UJ	H
SCSD-070M-0001-SD	Carbazole	28	400	28	ug/kg	UJ	H
SCSD-070M-0001-SD	Chrysene	70	400	25	ug/kg	J-	H
SCSD-070M-0001-SD	Dibenzo(a,h)anthracene	22	400	22	ug/kg	UJ	H, C
SCSD-070M-0001-SD	Dibenzofuran	24	400	24	ug/kg	UJ	H
SCSD-070M-0001-SD	Diethyl phthalate	65	400	65	ug/kg	UJ	H
SCSD-070M-0001-SD	Dimethyl phthalate	64	400	64	ug/kg	UJ	H
SCSD-070M-0001-SD	Di-n-butyl phthalate	300	400	80	ug/kg	J-	H
SCSD-070M-0001-SD	Di-n-octyl phthalate	60	400	60	ug/kg	UJ	H
SCSD-070M-0001-SD	Fluoranthene	89	400	26	ug/kg	J-	H
SCSD-070M-0001-SD	Fluorene	25	400	25	ug/kg	UJ	H
SCSD-070M-0001-SD	Hexachlorobenzene	28	400	28	ug/kg	UJ	H
SCSD-070M-0001-SD	Hexachlorobutadiene	63	400	63	ug/kg	UJ	H
SCSD-070M-0001-SD	Hexachlorocyclopentadiene	53	400	53	ug/kg	R	C
SCSD-070M-0001-SD	Hexachloroethane	33	400	33	ug/kg	UJ	H
SCSD-070M-0001-SD	Indeno(1,2,3-cd)pyrene	26	400	23	ug/kg	J-	H, C
SCSD-070M-0001-SD	Isophorone	51	400	51	ug/kg	UJ	H
SCSD-070M-0001-SD	Naphthalene	29	400	21	ug/kg	J-	H
SCSD-070M-0001-SD	Nitrobenzene	60	400	60	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSD-070M-0001-SD	N-Nitroso-di-n-propylamine	71	400	71	ug/kg	UJ	H
SCSD-070M-0001-SD	N-Nitrosodiphenylamine	51	810	51	ug/kg	UJ	H
SCSD-070M-0001-SD	Pentachlorophenol	240	1000	240	ug/kg	UJ	H
SCSD-070M-0001-SD	Phenanthrene	53	400	26	ug/kg	J-	H
SCSD-070M-0001-SD	Phenol	160	510	160	ug/kg	UJ	H
SCSD-070M-0001-SD	Pyrene	89	400	26	ug/kg	J-	H
SCSD-070M-0001-SD	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
SCSD-070M-0001-SD	1,3-Dinitrobenzene	0.079	0.44	0.079	mg/kg	UJ	H
SCSD-070M-0001-SD	2,4,6-Trinitrotoluene	0.089	0.44	0.089	mg/kg	UJ	H
SCSD-070M-0001-SD	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSD-070M-0001-SD	2,6-Dinitrotoluene	0.069	0.5	0.069	mg/kg	R	D
SCSD-070M-0001-SD	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
SCSD-070M-0001-SD	2-Nitrotoluene	0.089	0.44	0.089	mg/kg	UJ	H
SCSD-070M-0001-SD	3,5-Dinitroaniline	0.089	0.44	0.089	mg/kg	UJ	H
SCSD-070M-0001-SD	3-Nitrotoluene	0.069	0.44	0.069	mg/kg	UJ	H
SCSD-070M-0001-SD	4-Amino-2,6-dinitrotoluene	0.069	0.44	0.069	mg/kg	UJ	H
SCSD-070M-0001-SD	4-Nitrotoluene	0.069	0.5	0.069	mg/kg	UJ	H
SCSD-070M-0001-SD	HMX	0.12	0.44	0.12	mg/kg	UJ	H
SCSD-070M-0001-SD	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSD-070M-0001-SD	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
SCSD-070M-0001-SD	PETN	0.5	1.5	0.5	mg/kg	UJ	H
SCSD-070M-0001-SD	RDX	0.16	0.44	0.16	mg/kg	UJ	H
SCSD-070M-0001-SD	Tetryl	0.089	0.44	0.089	mg/kg	UJ	H
SCSD-070M-0001-SD	Cyanide	0.36	0.39	0.11	mg/kg	J-	H
SCSS-058M-0001-SO	Aluminum	10400	0.24	0.082	mg/kg	J-	Q, A
SCSS-058M-0001-SO	Antimony	3.1	0.55	0.16	mg/kg	J-	Q, *III
SCSS-058M-0001-SO	Arsenic	4.5	0.92	0.27	mg/kg	J	E
SCSS-058M-0001-SO	Barium	127	0.055	0.016	mg/kg	J-	A
SCSS-058M-0001-SO	Cadmium	1.9	0.043	0.012	mg/kg	J-	Q, *III
SCSS-058M-0001-SO	Calcium	21500	1	0.12	mg/kg	J-	A
SCSS-058M-0001-SO	Chromium	143	0.13	0.039	mg/kg	J-	A
SCSS-058M-0001-SO	Cobalt	6.7	0.1	0.031	mg/kg	J-	Q
SCSS-058M-0001-SO	Copper	33.7	0.41	0.12	mg/kg	J-	Q
SCSS-058M-0001-SO	Lead	139	0.29	0.082	mg/kg	J+	Q, *III
SCSS-058M-0001-SO	Magnesium	3930	0.82	0.24	mg/kg	J-	A
SCSS-058M-0001-SO	Manganese	729	0.1	0.033	mg/kg	J-	A
SCSS-058M-0001-SO	Nickel	21.7	0.12	0.037	mg/kg	J-	Q, A
SCSS-058M-0001-SO	Sodium	99.6	13	4.1	mg/kg	J	C
SCSS-058M-0001-SO	Thallium	1.7	0.29	0.082	mg/kg	J-	E, Q
SCSS-058M-0001-SO	Zinc	269	0.24	0.082	mg/kg	J-	Q, A
SCSS-058M-0001-SO	1,2,4-Trichlorobenzene	21	410	21	ug/kg	UJ	H
SCSS-058M-0001-SO	1,2-Dichlorobenzene	24	410	24	ug/kg	UJ	H
SCSS-058M-0001-SO	1,3-Dichlorobenzene	20	410	20	ug/kg	UJ	H
SCSS-058M-0001-SO	1,4-Dichlorobenzene	22	410	19	ug/kg	J-	H
SCSS-058M-0001-SO	2,4,5-Trichlorophenol	130	510	130	ug/kg	UJ	H
SCSS-058M-0001-SO	2,4,6-Trichlorophenol	130	510	130	ug/kg	UJ	H
SCSS-058M-0001-SO	2,4-Dichlorophenol	120	510	120	ug/kg	UJ	H
SCSS-058M-0001-SO	2,4-Dimethylphenol	100	410	100	ug/kg	UJ	H
SCSS-058M-0001-SO	2,4-Dinitrophenol	700	2000	700	ug/kg	UJ	H, C
SCSS-058M-0001-SO	2,4-Dinitrotoluene	24	410	24	ug/kg	UJ	H
SCSS-058M-0001-SO	2,6-Dinitrotoluene	24	410	24	ug/kg	UJ	H
SCSS-058M-0001-SO	2-Chloronaphthalene	23	410	23	ug/kg	UJ	H
SCSS-058M-0001-SO	2-Chlorophenol	350	510	350	ug/kg	UJ	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSS-058M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	270	ug/kg	UJ	H, C
SCSS-058M-0001-SO	2-Methylnaphthalene	370	410	25	ug/kg	J-	H
SCSS-058M-0001-SO	2-Methylphenol	430	1000	430	ug/kg	UJ	H
SCSS-058M-0001-SO	2-Nitroaniline	23	410	23	ug/kg	UJ	H
SCSS-058M-0001-SO	2-Nitrophenol	280	510	280	ug/kg	UJ	H
SCSS-058M-0001-SO	3,3'-Dichlorobenzidine	150	510	150	ug/kg	UJ	H
SCSS-058M-0001-SO	3-Nitroaniline	22	1000	22	ug/kg	UJ	H
SCSS-058M-0001-SO	4-Bromophenyl phenyl ether	25	410	25	ug/kg	UJ	H
SCSS-058M-0001-SO	4-Chloro-3-methylphenol	390	510	390	ug/kg	UJ	H
SCSS-058M-0001-SO	4-Chloroaniline	40	410	40	ug/kg	UJ	H
SCSS-058M-0001-SO	4-Chlorophenyl phenyl ether	26	410	26	ug/kg	UJ	H
SCSS-058M-0001-SO	4-Methylphenol	660	2000	660	ug/kg	UJ	H
SCSS-058M-0001-SO	4-Nitroaniline	31	1000	31	ug/kg	UJ	H, C
SCSS-058M-0001-SO	4-Nitrophenol	410	1000	410	ug/kg	UJ	H
SCSS-058M-0001-SO	Acenaphthene	43	410	24	ug/kg	J-	H
SCSS-058M-0001-SO	Acenaphthylene	160	410	24	ug/kg	J-	H
SCSS-058M-0001-SO	Anthracene	300	410	24	ug/kg	J-	H
SCSS-058M-0001-SO	Benzo(a)anthracene	740	410	25	ug/kg	J-	H
SCSS-058M-0001-SO	Benzo(a)pyrene	590	410	23	ug/kg	J-	H
SCSS-058M-0001-SO	Benzo(b)fluoranthene	1000	410	25	ug/kg	J-	H
SCSS-058M-0001-SO	Benzo(g,h,i)perylene	170	410	22	ug/kg	J-	H, C
SCSS-058M-0001-SO	Benzo(k)fluoranthene	330	410	25	ug/kg	J-	H
SCSS-058M-0001-SO	Benzoic acid	300	1000	300	ug/kg	UJ	H
SCSS-058M-0001-SO	Benzyl alcohol	84	1000	84	ug/kg	R	C
SCSS-058M-0001-SO	Bis(2-chloroethoxy)methane	23	410	23	ug/kg	UJ	H
SCSS-058M-0001-SO	Bis(2-chloroethyl) ether	25	410	25	ug/kg	UJ	H
SCSS-058M-0001-SO	Bis(2-chloroisopropyl) ether	31	410	31	ug/kg	UJ	H
SCSS-058M-0001-SO	Bis(2-ethylhexyl) phthalate	89	1000	89	ug/kg	UJ	H
SCSS-058M-0001-SO	Butylbenzyl phthalate	74	410	74	ug/kg	UJ	H
SCSS-058M-0001-SO	Carbazole	78	410	28	ug/kg	J-	H
SCSS-058M-0001-SO	Chrysene	700	410	25	ug/kg	J-	H
SCSS-058M-0001-SO	Dibenzo(a,h)anthracene	75	410	22	ug/kg	J-	H
SCSS-058M-0001-SO	Dibenzofuran	140	410	24	ug/kg	J-	H
SCSS-058M-0001-SO	Diethyl phthalate	65	410	65	ug/kg	UJ	H
SCSS-058M-0001-SO	Dimethyl phthalate	64	410	64	ug/kg	UJ	H
SCSS-058M-0001-SO	Di-n-butyl phthalate	120	410	80	ug/kg	J-	H
SCSS-058M-0001-SO	Di-n-octyl phthalate	60	410	60	ug/kg	UJ	H
SCSS-058M-0001-SO	Fluoranthene	1800	410	26	ug/kg	J-	H
SCSS-058M-0001-SO	Fluorene	190	410	25	ug/kg	J-	H
SCSS-058M-0001-SO	Hexachlorobenzene	28	410	28	ug/kg	UJ	H
SCSS-058M-0001-SO	Hexachlorobutadiene	63	410	63	ug/kg	UJ	H
SCSS-058M-0001-SO	Hexachlorocyclopentadiene	53	410	53	ug/kg	R	C
SCSS-058M-0001-SO	Hexachloroethane	34	410	34	ug/kg	UJ	H
SCSS-058M-0001-SO	Indeno(1,2,3-cd)pyrene	180	410	23	ug/kg	J-	H, C
SCSS-058M-0001-SO	Isophorone	110	410	51	ug/kg	J-	H
SCSS-058M-0001-SO	Naphthalene	240	410	21	ug/kg	J-	H
SCSS-058M-0001-SO	Nitrobenzene	60	410	60	ug/kg	UJ	H
SCSS-058M-0001-SO	N-Nitroso-di-n-propylamine	71	410	71	ug/kg	UJ	H
SCSS-058M-0001-SO	N-Nitrosodiphenylamine	51	810	51	ug/kg	UJ	H
SCSS-058M-0001-SO	Pentachlorophenol	240	1000	240	ug/kg	UJ	H
SCSS-058M-0001-SO	Phenanthrene	1200	410	26	ug/kg	J-	H
SCSS-058M-0001-SO	Phenol	160	510	160	ug/kg	UJ	H
SCSS-058M-0001-SO	Pyrene	1300	410	26	ug/kg	J-	H

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSS-058M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	0.13	mg/kg	UJ	H
SCSS-058M-0001-SO	1,3-Dinitrobenzene	0.08	0.44	0.08	mg/kg	UJ	H
SCSS-058M-0001-SO	2,4,6-Trinitrotoluene	0.26	0.44	0.09	mg/kg	J-	H, *III
SCSS-058M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSS-058M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
SCSS-058M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	0.05	mg/kg	UJ	H
SCSS-058M-0001-SO	2-Nitrotoluene	0.09	0.44	0.09	mg/kg	UJ	H
SCSS-058M-0001-SO	3,5-Dinitroaniline	0.09	0.44	0.09	mg/kg	UJ	H
SCSS-058M-0001-SO	3-Nitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSS-058M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	0.07	mg/kg	UJ	H
SCSS-058M-0001-SO	4-Nitrotoluene	0.07	0.5	0.07	mg/kg	UJ	H
SCSS-058M-0001-SO	HMX	0.12	0.44	0.12	mg/kg	UJ	H
SCSS-058M-0001-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSS-058M-0001-SO	Nitroglycerin	0.5	1.5	0.5	mg/kg	UJ	H
SCSS-058M-0001-SO	PETN	0.5	1.5	0.5	mg/kg	UJ	H
SCSS-058M-0001-SO	RDX	0.16	0.44	0.16	mg/kg	UJ	H
SCSS-058M-0001-SO	Tetryl	0.09	0.44	0.09	mg/kg	UJ	H
SCSS-068M-0001-SO	Aluminum	9150	0.12	0.041	mg/kg	J-	Q, A
SCSS-068M-0001-SO	Antimony	0.082	0.28	0.082	mg/kg	R	Q
SCSS-068M-0001-SO	Arsenic	11.2	0.46	0.13	mg/kg	J-	Q, *III, A
SCSS-068M-0001-SO	Barium	49.7	0.028	0.0082	mg/kg	J-	A
SCSS-068M-0001-SO	Beryllium	0.41	0.024	0.0082	mg/kg	J-	A
SCSS-068M-0001-SO	Cadmium	0.057	0.021	0.0061	mg/kg	J-	C, Q, *III
SCSS-068M-0001-SO	Calcium	1650	0.51	0.061	mg/kg	J-	A
SCSS-068M-0001-SO	Chromium	24.2	0.064	0.019	mg/kg	J-	Q, A
SCSS-068M-0001-SO	Cobalt	7.6	0.05	0.015	mg/kg	J-	Q, *III, A
SCSS-068M-0001-SO	Copper	11	0.2	0.061	mg/kg	J-	Q, *III, A
SCSS-068M-0001-SO	Iron	22500	1	0.31	mg/kg	J-	A
SCSS-068M-0001-SO	Lead	29.8	0.14	0.041	mg/kg	J-	Q, *III, A
SCSS-068M-0001-SO	Magnesium	2320	0.41	0.12	mg/kg	J-	Q, A
SCSS-068M-0001-SO	Manganese	395	0.051	0.016	mg/kg	J-	Q, A
SCSS-068M-0001-SO	Nickel	20.9	0.062	0.018	mg/kg	J-	Q, *III, A
SCSS-068M-0001-SO	Potassium	693	37	11	mg/kg	J-	Q
SCSS-068M-0001-SO	Selenium	0.24	0.43	0.071	mg/kg	J-	Q
SCSS-068M-0001-SO	Sodium	20.5	13	4.1	mg/kg	J-	C, Q
SCSS-068M-0001-SO	Thallium	0.62	0.29	0.082	mg/kg	J-	Q, *III, E
SCSS-068M-0001-SO	Vanadium	14.8	0.035	0.011	mg/kg	J-	Q, A, E
SCSS-068M-0001-SO	Zinc	48.2	0.12	0.041	mg/kg	J-	Q, *III, A
SCSS-068M-0001-SO	Mercury	0.031	0.0081	0.0024	mg/kg	J-	A
SCSS-068M-0001-SO	Bis(2-ethylhexyl) phthalate	100	1000	88	ug/kg	U	B
SCSS-068M-0001-SO	Hexachlorocyclopentadiene	53	410	53	ug/kg	UJ	C
SCSS-068M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSS-068M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
SCSS-068M-0001-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSS-073M-0001-SO	Antimony	2.9	0.55	0.16	mg/kg	J+	C
SCSS-073M-0001-SO	Selenium	2.4	0.86	0.14	mg/kg	J+	C
SCSS-073M-0001-SO	Sodium	101	13	4.1	mg/kg	J	C
SCSS-073M-0001-SO	Thallium	0.082	0.29	0.082	mg/kg	U	B
SCSS-073M-0001-SO	4-Nitrophenol	410	1000	410	ug/kg	UJ	C
SCSS-073M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	0.2	mg/kg	R	D
SCSS-073M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	R	D
SCSS-073M-0001-SO	Nitrobenzene	0.04	0.44	0.04	mg/kg	R	D
SCSS-076M-0001-SO	Selenium	2.2	0.86	0.14	mg/kg	J-	C

Sample	Analyte	Result	LOQ	DL	Units	Qualifier	Code
SCSS-076M-0001-SO	Sodium	68.1	13	4.1	mg/kg	J	C
SCSS-076M-0001-SO	Thallium	0.73	0.29	0.082	mg/kg	J-	B
SCSS-076M-0001-SO	Mercury	0.049	0.0081	0.0025	mg/kg	J-	C
SCSS-076M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	0.07	mg/kg	UJ	C

APPENDIX C

Primary/Field Duplicate Sample Comparisons

Open Demolition Area 1

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-059M-0203-SO	Aluminum	13300	0.6	mg/kg		DA1SB-081M-0203-SO	4960	0.6		91	N/A
DA1SB-059M-0203-SO	Antimony	1.7	1.4	mg/kg		DA1SB-081M-0203-SO	0.4	1.4	U	N/A	Yes
DA1SB-059M-0203-SO	Arsenic	12.1	2.3	mg/kg		DA1SB-081M-0203-SO	14.9	2.3		21	N/A
DA1SB-059M-0203-SO	Barium	71.4	0.14	mg/kg		DA1SB-081M-0203-SO	29.4	0.14		83	N/A
DA1SB-059M-0203-SO	Beryllium	0.48	0.06	mg/kg		DA1SB-081M-0203-SO	0.17	0.06		N/A	No
DA1SB-059M-0203-SO	Cadmium	0.03	0.11	mg/kg	U	DA1SB-081M-0203-SO	0.03	0.11	U	N/A	Yes
DA1SB-059M-0203-SO	Calcium	31100	2.5	mg/kg		DA1SB-081M-0203-SO	1130	2.5		186	N/A
DA1SB-059M-0203-SO	Chromium	114	0.32	mg/kg		DA1SB-081M-0203-SO	28.7	0.32		120	N/A
DA1SB-059M-0203-SO	Cobalt	11.1	0.25	mg/kg		DA1SB-081M-0203-SO	5.8	0.25		63	N/A
DA1SB-059M-0203-SO	Copper	17.6	1	mg/kg		DA1SB-081M-0203-SO	19	1		8	N/A
DA1SB-059M-0203-SO	Iron	31300	5	mg/kg		DA1SB-081M-0203-SO	21100	5		39	N/A
DA1SB-059M-0203-SO	Lead	10.2	0.7	mg/kg		DA1SB-081M-0203-SO	11.9	0.7		15	N/A
DA1SB-059M-0203-SO	Magnesium	7170	2	mg/kg		DA1SB-081M-0203-SO	1900	2		116	N/A
DA1SB-059M-0203-SO	Manganese	449	0.25	mg/kg		DA1SB-081M-0203-SO	217	0.25		70	N/A
DA1SB-059M-0203-SO	Nickel	25.6	0.31	mg/kg		DA1SB-081M-0203-SO	15.3	0.31		50	N/A
DA1SB-059M-0203-SO	Potassium	502	36	mg/kg		DA1SB-081M-0203-SO	507	36		1	N/A
DA1SB-059M-0203-SO	Selenium	0.35	2.1	mg/kg	U	DA1SB-081M-0203-SO	0.35	2.1	U	N/A	Yes
DA1SB-059M-0203-SO	Silver	0.085	0.28	mg/kg	U	DA1SB-081M-0203-SO	0.085	0.28	U	N/A	Yes
DA1SB-059M-0203-SO	Sodium	26.9	13	mg/kg		DA1SB-081M-0203-SO	30.6	13		N/A	Yes
DA1SB-059M-0203-SO	Thallium	2.1	0.7	mg/kg		DA1SB-081M-0203-SO	1.1	0.7		N/A	No
DA1SB-059M-0203-SO	Vanadium	19.5	0.17	mg/kg		DA1SB-081M-0203-SO	11.1	0.17		55	N/A
DA1SB-059M-0203-SO	Zinc	57.5	0.6	mg/kg		DA1SB-081M-0203-SO	69.8	0.6		19	N/A
DA1SB-059M-0203-SO	Mercury	0.015	0.0079	mg/kg		DA1SB-081M-0203-SO	0.009	0.0079		N/A	Yes
DA1SB-059M-0203-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.13	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.079	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.089	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.2	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	U	DA1SB-081M-0203-SO	0.07	0.5	U	N/A	Yes
DA1SB-059M-0203-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.05	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	2-Nitrotoluene	0.09	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.089	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.089	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	3-Nitrotoluene	0.07	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.07	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.07	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	4-Nitrotoluene	0.07	0.5	mg/kg	U	DA1SB-081M-0203-SO	0.07	0.5	U	N/A	Yes
DA1SB-059M-0203-SO	HMX	0.12	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.12	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	Nitrobenzene	0.04	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.04	0.44	U	N/A	Yes
DA1SB-059M-0203-SO	Nitroglycerin	0.5	1.5	mg/kg	U	DA1SB-081M-0203-SO	0.5	1.5	U	N/A	Yes
DA1SB-059M-0203-SO	PETN	0.5	1.5	mg/kg	U	DA1SB-081M-0203-SO	0.5	1.5	U	N/A	Yes
DA1SB-059M-0203-SO	RDX	0.16	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.16	0.44	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-059M-0203-SO	Tetryl	0.09	0.44	mg/kg	U	DA1SB-081M-0203-SO	0.089	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	Aluminum	13300	0.24	mg/kg	J-	DA1SB-082M-0202-SO	11200	0.24		17	N/A
DA1SB-063M-0202-SO	Antimony	0.16	0.55	mg/kg	R	DA1SB-082M-0202-SO	0.16	0.55	U	N/A	N/A
DA1SB-063M-0202-SO	Arsenic	4.5	0.91	mg/kg		DA1SB-082M-0202-SO	5.1	0.91		N/A	Yes
DA1SB-063M-0202-SO	Barium	56.6	0.055	mg/kg		DA1SB-082M-0202-SO	62.7	0.055		10	N/A
DA1SB-063M-0202-SO	Beryllium	0.43	0.024	mg/kg		DA1SB-082M-0202-SO	0.37	0.024		15	N/A
DA1SB-063M-0202-SO	Cadmium	0.2	0.2	mg/kg	UJ	DA1SB-082M-0202-SO	0.012	0.042	U	N/A	Yes
DA1SB-063M-0202-SO	Calcium	27500	1	mg/kg	J-	DA1SB-082M-0202-SO	23500	1		16	N/A
DA1SB-063M-0202-SO	Chromium	22.6	0.13	mg/kg	J-	DA1SB-082M-0202-SO	17.1	0.13		28	N/A
DA1SB-063M-0202-SO	Cobalt	9.4	0.099	mg/kg	J-	DA1SB-082M-0202-SO	9.5	0.099		1	N/A
DA1SB-063M-0202-SO	Copper	16.8	0.4	mg/kg	J-	DA1SB-082M-0202-SO	14.9	0.4		12	N/A
DA1SB-063M-0202-SO	Iron	31300	2	mg/kg		DA1SB-082M-0202-SO	27900	2		11	N/A
DA1SB-063M-0202-SO	Lead	5.8	0.28	mg/kg		DA1SB-082M-0202-SO	5.1	0.28		13	N/A
DA1SB-063M-0202-SO	Magnesium	7180	0.81	mg/kg	J-	DA1SB-082M-0202-SO	6170	0.81		15	N/A
DA1SB-063M-0202-SO	Manganese	299	0.1	mg/kg	J-	DA1SB-082M-0202-SO	486	0.1		48	N/A
DA1SB-063M-0202-SO	Nickel	22.1	0.12	mg/kg		DA1SB-082M-0202-SO	20.8	0.12		6	N/A
DA1SB-063M-0202-SO	Potassium	1850	36	mg/kg		DA1SB-082M-0202-SO	1620	36		13	N/A
DA1SB-063M-0202-SO	Selenium	0.53	0.85	mg/kg	U	DA1SB-082M-0202-SO	0.36	0.85	J	N/A	Yes
DA1SB-063M-0202-SO	Silver	0.1	0.11	mg/kg	U	DA1SB-082M-0202-SO	0.034	0.11	U	N/A	Yes
DA1SB-063M-0202-SO	Sodium	82.7	13	mg/kg	J	DA1SB-082M-0202-SO	72.5	13		13	N/A
DA1SB-063M-0202-SO	Thallium	2	0.28	mg/kg	J-	DA1SB-082M-0202-SO	1.8	0.28		11	N/A
DA1SB-063M-0202-SO	Vanadium	16.9	0.069	mg/kg		DA1SB-082M-0202-SO	14.2	0.069		17	N/A
DA1SB-063M-0202-SO	Zinc	51.1	0.24	mg/kg	J-	DA1SB-082M-0202-SO	45.9	0.24		11	N/A
DA1SB-063M-0202-SO	Mercury	0.01	0.008	mg/kg		DA1SB-082M-0202-SO	0.009	0.008		N/A	Yes
DA1SB-063M-0202-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.13	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	1,3-Dinitrobenzene	0.079	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.079	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	2,4,6-Trinitrotoluene	0.089	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.2	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-082M-0202-SO	0.069	0.5	U	N/A	Yes
DA1SB-063M-0202-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.05	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	2-Nitrotoluene	0.089	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	3,5-Dinitroaniline	0.089	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.069	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.069	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-082M-0202-SO	0.069	0.5	U	N/A	Yes
DA1SB-063M-0202-SO	HMX	0.12	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.12	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.04	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	DA1SB-082M-0202-SO	0.5	1.5	U	N/A	Yes
DA1SB-063M-0202-SO	Nitroguanidine	0.059	0.16	mg/kg	UJ	DA1SB-082M-0202-SO	0.06	0.16	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-063M-0202-SO	PETN	0.5	1.5	mg/kg	UJ	DA1SB-082M-0202-SO	0.5	1.5	U	N/A	Yes
DA1SB-063M-0202-SO	RDX	0.16	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.16	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	Tetryl	0.089	0.44	mg/kg	UJ	DA1SB-082M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-063M-0202-SO	Nitrocellulose	7	100	mg/kg	U	DA1SB-082M-0202-SO	7	100	U	N/A	Yes
DA1SB-065M-0202-SO	Aluminum	12900	0.24	mg/kg		DA1SB-083M-0202-SO	15900	0.24		21	N/A
DA1SB-065M-0202-SO	Antimony	0.16	0.55	mg/kg	U	DA1SB-083M-0202-SO	0.16	0.55	U	N/A	Yes
DA1SB-065M-0202-SO	Arsenic	2.5	0.91	mg/kg		DA1SB-083M-0202-SO	4.8	0.91		N/A	No
DA1SB-065M-0202-SO	Barium	58.8	0.055	mg/kg		DA1SB-083M-0202-SO	72.1	0.055		20	N/A
DA1SB-065M-0202-SO	Beryllium	0.47	0.024	mg/kg		DA1SB-083M-0202-SO	0.56	0.024		17	N/A
DA1SB-065M-0202-SO	Cadmium	0.012	0.043	mg/kg	U	DA1SB-083M-0202-SO	0.012	0.043	U	N/A	Yes
DA1SB-065M-0202-SO	Calcium	14800	1	mg/kg		DA1SB-083M-0202-SO	16100	1		8	N/A
DA1SB-065M-0202-SO	Chromium	25.8	0.13	mg/kg		DA1SB-083M-0202-SO	29.8	0.13		14	N/A
DA1SB-065M-0202-SO	Cobalt	8.6	0.099	mg/kg		DA1SB-083M-0202-SO	11.3	0.099		27	N/A
DA1SB-065M-0202-SO	Copper	13.6	0.41	mg/kg		DA1SB-083M-0202-SO	18.1	0.41		28	N/A
DA1SB-065M-0202-SO	Iron	28600	2	mg/kg		DA1SB-083M-0202-SO	34400	2		18	N/A
DA1SB-065M-0202-SO	Lead	4.4	0.28	mg/kg		DA1SB-083M-0202-SO	6.4	0.28		37	N/A
DA1SB-065M-0202-SO	Magnesium	5070	0.81	mg/kg		DA1SB-083M-0202-SO	6040	0.81		17	N/A
DA1SB-065M-0202-SO	Manganese	321	0.1	mg/kg		DA1SB-083M-0202-SO	372	0.1		15	N/A
DA1SB-065M-0202-SO	Nickel	19.8	0.12	mg/kg		DA1SB-083M-0202-SO	27	0.12		31	N/A
DA1SB-065M-0202-SO	Potassium	2200	36	mg/kg		DA1SB-083M-0202-SO	2390	37		8	N/A
DA1SB-065M-0202-SO	Selenium	0.56	0.85	mg/kg	J	DA1SB-083M-0202-SO	0.28	0.85	J	N/A	Yes
DA1SB-065M-0202-SO	Silver	0.034	0.11	mg/kg	U	DA1SB-083M-0202-SO	0.035	0.11	U	N/A	Yes
DA1SB-065M-0202-SO	Sodium	83.3	13	mg/kg		DA1SB-083M-0202-SO	87.6	13		5	N/A
DA1SB-065M-0202-SO	Thallium	1.8	0.28	mg/kg		DA1SB-083M-0202-SO	2.5	0.28		33	N/A
DA1SB-065M-0202-SO	Vanadium	15.7	0.069	mg/kg		DA1SB-083M-0202-SO	21.6	0.069		32	N/A
DA1SB-065M-0202-SO	Zinc	42.2	0.24	mg/kg		DA1SB-083M-0202-SO	55.8	0.24		28	N/A
DA1SB-065M-0202-SO	Mercury	0.011	0.008	mg/kg		DA1SB-083M-0202-SO	0.012	0.008		N/A	Yes
DA1SB-065M-0202-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.13	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	1,3-Dinitrobenzene	0.079	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.079	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	2,4,6-Trinitrotoluene	0.089	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.2	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	2,6-Dinitrotoluene	0.069	0.5	mg/kg	U	DA1SB-083M-0202-SO	0.07	0.5	U	N/A	Yes
DA1SB-065M-0202-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.05	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	2-Nitrotoluene	0.089	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	3,5-Dinitroaniline	0.089	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	3-Nitrotoluene	0.069	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.07	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	4-Amino-2,6-dinitrotoluene	0.069	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.07	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	4-Nitrotoluene	0.069	0.5	mg/kg	U	DA1SB-083M-0202-SO	0.07	0.5	U	N/A	Yes
DA1SB-065M-0202-SO	HMX	0.12	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.12	0.44	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-065M-0202-SO	Nitrobenzene	0.04	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.04	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	Nitroglycerin	0.5	1.5	mg/kg	U	DA1SB-083M-0202-SO	0.5	1.5	U	N/A	Yes
DA1SB-065M-0202-SO	PETN	0.5	1.5	mg/kg	U	DA1SB-083M-0202-SO	0.5	1.5	U	N/A	Yes
DA1SB-065M-0202-SO	RDX	0.16	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.16	0.44	U	N/A	Yes
DA1SB-065M-0202-SO	Tetryl	0.089	0.44	mg/kg	U	DA1SB-083M-0202-SO	0.089	0.44	U	N/A	Yes
DA1SB-068D-0201-SO	1,1,1-Trichloroethane	10	52	ug/kg	U	DA1SB-084D-0201-SO	11	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,1,2,2-Tetrachloroethane	6.2	52	ug/kg	U	DA1SB-084D-0201-SO	6.4	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,1,2-Trichloroethane	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,1-Dichloroethane	11	52	ug/kg	U	DA1SB-084D-0201-SO	12	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,1-Dichloroethene	17	52	ug/kg	U	DA1SB-084D-0201-SO	17	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,2-Dibromoethane	10	52	ug/kg	U	DA1SB-084D-0201-SO	11	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,2-Dichloroethane	12	52	ug/kg	U	DA1SB-084D-0201-SO	13	53	U	N/A	Yes
DA1SB-068D-0201-SO	1,2-Dichloropropane	7.3	52	ug/kg	U	DA1SB-084D-0201-SO	7.4	53	U	N/A	Yes
DA1SB-068D-0201-SO	2-Butanone	100	520	ug/kg	U	DA1SB-084D-0201-SO	110	530	U	N/A	Yes
DA1SB-068D-0201-SO	2-Hexanone	70	520	ug/kg	R	DA1SB-084D-0201-SO	72	530	U	N/A	N/A
DA1SB-068D-0201-SO	4-Methyl-2-pentanone	85	520	ug/kg	UJ	DA1SB-084D-0201-SO	87	530	U	N/A	Yes
DA1SB-068D-0201-SO	Acetone	65	1000	ug/kg	UJ	DA1SB-084D-0201-SO	67	1100	U	N/A	Yes
DA1SB-068D-0201-SO	Benzene	5.2	52	ug/kg	U	DA1SB-084D-0201-SO	5.3	53	U	N/A	Yes
DA1SB-068D-0201-SO	Bromochloromethane	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Bromodichloromethane	9.3	52	ug/kg	U	DA1SB-084D-0201-SO	9.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Bromoform	6.2	52	ug/kg	U	DA1SB-084D-0201-SO	6.4	53	U	N/A	Yes
DA1SB-068D-0201-SO	Bromomethane	31	100	ug/kg	U	DA1SB-084D-0201-SO	32	110	U	N/A	Yes
DA1SB-068D-0201-SO	Carbon disulfide	16	100	ug/kg	U	DA1SB-084D-0201-SO	16	110	U	N/A	Yes
DA1SB-068D-0201-SO	Carbon tetrachloride	11	52	ug/kg	U	DA1SB-084D-0201-SO	12	53	U	N/A	Yes
DA1SB-068D-0201-SO	Chlorobenzene	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Chloroethane	20	100	ug/kg	R	DA1SB-084D-0201-SO	20	110	U	N/A	N/A
DA1SB-068D-0201-SO	Chloroform	9.3	52	ug/kg	U	DA1SB-084D-0201-SO	9.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Chloromethane	26	100	ug/kg	R	DA1SB-084D-0201-SO	26	110	U	N/A	N/A
DA1SB-068D-0201-SO	cis-1,2-Dichloroethene	10	52	ug/kg	U	DA1SB-084D-0201-SO	11	53	U	N/A	Yes
DA1SB-068D-0201-SO	cis-1,3-Dichloropropene	10	52	ug/kg	U	DA1SB-084D-0201-SO	11	53	U	N/A	Yes
DA1SB-068D-0201-SO	Dibromochloromethane	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Ethylbenzene	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	m,p-Xylenes	19	100	ug/kg	UJ	DA1SB-084D-0201-SO	19	110	U	N/A	Yes
DA1SB-068D-0201-SO	Methylene chloride	41	100	ug/kg	U	DA1SB-084D-0201-SO	42	110	U	N/A	Yes
DA1SB-068D-0201-SO	o-Xylene	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Styrene	6.2	52	ug/kg	U	DA1SB-084D-0201-SO	6.4	53	U	N/A	Yes
DA1SB-068D-0201-SO	Tetrachloroethene	8.3	52	ug/kg	U	DA1SB-084D-0201-SO	8.5	53	U	N/A	Yes
DA1SB-068D-0201-SO	Toluene	7.3	52	ug/kg	U	DA1SB-084D-0201-SO	7.4	53	U	N/A	Yes
DA1SB-068D-0201-SO	trans-1,2-Dichloroethene	11	52	ug/kg	U	DA1SB-084D-0201-SO	12	53	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-068D-0201-SO	trans-1,3-Dichloropropene	7.3	100	ug/kg	U	DA1SB-084D-0201-SO	7.4	110	U	N/A	Yes
DA1SB-068D-0201-SO	Trichloroethene	10	52	ug/kg	U	DA1SB-084D-0201-SO	11	53	U	N/A	Yes
DA1SB-068D-0201-SO	Vinyl chloride	15	52	ug/kg	U	DA1SB-084D-0201-SO	15	53	U	N/A	Yes
DA1SB-068M-0201-SO	Aluminum	10900	0.24	mg/kg	J-	DA1SB-084M-0201-SO	9830	0.24		10	N/A
DA1SB-068M-0201-SO	Antimony	0.49	0.55	mg/kg	J-	DA1SB-084M-0201-SO	0.16	0.55	U	N/A	Yes
DA1SB-068M-0201-SO	Arsenic	5.4	0.91	mg/kg	J-	DA1SB-084M-0201-SO	11.6	0.91		73	N/A
DA1SB-068M-0201-SO	Barium	47.6	0.055	mg/kg	J-	DA1SB-084M-0201-SO	43.4	0.055		9	N/A
DA1SB-068M-0201-SO	Beryllium	0.42	0.024	mg/kg		DA1SB-084M-0201-SO	0.38	0.024		10	N/A
DA1SB-068M-0201-SO	Cadmium	0.096	0.043	mg/kg	J-	DA1SB-084M-0201-SO	0.016	0.043	J	N/A	No
DA1SB-068M-0201-SO	Calcium	420	1	mg/kg	J-	DA1SB-084M-0201-SO	438	1		4	N/A
DA1SB-068M-0201-SO	Chromium	49.1	0.13	mg/kg	J-	DA1SB-084M-0201-SO	13.1	0.13		116	N/A
DA1SB-068M-0201-SO	Cobalt	8	0.099	mg/kg	J-	DA1SB-084M-0201-SO	7.8	0.099		3	N/A
DA1SB-068M-0201-SO	Copper	21.2	0.4	mg/kg	J-	DA1SB-084M-0201-SO	19.7	0.41		7	N/A
DA1SB-068M-0201-SO	Iron	24600	2	mg/kg		DA1SB-084M-0201-SO	26500	2		7	N/A
DA1SB-068M-0201-SO	Lead	24.5	0.28	mg/kg	J-	DA1SB-084M-0201-SO	11.1	0.28		75	N/A
DA1SB-068M-0201-SO	Magnesium	2590	0.81	mg/kg	J-	DA1SB-084M-0201-SO	2720	0.81		5	N/A
DA1SB-068M-0201-SO	Manganese	293	0.1	mg/kg	J-	DA1SB-084M-0201-SO	343	0.1		16	N/A
DA1SB-068M-0201-SO	Nickel	15.9	0.12	mg/kg	J-	DA1SB-084M-0201-SO	15.2	0.12		5	N/A
DA1SB-068M-0201-SO	Potassium	1000	36	mg/kg	J-	DA1SB-084M-0201-SO	527	36		62	N/A
DA1SB-068M-0201-SO	Selenium	0.23	0.85	mg/kg	J-	DA1SB-084M-0201-SO	0.63	0.85	J	N/A	Yes
DA1SB-068M-0201-SO	Silver	0.1	0.11	mg/kg	UJ	DA1SB-084M-0201-SO	0.034	0.11	U	N/A	Yes
DA1SB-068M-0201-SO	Sodium	45.3	13	mg/kg	J-	DA1SB-084M-0201-SO	20	13		N/A	No
DA1SB-068M-0201-SO	Thallium	1.5	0.28	mg/kg	J-	DA1SB-084M-0201-SO	1.3	0.28		N/A	Yes
DA1SB-068M-0201-SO	Vanadium	15.2	0.069	mg/kg	J-	DA1SB-084M-0201-SO	13.9	0.069		9	N/A
DA1SB-068M-0201-SO	Zinc	51.6	0.24	mg/kg	J-	DA1SB-084M-0201-SO	48.6	0.24		6	N/A
DA1SB-068M-0201-SO	Mercury	0.019	0.008	mg/kg	J-	DA1SB-084M-0201-SO	0.022	0.008		N/A	Yes
DA1SB-068M-0201-SO	4,4'-DDD	0.3	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.31	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	4,4'-DDE	0.3	4	ug/kg	U	DA1SB-084M-0201-SO	0.31	4.1	U	N/A	Yes
DA1SB-068M-0201-SO	4,4'-DDT	0.5	2.4	ug/kg	J	DA1SB-084M-0201-SO	0.61	2.4	J	N/A	Yes
DA1SB-068M-0201-SO	Aldrin	0.5	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.51	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	alpha-BHC	0.61	4	ug/kg	U	DA1SB-084M-0201-SO	0.61	4.1	U	N/A	Yes
DA1SB-068M-0201-SO	alpha-Chlordane	0.3	4	ug/kg	U	DA1SB-084M-0201-SO	0.31	4.1	U	N/A	Yes
DA1SB-068M-0201-SO	beta-BHC	0.61	4	ug/kg	U	DA1SB-084M-0201-SO	0.61	4.1	U	N/A	Yes
DA1SB-068M-0201-SO	Chlordane (Technical)	4	76	ug/kg	U	DA1SB-084M-0201-SO	4.1	76	U	N/A	Yes
DA1SB-068M-0201-SO	delta-BHC	0.3	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.31	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	Dieldrin	0.3	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.31	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	Endosulfan I	0.71	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.71	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	Endosulfan II	0.91	2.4	ug/kg	J	DA1SB-084M-0201-SO	0.31	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	Endosulfan sulfate	0.91	4	ug/kg	U	DA1SB-084M-0201-SO	0.92	4.1	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-068M-0201-SO	Endrin	0.4	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.41	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	Endrin aldehyde	1.1	4	ug/kg	U	DA1SB-084M-0201-SO	1.1	4.1	U	N/A	Yes
DA1SB-068M-0201-SO	Endrin ketone	0.81	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.81	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	GAMMA-BHC	0.5	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.51	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	gamma-Chlordane	0.3	4	ug/kg	U	DA1SB-084M-0201-SO	1.5	4.1	J	N/A	Yes
DA1SB-068M-0201-SO	Heptachlor	7.3	2.4	ug/kg		DA1SB-084M-0201-SO	5.8	2.4		N/A	Yes
DA1SB-068M-0201-SO	Heptachlor epoxide	0.61	4	ug/kg	J	DA1SB-084M-0201-SO	0.51	4.1	U	N/A	Yes
DA1SB-068M-0201-SO	Methoxychlor	0.71	2.4	ug/kg	U	DA1SB-084M-0201-SO	0.71	2.4	U	N/A	Yes
DA1SB-068M-0201-SO	Toxaphene	5	50	ug/kg	U	DA1SB-084M-0201-SO	5.1	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1016	10	51	ug/kg	U	DA1SB-084M-0201-SO	10	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1221	20	51	ug/kg	U	DA1SB-084M-0201-SO	20	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1232	27	51	ug/kg	U	DA1SB-084M-0201-SO	27	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1242	29	51	ug/kg	U	DA1SB-084M-0201-SO	30	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1248	29	51	ug/kg	U	DA1SB-084M-0201-SO	30	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1254	23	51	ug/kg	U	DA1SB-084M-0201-SO	23	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1260	12	51	ug/kg	U	DA1SB-084M-0201-SO	12	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1262	21	51	ug/kg	U	DA1SB-084M-0201-SO	21	51	U	N/A	Yes
DA1SB-068M-0201-SO	Aroclor 1268	28	51	ug/kg	U	DA1SB-084M-0201-SO	29	51	U	N/A	Yes
DA1SB-068M-0201-SO	1,2,4-Trichlorobenzene	21	400	ug/kg	UJ	DA1SB-084M-0201-SO	21	400	U	N/A	Yes
DA1SB-068M-0201-SO	1,2-Dichlorobenzene	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	1,3-Dichlorobenzene	20	400	ug/kg	UJ	DA1SB-084M-0201-SO	20	400	U	N/A	Yes
DA1SB-068M-0201-SO	1,4-Dichlorobenzene	19	400	ug/kg	UJ	DA1SB-084M-0201-SO	19	400	U	N/A	Yes
DA1SB-068M-0201-SO	2,4,5-Trichlorophenol	130	500	ug/kg	UJ	DA1SB-084M-0201-SO	130	510	U	N/A	Yes
DA1SB-068M-0201-SO	2,4,6-Trichlorophenol	130	500	ug/kg	UJ	DA1SB-084M-0201-SO	130	510	U	N/A	Yes
DA1SB-068M-0201-SO	2,4-Dichlorophenol	120	500	ug/kg	UJ	DA1SB-084M-0201-SO	120	510	U	N/A	Yes
DA1SB-068M-0201-SO	2,4-Dimethylphenol	100	400	ug/kg	UJ	DA1SB-084M-0201-SO	100	400	U	N/A	Yes
DA1SB-068M-0201-SO	2,4-Dinitrophenol	700	2000	ug/kg	UJ	DA1SB-084M-0201-SO	700	2000	U	N/A	Yes
DA1SB-068M-0201-SO	2,4-Dinitrotoluene	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	2,6-Dinitrotoluene	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	2-Chloronaphthalene	23	400	ug/kg	UJ	DA1SB-084M-0201-SO	23	400	U	N/A	Yes
DA1SB-068M-0201-SO	2-Chlorophenol	340	500	ug/kg	UJ	DA1SB-084M-0201-SO	340	510	U	N/A	Yes
DA1SB-068M-0201-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	UJ	DA1SB-084M-0201-SO	270	1000	U	N/A	Yes
DA1SB-068M-0201-SO	2-Methylnaphthalene	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	2-Methylphenol	420	1000	ug/kg	UJ	DA1SB-084M-0201-SO	420	1000	U	N/A	Yes
DA1SB-068M-0201-SO	2-Nitroaniline	23	400	ug/kg	UJ	DA1SB-084M-0201-SO	23	400	U	N/A	Yes
DA1SB-068M-0201-SO	2-Nitrophenol	280	500	ug/kg	UJ	DA1SB-084M-0201-SO	280	510	U	N/A	Yes
DA1SB-068M-0201-SO	3,3'-Dichlorobenzidine	150	500	ug/kg	UJ	DA1SB-084M-0201-SO	150	510	U	N/A	Yes
DA1SB-068M-0201-SO	3-Nitroaniline	22	1000	ug/kg	UJ	DA1SB-084M-0201-SO	22	1000	U	N/A	Yes
DA1SB-068M-0201-SO	4-Bromophenyl phenyl ether	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-068M-0201-SO	4-Chloro-3-methylphenol	380	500	ug/kg	UJ	DA1SB-084M-0201-SO	380	510	U	N/A	Yes
DA1SB-068M-0201-SO	4-Chloroaniline	39	400	ug/kg	UJ	DA1SB-084M-0201-SO	39	400	U	N/A	Yes
DA1SB-068M-0201-SO	4-Chlorophenyl phenyl ether	26	400	ug/kg	UJ	DA1SB-084M-0201-SO	26	400	U	N/A	Yes
DA1SB-068M-0201-SO	4-Methylphenol	660	2000	ug/kg	UJ	DA1SB-084M-0201-SO	660	2000	U	N/A	Yes
DA1SB-068M-0201-SO	4-Nitroaniline	30	1000	ug/kg	UJ	DA1SB-084M-0201-SO	30	1000	U	N/A	Yes
DA1SB-068M-0201-SO	4-Nitrophenol	400	1000	ug/kg	UJ	DA1SB-084M-0201-SO	400	1000	U	N/A	Yes
DA1SB-068M-0201-SO	Acenaphthene	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	Acenaphthylene	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	Anthracene	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	Benzo(a)anthracene	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	Benzo(a)pyrene	23	400	ug/kg	UJ	DA1SB-084M-0201-SO	23	400	U	N/A	Yes
DA1SB-068M-0201-SO	Benzo(b)fluoranthene	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	Benzo(g,h,i)perylene	22	400	ug/kg	UJ	DA1SB-084M-0201-SO	22	400	U	N/A	Yes
DA1SB-068M-0201-SO	Benzo(k)fluoranthene	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	Benzoic acid	290	990	ug/kg	UJ	DA1SB-084M-0201-SO	290	990	U	N/A	Yes
DA1SB-068M-0201-SO	Benzyl alcohol	84	1000	ug/kg	R	DA1SB-084M-0201-SO	84	1000	U	N/A	N/A
DA1SB-068M-0201-SO	Bis(2-chloroethoxy)methane	23	400	ug/kg	UJ	DA1SB-084M-0201-SO	23	400	U	N/A	Yes
DA1SB-068M-0201-SO	Bis(2-chloroethyl) ether	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	Bis(2-chloroisopropyl) ether	30	400	ug/kg	UJ	DA1SB-084M-0201-SO	30	400	U	N/A	Yes
DA1SB-068M-0201-SO	Bis(2-ethylhexyl) phthalate	88	1000	ug/kg	UJ	DA1SB-084M-0201-SO	110	1000	J	N/A	Yes
DA1SB-068M-0201-SO	Butylbenzyl phthalate	74	400	ug/kg	UJ	DA1SB-084M-0201-SO	74	400	U	N/A	Yes
DA1SB-068M-0201-SO	Carbazole	28	400	ug/kg	UJ	DA1SB-084M-0201-SO	28	400	U	N/A	Yes
DA1SB-068M-0201-SO	Chrysene	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	Dibenzo(a,h)anthracene	22	400	ug/kg	UJ	DA1SB-084M-0201-SO	22	400	U	N/A	Yes
DA1SB-068M-0201-SO	Dibenzofuran	24	400	ug/kg	UJ	DA1SB-084M-0201-SO	24	400	U	N/A	Yes
DA1SB-068M-0201-SO	Diethyl phthalate	65	400	ug/kg	UJ	DA1SB-084M-0201-SO	65	400	U	N/A	Yes
DA1SB-068M-0201-SO	Dimethyl phthalate	64	400	ug/kg	UJ	DA1SB-084M-0201-SO	64	400	U	N/A	Yes
DA1SB-068M-0201-SO	Di-n-butyl phthalate	85	400	ug/kg	J-	DA1SB-084M-0201-SO	80	400	U	N/A	Yes
DA1SB-068M-0201-SO	Di-n-octyl phthalate	60	400	ug/kg	UJ	DA1SB-084M-0201-SO	60	400	U	N/A	Yes
DA1SB-068M-0201-SO	Fluoranthene	26	400	ug/kg	UJ	DA1SB-084M-0201-SO	26	400	U	N/A	Yes
DA1SB-068M-0201-SO	Fluorene	25	400	ug/kg	UJ	DA1SB-084M-0201-SO	25	400	U	N/A	Yes
DA1SB-068M-0201-SO	Hexachlorobenzene	28	400	ug/kg	UJ	DA1SB-084M-0201-SO	28	400	U	N/A	Yes
DA1SB-068M-0201-SO	Hexachlorobutadiene	63	400	ug/kg	UJ	DA1SB-084M-0201-SO	63	400	U	N/A	Yes
DA1SB-068M-0201-SO	Hexachlorocyclopentadiene	52	400	ug/kg	R	DA1SB-084M-0201-SO	53	400	U	N/A	N/A
DA1SB-068M-0201-SO	Hexachloroethane	33	400	ug/kg	UJ	DA1SB-084M-0201-SO	33	400	U	N/A	Yes
DA1SB-068M-0201-SO	Indeno(1,2,3-cd)pyrene	23	400	ug/kg	UJ	DA1SB-084M-0201-SO	23	400	U	N/A	Yes
DA1SB-068M-0201-SO	Isophorone	50	400	ug/kg	UJ	DA1SB-084M-0201-SO	74	400	J	N/A	Yes
DA1SB-068M-0201-SO	Naphthalene	21	400	ug/kg	UJ	DA1SB-084M-0201-SO	21	400	U	N/A	Yes
DA1SB-068M-0201-SO	Nitrobenzene	60	400	ug/kg	R	DA1SB-084M-0201-SO	60	400	U	N/A	N/A

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-068M-0201-SO	N-Nitroso-di-n-propylamine	71	400	ug/kg	UJ	DA1SB-084M-0201-SO	71	400	U	N/A	Yes
DA1SB-068M-0201-SO	N-Nitrosodiphenylamine	50	810	ug/kg	UJ	DA1SB-084M-0201-SO	51	810	U	N/A	Yes
DA1SB-068M-0201-SO	Pentachlorophenol	240	1000	ug/kg	UJ	DA1SB-084M-0201-SO	240	1000	U	N/A	Yes
DA1SB-068M-0201-SO	Phenanthrene	26	400	ug/kg	UJ	DA1SB-084M-0201-SO	26	400	U	N/A	Yes
DA1SB-068M-0201-SO	Phenol	160	500	ug/kg	UJ	DA1SB-084M-0201-SO	160	510	U	N/A	Yes
DA1SB-068M-0201-SO	Pyrene	26	400	ug/kg	UJ	DA1SB-084M-0201-SO	26	400	U	N/A	Yes
DA1SB-068M-0201-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.13	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.08	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	2,4,6-Trinitrotoluene	0.091	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	DA1SB-084M-0201-SO	0.2	0.44	U	N/A	N/A
DA1SB-068M-0201-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	DA1SB-084M-0201-SO	0.07	0.5	U	N/A	N/A
DA1SB-068M-0201-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.05	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	2-Nitrotoluene	0.091	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	3,5-Dinitroaniline	0.091	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.07	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.07	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-084M-0201-SO	0.07	0.5	U	N/A	Yes
DA1SB-068M-0201-SO	HMX	0.12	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.12	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.04	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	DA1SB-084M-0201-SO	0.5	1.5	U	N/A	Yes
DA1SB-068M-0201-SO	Nitroguanidine	0.06	0.16	mg/kg	UJ	DA1SB-084M-0201-SO	0.059	0.16	U	N/A	Yes
DA1SB-068M-0201-SO	PETN	0.5	1.5	mg/kg	UJ	DA1SB-084M-0201-SO	0.5	1.5	U	N/A	Yes
DA1SB-068M-0201-SO	RDX	0.16	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.16	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	Tetryl	0.091	0.44	mg/kg	UJ	DA1SB-084M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SB-068M-0201-SO	Cyanide	0.4	0.38	mg/kg		DA1SB-084M-0201-SO	0.11	0.39	U	N/A	Yes
DA1SB-068M-0201-SO	Nitrocellulose	7	100	mg/kg	U	DA1SB-084M-0201-SO	7	23	U	N/A	Yes
DA1SB-070D-0203-SO	1,1,1-Trichloroethane	9.9	50	ug/kg	U	DA1SB-085D-0204-SO	10	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,1,2,2-Tetrachloroethane	6	50	ug/kg	U	DA1SB-085D-0204-SO	6.3	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,1,2-Trichloroethane	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,1-Dichloroethane	11	50	ug/kg	U	DA1SB-085D-0204-SO	11	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,1-Dichloroethene	16	50	ug/kg	U	DA1SB-085D-0204-SO	17	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,2-Dibromoethane	9.9	50	ug/kg	U	DA1SB-085D-0204-SO	10	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,2-Dichloroethane	12	50	ug/kg	U	DA1SB-085D-0204-SO	13	52	U	N/A	Yes
DA1SB-070D-0203-SO	1,2-Dichloropropane	7	50	ug/kg	U	DA1SB-085D-0204-SO	7.3	52	U	N/A	Yes
DA1SB-070D-0203-SO	2-Butanone	99	500	ug/kg	U	DA1SB-085D-0204-SO	100	520	U	N/A	Yes
DA1SB-070D-0203-SO	2-Hexanone	68	500	ug/kg	U	DA1SB-085D-0204-SO	71	520	U	N/A	Yes
DA1SB-070D-0203-SO	4-Methyl-2-pentanone	82	500	ug/kg	U	DA1SB-085D-0204-SO	86	520	U	N/A	Yes
DA1SB-070D-0203-SO	Acetone	63	990	ug/kg	U	DA1SB-085D-0204-SO	66	1000	U	N/A	Yes
DA1SB-070D-0203-SO	Benzene	5	50	ug/kg	U	DA1SB-085D-0204-SO	5.2	52	U	N/A	Yes

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-070D-0203-SO	Bromochloromethane	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Bromodichloromethane	8.9	50	ug/kg	U	DA1SB-085D-0204-SO	9.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Bromoform	6	50	ug/kg	U	DA1SB-085D-0204-SO	6.3	52	U	N/A	Yes
DA1SB-070D-0203-SO	Bromomethane	30	99	ug/kg	U	DA1SB-085D-0204-SO	31	100	U	N/A	Yes
DA1SB-070D-0203-SO	Carbon disulfide	15	99	ug/kg	U	DA1SB-085D-0204-SO	16	100	U	N/A	Yes
DA1SB-070D-0203-SO	Carbon tetrachloride	11	50	ug/kg	U	DA1SB-085D-0204-SO	11	52	U	N/A	Yes
DA1SB-070D-0203-SO	Chlorobenzene	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Chloroethane	19	99	ug/kg	U	DA1SB-085D-0204-SO	20	100	U	N/A	Yes
DA1SB-070D-0203-SO	Chloroform	8.9	50	ug/kg	U	DA1SB-085D-0204-SO	9.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Chloromethane	25	99	ug/kg	U	DA1SB-085D-0204-SO	26	100	U	N/A	Yes
DA1SB-070D-0203-SO	cis-1,2-Dichloroethene	9.9	50	ug/kg	U	DA1SB-085D-0204-SO	10	52	U	N/A	Yes
DA1SB-070D-0203-SO	cis-1,3-Dichloropropene	9.9	50	ug/kg	U	DA1SB-085D-0204-SO	10	52	U	N/A	Yes
DA1SB-070D-0203-SO	Dibromochloromethane	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Ethylbenzene	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	m,p-Xylenes	18	99	ug/kg	U	DA1SB-085D-0204-SO	19	100	U	N/A	Yes
DA1SB-070D-0203-SO	Methylene chloride	40	99	ug/kg	U	DA1SB-085D-0204-SO	42	100	U	N/A	Yes
DA1SB-070D-0203-SO	o-Xylene	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Styrene	6	50	ug/kg	U	DA1SB-085D-0204-SO	6.3	52	U	N/A	Yes
DA1SB-070D-0203-SO	Tetrachloroethene	8	50	ug/kg	U	DA1SB-085D-0204-SO	8.4	52	U	N/A	Yes
DA1SB-070D-0203-SO	Toluene	7	50	ug/kg	U	DA1SB-085D-0204-SO	7.3	52	U	N/A	Yes
DA1SB-070D-0203-SO	trans-1,2-Dichloroethene	11	50	ug/kg	U	DA1SB-085D-0204-SO	11	52	U	N/A	Yes
DA1SB-070D-0203-SO	trans-1,3-Dichloropropene	7	99	ug/kg	U	DA1SB-085D-0204-SO	7.3	100	U	N/A	Yes
DA1SB-070D-0203-SO	Trichloroethene	9.9	50	ug/kg	U	DA1SB-085D-0204-SO	10	52	U	N/A	Yes
DA1SB-070D-0203-SO	Vinyl chloride	14	50	ug/kg	U	DA1SB-085D-0204-SO	15	52	U	N/A	Yes
DA1SB-070M-0204-SO	Aluminum	12900	0.24	mg/kg	J-	DA1SB-085M-0204-SO	12900	0.24		0	N/A
DA1SB-070M-0204-SO	Antimony	0.57	0.55	mg/kg	J-	DA1SB-085M-0204-SO	0.66	0.55		N/A	Yes
DA1SB-070M-0204-SO	Arsenic	10.2	0.91	mg/kg	J-	DA1SB-085M-0204-SO	9.8	0.91		4	N/A
DA1SB-070M-0204-SO	Barium	62.9	0.055	mg/kg	J-	DA1SB-085M-0204-SO	64.4	0.055		2	N/A
DA1SB-070M-0204-SO	Beryllium	0.46	0.024	mg/kg		DA1SB-085M-0204-SO	0.46	0.024		0	N/A
DA1SB-070M-0204-SO	Cadmium	0.08	0.08	mg/kg	UJ	DA1SB-085M-0204-SO	0.012	0.043	U	N/A	Yes
DA1SB-070M-0204-SO	Calcium	30200	1	mg/kg	J-	DA1SB-085M-0204-SO	30700	1		2	N/A
DA1SB-070M-0204-SO	Chromium	58.3	0.13	mg/kg	J-	DA1SB-085M-0204-SO	74	0.13		24	N/A
DA1SB-070M-0204-SO	Cobalt	9.8	0.099	mg/kg	J-	DA1SB-085M-0204-SO	9.3	0.099		5	N/A
DA1SB-070M-0204-SO	Copper	17.3	0.41	mg/kg	J-	DA1SB-085M-0204-SO	16.1	0.41		7	N/A
DA1SB-070M-0204-SO	Iron	29000	2	mg/kg		DA1SB-085M-0204-SO	29100	2		0	N/A
DA1SB-070M-0204-SO	Lead	10.9	0.28	mg/kg	J-	DA1SB-085M-0204-SO	11.2	0.28		3	N/A
DA1SB-070M-0204-SO	Magnesium	8010	0.81	mg/kg	J-	DA1SB-085M-0204-SO	7910	0.81		1	N/A
DA1SB-070M-0204-SO	Manganese	311	0.1	mg/kg	J-	DA1SB-085M-0204-SO	313	0.1		1	N/A
DA1SB-070M-0204-SO	Nickel	24.1	0.12	mg/kg	J-	DA1SB-085M-0204-SO	23	0.12		5	N/A

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-070M-0204-SO	Potassium	1860	37	mg/kg	J-	DA1SB-085M-0204-SO	1950	37		5	N/A
DA1SB-070M-0204-SO	Selenium	0.43	0.85	mg/kg	J-	DA1SB-085M-0204-SO	0.71	0.85	J	N/A	Yes
DA1SB-070M-0204-SO	Silver	0.034	0.11	mg/kg	UJ	DA1SB-085M-0204-SO	0.034	0.11	U	N/A	Yes
DA1SB-070M-0204-SO	Sodium	78.9	13	mg/kg	J-	DA1SB-085M-0204-SO	78.9	13		0	N/A
DA1SB-070M-0204-SO	Thallium	1.8	0.28	mg/kg	J-	DA1SB-085M-0204-SO	1.8	0.28		0	N/A
DA1SB-070M-0204-SO	Vanadium	18.9	0.069	mg/kg	J-	DA1SB-085M-0204-SO	18.5	0.069		2	N/A
DA1SB-070M-0204-SO	Zinc	51.2	0.24	mg/kg	J-	DA1SB-085M-0204-SO	47.7	0.24		7	N/A
DA1SB-070M-0204-SO	Mercury	0.01	0.008	mg/kg	J-	DA1SB-085M-0204-SO	0.01	0.008		N/A	Yes
DA1SB-070M-0204-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.13	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.08	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.09	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.2	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-085M-0204-SO	0.07	0.5	U	N/A	Yes
DA1SB-070M-0204-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.05	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.09	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.09	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.07	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.07	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-085M-0204-SO	0.07	0.5	U	N/A	Yes
DA1SB-070M-0204-SO	HMX	0.12	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.12	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.04	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	DA1SB-085M-0204-SO	0.5	1.5	U	N/A	Yes
DA1SB-070M-0204-SO	PETN	0.5	1.5	mg/kg	UJ	DA1SB-085M-0204-SO	0.5	1.5	U	N/A	Yes
DA1SB-070M-0204-SO	RDX	0.16	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.16	0.44	U	N/A	Yes
DA1SB-070M-0204-SO	Tetryl	0.09	0.44	mg/kg	UJ	DA1SB-085M-0204-SO	0.09	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	Aluminum	6790	0.24	mg/kg	J-	DA1SB-086M-0204-SO	5940	0.24		13	N/A
DA1SB-072M-0204-SO	Antimony	7.6	0.54	mg/kg	J-	DA1SB-086M-0204-SO	5.1	0.54		39	N/A
DA1SB-072M-0204-SO	Arsenic	10.7	0.91	mg/kg	J-	DA1SB-086M-0204-SO	9.8	0.91		9	N/A
DA1SB-072M-0204-SO	Barium	40.2	0.054	mg/kg	J-	DA1SB-086M-0204-SO	35.7	0.054		12	N/A
DA1SB-072M-0204-SO	Beryllium	0.24	0.024	mg/kg	J	DA1SB-086M-0204-SO	0.25	0.024		4	N/A
DA1SB-072M-0204-SO	Cadmium	0.2	0.2	mg/kg	UJ	DA1SB-086M-0204-SO	0.012	0.042	U	N/A	Yes
DA1SB-072M-0204-SO	Calcium	1060	1	mg/kg	J-	DA1SB-086M-0204-SO	790	1		29	N/A
DA1SB-072M-0204-SO	Chromium	589	0.13	mg/kg	J-	DA1SB-086M-0204-SO	384	0.13		42	N/A
DA1SB-072M-0204-SO	Cobalt	5.9	0.099	mg/kg	J-	DA1SB-086M-0204-SO	6.1	0.099		3	N/A
DA1SB-072M-0204-SO	Copper	26.5	0.4	mg/kg	J-	DA1SB-086M-0204-SO	25.7	0.4		3	N/A
DA1SB-072M-0204-SO	Iron	25500	2	mg/kg		DA1SB-086M-0204-SO	22500	2		13	N/A
DA1SB-072M-0204-SO	Lead	13.9	0.28	mg/kg	J-	DA1SB-086M-0204-SO	10.5	0.28		28	N/A
DA1SB-072M-0204-SO	Magnesium	1750	0.8	mg/kg	J-	DA1SB-086M-0204-SO	1700	0.8		3	N/A
DA1SB-072M-0204-SO	Manganese	342	0.1	mg/kg	J-	DA1SB-086M-0204-SO	390	0.1		13	N/A

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SB-072M-0204-SO	Nickel	16	0.12	mg/kg	J-	DA1SB-086M-0204-SO	16.4	0.12		2	N/A
DA1SB-072M-0204-SO	Potassium	1330	36	mg/kg	J-	DA1SB-086M-0204-SO	966	36		32	N/A
DA1SB-072M-0204-SO	Selenium	0.68	0.85	mg/kg	J-	DA1SB-086M-0204-SO	0.45	0.85	J	N/A	Yes
DA1SB-072M-0204-SO	Silver	0.034	0.11	mg/kg	UJ	DA1SB-086M-0204-SO	0.034	0.11	U	N/A	Yes
DA1SB-072M-0204-SO	Sodium	115	13	mg/kg	J-	DA1SB-086M-0204-SO	75.7	13		41	N/A
DA1SB-072M-0204-SO	Thallium	1.3	0.28	mg/kg	J-	DA1SB-086M-0204-SO	1.3	0.28		N/A	Yes
DA1SB-072M-0204-SO	Vanadium	13.3	0.068	mg/kg	J-	DA1SB-086M-0204-SO	11.6	0.068		14	N/A
DA1SB-072M-0204-SO	Zinc	63.9	0.24	mg/kg	J-	DA1SB-086M-0204-SO	59.9	0.24		6	N/A
DA1SB-072M-0204-SO	Mercury	0.037	0.0079	mg/kg	J-	DA1SB-086M-0204-SO	0.019	0.0079		N/A	No
DA1SB-072M-0204-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.13	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.08	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.089	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.2	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-086M-0204-SO	0.07	0.5	U	N/A	Yes
DA1SB-072M-0204-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.05	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.089	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.089	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.07	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.07	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	DA1SB-086M-0204-SO	0.07	0.5	U	N/A	Yes
DA1SB-072M-0204-SO	HMX	0.12	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.12	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.04	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	DA1SB-086M-0204-SO	0.5	1.5	U	N/A	Yes
DA1SB-072M-0204-SO	PETN	0.5	1.5	mg/kg	UJ	DA1SB-086M-0204-SO	0.5	1.5	U	N/A	Yes
DA1SB-072M-0204-SO	RDX	0.16	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.16	0.44	U	N/A	Yes
DA1SB-072M-0204-SO	Tetryl	0.09	0.44	mg/kg	UJ	DA1SB-086M-0204-SO	0.089	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	Aluminum	10900	0.24	mg/kg	J-	DA1SS-080M-0201-SO	11400	0.25		4	N/A
DA1SS-050M-0201-SO	Antimony	1.2	0.55	mg/kg	J-	DA1SS-080M-0201-SO	0.16	0.55	U	N/A	No
DA1SS-050M-0201-SO	Arsenic	9.1	0.92	mg/kg	J-	DA1SS-080M-0201-SO	8.9	0.92		2	N/A
DA1SS-050M-0201-SO	Barium	78.8	0.055	mg/kg	J-	DA1SS-080M-0201-SO	107	0.055		30	N/A
DA1SS-050M-0201-SO	Beryllium	0.38	0.024	mg/kg		DA1SS-080M-0201-SO	0.4	0.025		5	N/A
DA1SS-050M-0201-SO	Cadmium	2.6	0.043	mg/kg	J-	DA1SS-080M-0201-SO	3	0.043		14	N/A
DA1SS-050M-0201-SO	Calcium	2500	1	mg/kg	J-	DA1SS-080M-0201-SO	2260	1		10	N/A
DA1SS-050M-0201-SO	Chromium	110	0.13	mg/kg	J-	DA1SS-080M-0201-SO	43	0.13		88	N/A
DA1SS-050M-0201-SO	Cobalt	7.6	0.1	mg/kg	J-	DA1SS-080M-0201-SO	8.4	0.1		10	N/A
DA1SS-050M-0201-SO	Copper	188	0.41	mg/kg	J-	DA1SS-080M-0201-SO	150	0.41		22	N/A
DA1SS-050M-0201-SO	Iron	23700	2	mg/kg		DA1SS-080M-0201-SO	24300	2		3	N/A
DA1SS-050M-0201-SO	Lead	23.4	0.28	mg/kg	J-	DA1SS-080M-0201-SO	25.3	0.29		8	N/A
DA1SS-050M-0201-SO	Magnesium	2860	0.81	mg/kg	J-	DA1SS-080M-0201-SO	2890	0.82		1	N/A

ODA1 Field Duplicate Comparison

Sample	Analyte	Result	LOQ	Units	Qualifier	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
DA1SS-050M-0201-SO	Manganese	407	0.1	mg/kg	J-	DA1SS-080M-0201-SO	456	0.1		11	N/A
DA1SS-050M-0201-SO	Nickel	18.4	0.12	mg/kg	J-	DA1SS-080M-0201-SO	18	0.12		2	N/A
DA1SS-050M-0201-SO	Potassium	814	37	mg/kg	J-	DA1SS-080M-0201-SO	729	37		11	N/A
DA1SS-050M-0201-SO	Selenium	0.75	0.85	mg/kg	J-	DA1SS-080M-0201-SO	0.62	0.86	J	N/A	Yes
DA1SS-050M-0201-SO	Silver	0.035	0.11	mg/kg	UJ	DA1SS-080M-0201-SO	0.035	0.11	U	N/A	Yes
DA1SS-050M-0201-SO	Sodium	31.8	13	mg/kg	J-	DA1SS-080M-0201-SO	26.8	13		N/A	Yes
DA1SS-050M-0201-SO	Thallium	1.6	0.28	mg/kg	J-	DA1SS-080M-0201-SO	1.5	0.29		6	N/A
DA1SS-050M-0201-SO	Vanadium	16.1	0.069	mg/kg	J-	DA1SS-080M-0201-SO	16	0.07		1	N/A
DA1SS-050M-0201-SO	Zinc	191	0.24	mg/kg	J-	DA1SS-080M-0201-SO	187	0.25		2	N/A
DA1SS-050M-0201-SO	Hexavalent Chromium	1.9	6.5	mg/kg	U	DA1SS-080M-0201-SO	1.9	6.5	U	N/A	Yes
DA1SS-050M-0201-SO	Mercury	0.037	0.008	mg/kg	J-	DA1SS-080M-0201-SO	0.037	0.0081		N/A	Yes
DA1SS-050M-0201-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.13	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.08	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.2	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	UJ	DA1SS-080M-0201-SO	0.07	0.5	U	N/A	Yes
DA1SS-050M-0201-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.05	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.09	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.07	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.07	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	DA1SS-080M-0201-SO	0.07	0.5	U	N/A	Yes
DA1SS-050M-0201-SO	HMX	0.12	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.12	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.04	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	DA1SS-080M-0201-SO	0.5	1.5	U	N/A	Yes
DA1SS-050M-0201-SO	PETN	0.5	1.5	mg/kg	UJ	DA1SS-080M-0201-SO	0.5	1.5	U	N/A	Yes
DA1SS-050M-0201-SO	RDX	0.16	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.16	0.44	U	N/A	Yes
DA1SS-050M-0201-SO	Tetryl	0.09	0.44	mg/kg	UJ	DA1SS-080M-0201-SO	0.09	0.44	U	N/A	Yes

Sand Creek

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-037D-0001-SO	1,1,1-Trichloroethane	14	70	ug/kg	U	8260	SCSB-080D-0001-SO	12	58	U	N/A	Yes
SCSB-037D-0001-SO	1,1,2,2-Tetrachloroethane	8.3	70	ug/kg	U	8260	SCSB-080D-0001-SO	6.9	58	U	N/A	Yes
SCSB-037D-0001-SO	1,1,2-Trichloroethane	11	70	ug/kg	U	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	1,1-Dichloroethane	15	70	ug/kg	U	8260	SCSB-080D-0001-SO	13	58	U	N/A	Yes
SCSB-037D-0001-SO	1,1-Dichloroethene	22	70	ug/kg	U	8260	SCSB-080D-0001-SO	19	58	U	N/A	Yes
SCSB-037D-0001-SO	1,2-Dibromoethane	14	70	ug/kg	U	8260	SCSB-080D-0001-SO	12	58	U	N/A	Yes
SCSB-037D-0001-SO	1,2-Dichloroethane	17	70	ug/kg	U	8260	SCSB-080D-0001-SO	14	58	U	N/A	Yes
SCSB-037D-0001-SO	1,2-Dichloropropane	9.7	70	ug/kg	U	8260	SCSB-080D-0001-SO	8.1	58	U	N/A	Yes
SCSB-037D-0001-SO	2-Butanone	140	700	ug/kg	U	8260	SCSB-080D-0001-SO	120	580	U	N/A	Yes
SCSB-037D-0001-SO	2-Hexanone	95	700	ug/kg	U	8260	SCSB-080D-0001-SO	79	580	U	N/A	Yes
SCSB-037D-0001-SO	4-Methyl-2-pentanone	110	700	ug/kg	U	8260	SCSB-080D-0001-SO	95	580	U	N/A	Yes
SCSB-037D-0001-SO	Acetone	88	1400	ug/kg	U	8260	SCSB-080D-0001-SO	73	1200	U	N/A	Yes
SCSB-037D-0001-SO	Benzene	7	70	ug/kg	U	8260	SCSB-080D-0001-SO	5.8	58	U	N/A	Yes
SCSB-037D-0001-SO	Bromochloromethane	11	70	ug/kg	U	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	Bromodichloromethane	13	70	ug/kg	U	8260	SCSB-080D-0001-SO	10	58	U	N/A	Yes
SCSB-037D-0001-SO	Bromoform	8.3	70	ug/kg	U	8260	SCSB-080D-0001-SO	6.9	58	U	N/A	Yes
SCSB-037D-0001-SO	Bromomethane	42	140	ug/kg	U	8260	SCSB-080D-0001-SO	35	120	U	N/A	Yes
SCSB-037D-0001-SO	Carbon disulfide	21	140	ug/kg	U	8260	SCSB-080D-0001-SO	17	120	U	N/A	Yes
SCSB-037D-0001-SO	Carbon tetrachloride	15	70	ug/kg	U	8260	SCSB-080D-0001-SO	13	58	U	N/A	Yes
SCSB-037D-0001-SO	Chlorobenzene	11	70	ug/kg	U	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	Chloroethane	26	140	ug/kg	U	8260	SCSB-080D-0001-SO	22	120	U	N/A	Yes
SCSB-037D-0001-SO	Chloroform	13	70	ug/kg	U	8260	SCSB-080D-0001-SO	10	58	U	N/A	Yes
SCSB-037D-0001-SO	Chloromethane	35	140	ug/kg	U	8260	SCSB-080D-0001-SO	29	120	U	N/A	Yes
SCSB-037D-0001-SO	cis-1,2-Dichloroethene	14	70	ug/kg	U	8260	SCSB-080D-0001-SO	12	58	U	N/A	Yes
SCSB-037D-0001-SO	cis-1,3-Dichloropropene	14	70	ug/kg	U	8260	SCSB-080D-0001-SO	12	58	U	N/A	Yes
SCSB-037D-0001-SO	Dibromochloromethane	11	70	ug/kg	U	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	Ethylbenzene	11	70	ug/kg	U	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	m,p-Xylenes	25	140	ug/kg	U	8260	SCSB-080D-0001-SO	21	120	U	N/A	Yes
SCSB-037D-0001-SO	Methylene chloride	56	140	ug/kg	U	8260	SCSB-080D-0001-SO	46	120	U	N/A	Yes
SCSB-037D-0001-SO	o-Xylene	13	70	ug/kg	J	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	Styrene	8.3	70	ug/kg	U	8260	SCSB-080D-0001-SO	6.9	58	U	N/A	Yes
SCSB-037D-0001-SO	Tetrachloroethene	11	70	ug/kg	U	8260	SCSB-080D-0001-SO	9.3	58	U	N/A	Yes
SCSB-037D-0001-SO	Toluene	12	70	ug/kg	J	8260	SCSB-080D-0001-SO	8.1	58	U	N/A	Yes
SCSB-037D-0001-SO	trans-1,2-Dichloroethene	15	70	ug/kg	U	8260	SCSB-080D-0001-SO	13	58	U	N/A	Yes
SCSB-037D-0001-SO	trans-1,3-Dichloropropene	9.7	140	ug/kg	U	8260	SCSB-080D-0001-SO	8.1	120	U	N/A	Yes
SCSB-037D-0001-SO	Trichloroethene	14	70	ug/kg	U	8260	SCSB-080D-0001-SO	12	58	U	N/A	Yes
SCSB-037D-0001-SO	Vinyl chloride	19	70	ug/kg	U	8260	SCSB-080D-0001-SO	16	58	U	N/A	Yes
SCSB-037M-0001-SO	Aluminum	14800	0.49	mg/kg	J-	6010	SCSB-080M-0001-SO	14100	0.49		5	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-037M-0001-SO	Antimony	0.93	1.1	mg/kg	J-	6010	SCSB-080M-0001-SO	0.67	1.1	J	N/A	Yes
SCSB-037M-0001-SO	Arsenic	182	1.8	mg/kg	J-	6010	SCSB-080M-0001-SO	214	1.8		16	N/A
SCSB-037M-0001-SO	Barium	932	0.11	mg/kg	J-	6010	SCSB-080M-0001-SO	1050	0.11		12	N/A
SCSB-037M-0001-SO	Beryllium	3.9	0.049	mg/kg	J-	6010	SCSB-080M-0001-SO	3.8	0.049		3	N/A
SCSB-037M-0001-SO	Cadmium	1.6	0.085	mg/kg	J-	6010	SCSB-080M-0001-SO	2.1	0.085		27	N/A
SCSB-037M-0001-SO	Calcium	13900	2	mg/kg	J-	6010	SCSB-080M-0001-SO	16700	2		18	N/A
SCSB-037M-0001-SO	Chromium	112	0.26	mg/kg	J-	6010	SCSB-080M-0001-SO	66	0.26		52	N/A
SCSB-037M-0001-SO	Cobalt	9	0.2	mg/kg	J-	6010	SCSB-080M-0001-SO	8.5	0.2		6	N/A
SCSB-037M-0001-SO	Copper	95.7	0.81	mg/kg	J-	6010	SCSB-080M-0001-SO	118	0.81		21	N/A
SCSB-037M-0001-SO	Iron	41500	4.1	mg/kg	J-	6010	SCSB-080M-0001-SO	38900	4.1		6	N/A
SCSB-037M-0001-SO	Lead	325	0.57	mg/kg	J-	6010	SCSB-080M-0001-SO	400	0.57		21	N/A
SCSB-037M-0001-SO	Magnesium	3050	1.6	mg/kg	J-	6010	SCSB-080M-0001-SO	3270	1.6		7	N/A
SCSB-037M-0001-SO	Manganese	743	0.2	mg/kg	J-	6010	SCSB-080M-0001-SO	770	0.2		4	N/A
SCSB-037M-0001-SO	Nickel	35.7	0.25	mg/kg	J-	6010	SCSB-080M-0001-SO	35.2	0.25		1	N/A
SCSB-037M-0001-SO	Potassium	1020	37	mg/kg	J-	6010	SCSB-080M-0001-SO	885	37		14	N/A
SCSB-037M-0001-SO	Selenium	3.1	1.7	mg/kg	J-	6010	SCSB-080M-0001-SO	3.4	1.7		N/A	Yes
SCSB-037M-0001-SO	Silver	1.2	0.23	mg/kg		6010	SCSB-080M-0001-SO	1.5	0.23		22	N/A
SCSB-037M-0001-SO	Sodium	178	13	mg/kg	J-	6010	SCSB-080M-0001-SO	175	13		2	N/A
SCSB-037M-0001-SO	Thallium	5.5	0.57	mg/kg	J-	6010	SCSB-080M-0001-SO	5.3	0.57		4	N/A
SCSB-037M-0001-SO	Vanadium	41	0.14	mg/kg	J-	6010	SCSB-080M-0001-SO	41.4	0.14		1	N/A
SCSB-037M-0001-SO	Zinc	298	0.49	mg/kg	J-	6010	SCSB-080M-0001-SO	337	0.49		12	N/A
SCSB-037M-0001-SO	Mercury	0.24	0.008	mg/kg	J-	7471	SCSB-080M-0001-SO	0.31	0.008		25	N/A
SCSB-037M-0001-SO	1,2,4-Trichlorobenzene	21	400	ug/kg	U	8270	SCSB-080M-0001-SO	21	410	U	N/A	Yes
SCSB-037M-0001-SO	1,2-Dichlorobenzene	49	400	ug/kg	J	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	1,3-Dichlorobenzene	20	400	ug/kg	U	8270	SCSB-080M-0001-SO	20	410	U	N/A	Yes
SCSB-037M-0001-SO	1,4-Dichlorobenzene	19	400	ug/kg	U	8270	SCSB-080M-0001-SO	19	410	U	N/A	Yes
SCSB-037M-0001-SO	2,4,5-Trichlorophenol	130	510	ug/kg	U	8270	SCSB-080M-0001-SO	130	510	U	N/A	Yes
SCSB-037M-0001-SO	2,4,6-Trichlorophenol	130	510	ug/kg	U	8270	SCSB-080M-0001-SO	130	510	U	N/A	Yes
SCSB-037M-0001-SO	2,4-Dichlorophenol	120	510	ug/kg	U	8270	SCSB-080M-0001-SO	120	510	U	N/A	Yes
SCSB-037M-0001-SO	2,4-Dimethylphenol	100	400	ug/kg	U	8270	SCSB-080M-0001-SO	100	410	U	N/A	Yes
SCSB-037M-0001-SO	2,4-Dinitrophenol	700	2000	ug/kg	UJ	8270	SCSB-080M-0001-SO	700	2000	U	N/A	Yes
SCSB-037M-0001-SO	2,4-Dinitrotoluene	24	400	ug/kg	U	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	2,6-Dinitrotoluene	24	400	ug/kg	U	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	2-Chloronaphthalene	23	400	ug/kg	U	8270	SCSB-080M-0001-SO	23	410	U	N/A	Yes
SCSB-037M-0001-SO	2-Chlorophenol	340	510	ug/kg	U	8270	SCSB-080M-0001-SO	340	510	U	N/A	Yes
SCSB-037M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	U	8270	SCSB-080M-0001-SO	270	1000	U	N/A	Yes
SCSB-037M-0001-SO	2-Methylnaphthalene	260	400	ug/kg	J	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	2-Methylphenol	420	1000	ug/kg	U	8270	SCSB-080M-0001-SO	430	1000	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-037M-0001-SO	2-Nitroaniline	23	400	ug/kg	U	8270	SCSB-080M-0001-SO	23	410	U	N/A	Yes
SCSB-037M-0001-SO	2-Nitrophenol	280	510	ug/kg	U	8270	SCSB-080M-0001-SO	280	510	U	N/A	Yes
SCSB-037M-0001-SO	3,3'-Dichlorobenzidine	150	510	ug/kg	UJ	8270	SCSB-080M-0001-SO	150	510	U	N/A	Yes
SCSB-037M-0001-SO	3-Nitroaniline	22	1000	ug/kg	UJ	8270	SCSB-080M-0001-SO	22	1000	U	N/A	Yes
SCSB-037M-0001-SO	4-Bromophenyl phenyl ether	25	400	ug/kg	U	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	4-Chloro-3-methylphenol	380	510	ug/kg	U	8270	SCSB-080M-0001-SO	390	510	U	N/A	Yes
SCSB-037M-0001-SO	4-Chloroaniline	39	400	ug/kg	UJ	8270	SCSB-080M-0001-SO	40	410	U	N/A	Yes
SCSB-037M-0001-SO	4-Chlorophenyl phenyl ether	26	400	ug/kg	U	8270	SCSB-080M-0001-SO	26	410	U	N/A	Yes
SCSB-037M-0001-SO	4-Methylphenol	660	2000	ug/kg	U	8270	SCSB-080M-0001-SO	660	2000	U	N/A	Yes
SCSB-037M-0001-SO	4-Nitroaniline	30	1000	ug/kg	U	8270	SCSB-080M-0001-SO	30	1000	U	N/A	Yes
SCSB-037M-0001-SO	4-Nitrophenol	400	1000	ug/kg	U	8270	SCSB-080M-0001-SO	410	1000	U	N/A	Yes
SCSB-037M-0001-SO	Acenaphthene	24	400	ug/kg	U	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	Acenaphthylene	24	400	ug/kg	U	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	Anthracene	32	400	ug/kg	J	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	Benzo(a)anthracene	120	400	ug/kg	J	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	Benzo(a)pyrene	140	400	ug/kg	J	8270	SCSB-080M-0001-SO	23	410	U	N/A	Yes
SCSB-037M-0001-SO	Benzo(b)fluoranthene	260	400	ug/kg	J	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	Benzo(g,h,i)perylene	120	400	ug/kg	J	8270	SCSB-080M-0001-SO	22	410	U	N/A	Yes
SCSB-037M-0001-SO	Benzo(k)fluoranthene	69	400	ug/kg	J	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	Benzoic acid	290	990	ug/kg	U	8270	SCSB-080M-0001-SO	290	990	U	N/A	Yes
SCSB-037M-0001-SO	Benzyl alcohol	84	1000	ug/kg	UJ	8270	SCSB-080M-0001-SO	84	1000	U	N/A	Yes
SCSB-037M-0001-SO	Bis(2-chloroethoxy)methane	23	400	ug/kg	U	8270	SCSB-080M-0001-SO	23	410	U	N/A	Yes
SCSB-037M-0001-SO	Bis(2-chloroethyl) ether	25	400	ug/kg	U	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	Bis(2-chloroisopropyl) ether	30	400	ug/kg	U	8270	SCSB-080M-0001-SO	30	410	U	N/A	Yes
SCSB-037M-0001-SO	Bis(2-ethylhexyl) phthalate	88	1000	ug/kg	U	8270	SCSB-080M-0001-SO	88	1000	U	N/A	Yes
SCSB-037M-0001-SO	Butylbenzyl phthalate	74	400	ug/kg	U	8270	SCSB-080M-0001-SO	74	410	U	N/A	Yes
SCSB-037M-0001-SO	Carbazole	33	400	ug/kg	J	8270	SCSB-080M-0001-SO	28	410	U	N/A	Yes
SCSB-037M-0001-SO	Chrysene	160	400	ug/kg	J	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	Dibenzo(a,h)anthracene	32	400	ug/kg	J	8270	SCSB-080M-0001-SO	22	410	U	N/A	Yes
SCSB-037M-0001-SO	Dibenzofuran	69	400	ug/kg	J	8270	SCSB-080M-0001-SO	24	410	U	N/A	Yes
SCSB-037M-0001-SO	Diethyl phthalate	65	400	ug/kg	U	8270	SCSB-080M-0001-SO	65	410	U	N/A	Yes
SCSB-037M-0001-SO	Dimethyl phthalate	64	400	ug/kg	U	8270	SCSB-080M-0001-SO	64	410	U	N/A	Yes
SCSB-037M-0001-SO	Di-n-butyl phthalate	120	400	ug/kg	J	8270	SCSB-080M-0001-SO	92	410	J	N/A	Yes
SCSB-037M-0001-SO	Di-n-octyl phthalate	60	400	ug/kg	U	8270	SCSB-080M-0001-SO	60	410	U	N/A	Yes
SCSB-037M-0001-SO	Fluoranthene	360	400	ug/kg	J	8270	SCSB-080M-0001-SO	26	410	U	N/A	Yes
SCSB-037M-0001-SO	Fluorene	25	400	ug/kg	U	8270	SCSB-080M-0001-SO	25	410	U	N/A	Yes
SCSB-037M-0001-SO	Hexachlorobenzene	28	400	ug/kg	U	8270	SCSB-080M-0001-SO	28	410	U	N/A	Yes
SCSB-037M-0001-SO	Hexachlorobutadiene	63	400	ug/kg	U	8270	SCSB-080M-0001-SO	63	410	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-037M-0001-SO	Hexachlorocyclopentadiene	53	400	ug/kg	UJ	8270	SCSB-080M-0001-SO	53	410	U	N/A	Yes
SCSB-037M-0001-SO	Hexachloroethane	33	400	ug/kg	U	8270	SCSB-080M-0001-SO	33	410	U	N/A	Yes
SCSB-037M-0001-SO	Indeno(1,2,3-cd)pyrene	93	400	ug/kg	J	8270	SCSB-080M-0001-SO	23	410	U	N/A	Yes
SCSB-037M-0001-SO	Isophorone	500	400	ug/kg		8270	SCSB-080M-0001-SO	180	410	J	N/A	Yes
SCSB-037M-0001-SO	Naphthalene	150	400	ug/kg	J	8270	SCSB-080M-0001-SO	21	410	U	N/A	Yes
SCSB-037M-0001-SO	Nitrobenzene	60	400	ug/kg	R	8270	SCSB-080M-0001-SO	60	410	U	N/A	N/A
SCSB-037M-0001-SO	N-Nitroso-di-n-propylamine	71	400	ug/kg	U	8270	SCSB-080M-0001-SO	71	410	U	N/A	Yes
SCSB-037M-0001-SO	N-Nitrosodiphenylamine	51	810	ug/kg	U	8270	SCSB-080M-0001-SO	51	810	U	N/A	Yes
SCSB-037M-0001-SO	Pentachlorophenol	240	1000	ug/kg	U	8270	SCSB-080M-0001-SO	240	1000	U	N/A	Yes
SCSB-037M-0001-SO	Phenanthrene	280	400	ug/kg	J	8270	SCSB-080M-0001-SO	26	410	U	N/A	Yes
SCSB-037M-0001-SO	Phenol	160	510	ug/kg	U	8270	SCSB-080M-0001-SO	160	510	U	N/A	Yes
SCSB-037M-0001-SO	Pyrene	280	400	ug/kg	J	8270	SCSB-080M-0001-SO	26	410	U	N/A	Yes
SCSB-037M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.13	0.44	U	N/A	Yes
SCSB-037M-0001-SO	1,3-Dinitrobenzene	0.081	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.081	0.44	U	N/A	Yes
SCSB-037M-0001-SO	2,4,6-Trinitrotoluene	0.091	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.091	0.44	U	N/A	Yes
SCSB-037M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSB-080M-0001-SO	0.2	0.44	U	N/A	N/A
SCSB-037M-0001-SO	2,6-Dinitrotoluene	0.071	0.51	mg/kg	R	8330B	SCSB-080M-0001-SO	0.071	0.5	U	N/A	N/A
SCSB-037M-0001-SO	2-Amino-4,6-dinitrotoluene	0.051	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.05	0.44	U	N/A	Yes
SCSB-037M-0001-SO	2-Nitrotoluene	0.091	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.091	0.44	U	N/A	Yes
SCSB-037M-0001-SO	3,5-Dinitroaniline	0.091	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.091	0.44	U	N/A	Yes
SCSB-037M-0001-SO	3-Nitrotoluene	0.071	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.071	0.44	U	N/A	Yes
SCSB-037M-0001-SO	4-Amino-2,6-dinitrotoluene	0.071	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.071	0.44	U	N/A	Yes
SCSB-037M-0001-SO	4-Nitrotoluene	0.071	0.51	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.071	0.5	U	N/A	Yes
SCSB-037M-0001-SO	HMX	0.12	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.12	0.44	U	N/A	Yes
SCSB-037M-0001-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.04	0.44	U	N/A	Yes
SCSB-037M-0001-SO	Nitroglycerin	0.51	1.5	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.5	1.5	U	N/A	Yes
SCSB-037M-0001-SO	PETN	0.51	1.5	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.5	1.5	U	N/A	Yes
SCSB-037M-0001-SO	RDX	0.16	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.16	0.44	U	N/A	Yes
SCSB-037M-0001-SO	Tetryl	0.091	0.44	mg/kg	UJ	8330B	SCSB-080M-0001-SO	0.091	0.44	U	N/A	Yes
SCSB-038D-0005-SO	1,1,1-Trichloroethane	12	60	ug/kg	U	8260	SCSB-081D-0005-SO	11	57	U	N/A	Yes
SCSB-038D-0005-SO	1,1,2,2-Tetrachloroethane	7.2	60	ug/kg	U	8260	SCSB-081D-0005-SO	6.9	57	U	N/A	Yes
SCSB-038D-0005-SO	1,1,2-Trichloroethane	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	1,1-Dichloroethane	13	60	ug/kg	U	8260	SCSB-081D-0005-SO	13	57	U	N/A	Yes
SCSB-038D-0005-SO	1,1-Dichloroethene	19	60	ug/kg	U	8260	SCSB-081D-0005-SO	18	57	U	N/A	Yes
SCSB-038D-0005-SO	1,2-Dibromoethane	12	60	ug/kg	U	8260	SCSB-081D-0005-SO	11	57	U	N/A	Yes
SCSB-038D-0005-SO	1,2-Dichloroethane	14	60	ug/kg	U	8260	SCSB-081D-0005-SO	14	57	U	N/A	Yes
SCSB-038D-0005-SO	1,2-Dichloropropane	8.4	60	ug/kg	U	8260	SCSB-081D-0005-SO	8	57	U	N/A	Yes
SCSB-038D-0005-SO	2-Butanone	120	600	ug/kg	U	8260	SCSB-081D-0005-SO	110	570	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-038D-0005-SO	2-Hexanone	82	600	ug/kg	U	8260	SCSB-081D-0005-SO	78	570	U	N/A	Yes
SCSB-038D-0005-SO	4-Methyl-2-pentanone	99	600	ug/kg	U	8260	SCSB-081D-0005-SO	94	570	U	N/A	Yes
SCSB-038D-0005-SO	Acetone	76	1200	ug/kg	U	8260	SCSB-081D-0005-SO	72	1100	U	N/A	Yes
SCSB-038D-0005-SO	Benzene	6	60	ug/kg	U	8260	SCSB-081D-0005-SO	5.7	57	U	N/A	Yes
SCSB-038D-0005-SO	Bromochloromethane	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	Bromodichloromethane	11	60	ug/kg	U	8260	SCSB-081D-0005-SO	10	57	U	N/A	Yes
SCSB-038D-0005-SO	Bromoform	7.2	60	ug/kg	U	8260	SCSB-081D-0005-SO	6.9	57	U	N/A	Yes
SCSB-038D-0005-SO	Bromomethane	36	120	ug/kg	U	8260	SCSB-081D-0005-SO	34	110	U	N/A	Yes
SCSB-038D-0005-SO	Carbon disulfide	18	120	ug/kg	U	8260	SCSB-081D-0005-SO	17	110	U	N/A	Yes
SCSB-038D-0005-SO	Carbon tetrachloride	13	60	ug/kg	U	8260	SCSB-081D-0005-SO	13	57	U	N/A	Yes
SCSB-038D-0005-SO	Chlorobenzene	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	Chloroethane	23	120	ug/kg	U	8260	SCSB-081D-0005-SO	22	110	U	N/A	Yes
SCSB-038D-0005-SO	Chloroform	11	60	ug/kg	U	8260	SCSB-081D-0005-SO	10	57	U	N/A	Yes
SCSB-038D-0005-SO	Chloromethane	30	120	ug/kg	U	8260	SCSB-081D-0005-SO	29	110	U	N/A	Yes
SCSB-038D-0005-SO	cis-1,2-Dichloroethene	12	60	ug/kg	U	8260	SCSB-081D-0005-SO	11	57	U	N/A	Yes
SCSB-038D-0005-SO	cis-1,3-Dichloropropene	12	60	ug/kg	U	8260	SCSB-081D-0005-SO	11	57	U	N/A	Yes
SCSB-038D-0005-SO	Dibromochloromethane	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	Ethylbenzene	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	m,p-Xylenes	22	120	ug/kg	U	8260	SCSB-081D-0005-SO	21	110	U	N/A	Yes
SCSB-038D-0005-SO	Methylene chloride	48	120	ug/kg	U	8260	SCSB-081D-0005-SO	46	110	U	N/A	Yes
SCSB-038D-0005-SO	o-Xylene	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	Styrene	7.2	60	ug/kg	U	8260	SCSB-081D-0005-SO	6.9	57	U	N/A	Yes
SCSB-038D-0005-SO	Tetrachloroethene	9.6	60	ug/kg	U	8260	SCSB-081D-0005-SO	9.2	57	U	N/A	Yes
SCSB-038D-0005-SO	Toluene	8.4	60	ug/kg	U	8260	SCSB-081D-0005-SO	8	57	U	N/A	Yes
SCSB-038D-0005-SO	trans-1,2-Dichloroethene	13	60	ug/kg	U	8260	SCSB-081D-0005-SO	13	57	U	N/A	Yes
SCSB-038D-0005-SO	trans-1,3-Dichloropropene	8.4	120	ug/kg	U	8260	SCSB-081D-0005-SO	8	110	U	N/A	Yes
SCSB-038D-0005-SO	Trichloroethene	12	60	ug/kg	U	8260	SCSB-081D-0005-SO	11	57	U	N/A	Yes
SCSB-038D-0005-SO	Vinyl chloride	17	60	ug/kg	U	8260	SCSB-081D-0005-SO	16	57	U	N/A	Yes
SCSB-038M-0005-SO	Aluminum	10900	0.24	mg/kg	J-	6010	SCSB-081M-0005-SO	10500	0.24		4	N/A
SCSB-038M-0005-SO	Antimony	0.63	0.54	mg/kg	J-	6010	SCSB-081M-0005-SO	0.57	0.54		N/A	Yes
SCSB-038M-0005-SO	Arsenic	6.1	0.91	mg/kg	J-	6010	SCSB-081M-0005-SO	5.5	0.9		10	N/A
SCSB-038M-0005-SO	Barium	43.8	0.054	mg/kg	J-	6010	SCSB-081M-0005-SO	43.3	0.054		1	N/A
SCSB-038M-0005-SO	Beryllium	0.38	0.024	mg/kg	J-	6010	SCSB-081M-0005-SO	0.38	0.024		0	N/A
SCSB-038M-0005-SO	Cadmium	0.012	0.042	mg/kg	UJ	6010	SCSB-081M-0005-SO	0.012	0.042	U	N/A	Yes
SCSB-038M-0005-SO	Calcium	10900	1	mg/kg	J-	6010	SCSB-081M-0005-SO	10200	1		7	N/A
SCSB-038M-0005-SO	Chromium	156	0.13	mg/kg	J-	6010	SCSB-081M-0005-SO	123	0.13		24	N/A
SCSB-038M-0005-SO	Cobalt	9	0.099	mg/kg	J-	6010	SCSB-081M-0005-SO	8.6	0.098		5	N/A
SCSB-038M-0005-SO	Copper	18.6	0.4	mg/kg	J-	6010	SCSB-081M-0005-SO	17.2	0.4		8	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-038M-0005-SO	Iron	29600	2	mg/kg	J-	6010	SCSB-081M-0005-SO	28300	2		4	N/A
SCSB-038M-0005-SO	Lead	5.3	0.28	mg/kg	J-	6010	SCSB-081M-0005-SO	4.9	0.28		8	N/A
SCSB-038M-0005-SO	Magnesium	6840	0.8	mg/kg	J-	6010	SCSB-081M-0005-SO	6530	0.8		5	N/A
SCSB-038M-0005-SO	Manganese	369	0.1	mg/kg	J-	6010	SCSB-081M-0005-SO	347	0.1		6	N/A
SCSB-038M-0005-SO	Nickel	20.4	0.12	mg/kg	J-	6010	SCSB-081M-0005-SO	19.9	0.12		2	N/A
SCSB-038M-0005-SO	Potassium	2020	36	mg/kg	J-	6010	SCSB-081M-0005-SO	1960	36		3	N/A
SCSB-038M-0005-SO	Selenium	0.6	0.85	mg/kg	J-	6010	SCSB-081M-0005-SO	0.45	0.84	J	N/A	Yes
SCSB-038M-0005-SO	Silver	0.034	0.11	mg/kg	U	6010	SCSB-081M-0005-SO	0.034	0.11	U	N/A	Yes
SCSB-038M-0005-SO	Sodium	134	13	mg/kg	J-	6010	SCSB-081M-0005-SO	122	13		9	N/A
SCSB-038M-0005-SO	Thallium	1.7	0.28	mg/kg	J-	6010	SCSB-081M-0005-SO	1.6	0.28		6	N/A
SCSB-038M-0005-SO	Vanadium	14.3	0.068	mg/kg	J-	6010	SCSB-081M-0005-SO	13.7	0.068		4	N/A
SCSB-038M-0005-SO	Zinc	48.1	0.24	mg/kg	J-	6010	SCSB-081M-0005-SO	46.4	0.24		4	N/A
SCSB-038M-0005-SO	Mercury	0.0079	0.008	mg/kg	J-	7471	SCSB-081M-0005-SO	0.0076	0.008	J	N/A	Yes
SCSB-038M-0005-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.13	0.43	U	N/A	Yes
SCSB-038M-0005-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.079	0.43	U	N/A	Yes
SCSB-038M-0005-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.089	0.43	U	N/A	Yes
SCSB-038M-0005-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSB-081M-0005-SO	0.2	0.43	U	N/A	N/A
SCSB-038M-0005-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	8330B	SCSB-081M-0005-SO	0.069	0.49	U	N/A	N/A
SCSB-038M-0005-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.049	0.43	U	N/A	Yes
SCSB-038M-0005-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.089	0.43	U	N/A	Yes
SCSB-038M-0005-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.089	0.43	U	N/A	Yes
SCSB-038M-0005-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.069	0.43	U	N/A	Yes
SCSB-038M-0005-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.069	0.43	U	N/A	Yes
SCSB-038M-0005-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.069	0.49	U	N/A	Yes
SCSB-038M-0005-SO	HMX	0.12	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.12	0.43	U	N/A	Yes
SCSB-038M-0005-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.039	0.43	U	N/A	Yes
SCSB-038M-0005-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.49	1.5	U	N/A	Yes
SCSB-038M-0005-SO	PETN	0.5	1.5	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.49	1.5	U	N/A	Yes
SCSB-038M-0005-SO	RDX	0.16	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.16	0.43	U	N/A	Yes
SCSB-038M-0005-SO	Tetryl	0.09	0.44	mg/kg	UJ	8330B	SCSB-081M-0005-SO	0.089	0.43	U	N/A	Yes
SCSB-040M-0002-SO	Aluminum	11500	0.12	mg/kg		6010	SCSB-082M-0002-SO	14300	0.12		22	N/A
SCSB-040M-0002-SO	Antimony	1	0.27	mg/kg		6010	SCSB-082M-0002-SO	0.082	0.28	U	N/A	No
SCSB-040M-0002-SO	Arsenic	14.7	0.46	mg/kg		6010	SCSB-082M-0002-SO	15.2	0.46		3	N/A
SCSB-040M-0002-SO	Barium	49.8	0.027	mg/kg		6010	SCSB-082M-0002-SO	55.6	0.028		11	N/A
SCSB-040M-0002-SO	Beryllium	0.66	0.012	mg/kg		6010	SCSB-082M-0002-SO	0.68	0.024		3	N/A
SCSB-040M-0002-SO	Cadmium	0.28	0.021	mg/kg		6010	SCSB-082M-0002-SO	0.22	0.021		24	N/A
SCSB-040M-0002-SO	Calcium	4700	0.51	mg/kg		6010	SCSB-082M-0002-SO	5120	0.51		9	N/A
SCSB-040M-0002-SO	Chromium	54.9	0.064	mg/kg		6010	SCSB-082M-0002-SO	44.6	0.064		21	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-040M-0002-SO	Cobalt	11.1	0.05	mg/kg		6010	SCSB-082M-0002-SO	12	0.05		8	N/A
SCSB-040M-0002-SO	Copper	17.1	0.2	mg/kg		6010	SCSB-082M-0002-SO	16.3	0.2		5	N/A
SCSB-040M-0002-SO	Iron	33700	2	mg/kg		6010	SCSB-082M-0002-SO	33400	2		1	N/A
SCSB-040M-0002-SO	Lead	42.5	0.14	mg/kg		6010	SCSB-082M-0002-SO	35.2	0.14		19	N/A
SCSB-040M-0002-SO	Magnesium	5690	0.4	mg/kg		6010	SCSB-082M-0002-SO	6750	0.41		17	N/A
SCSB-040M-0002-SO	Manganese	312	0.1	mg/kg		6010	SCSB-082M-0002-SO	347	0.051		11	N/A
SCSB-040M-0002-SO	Nickel	25.8	0.062	mg/kg		6010	SCSB-082M-0002-SO	31.9	0.062		21	N/A
SCSB-040M-0002-SO	Potassium	2070	36	mg/kg		6010	SCSB-082M-0002-SO	2220	37		7	N/A
SCSB-040M-0002-SO	Selenium	0.071	0.42	mg/kg	U	6010	SCSB-082M-0002-SO	0.071	0.43	U	N/A	Yes
SCSB-040M-0002-SO	Silver	0.017	0.057	mg/kg	U	6010	SCSB-082M-0002-SO	0.017	0.057	U	N/A	Yes
SCSB-040M-0002-SO	Sodium	124	13	mg/kg		6010	SCSB-082M-0002-SO	122	13		2	N/A
SCSB-040M-0002-SO	Thallium	0.081	0.28	mg/kg	U	6010	SCSB-082M-0002-SO	0.86	0.29		N/A	No
SCSB-040M-0002-SO	Vanadium	15.3	0.034	mg/kg		6010	SCSB-082M-0002-SO	18.9	0.035		21	N/A
SCSB-040M-0002-SO	Zinc	54.1	0.12	mg/kg		6010	SCSB-082M-0002-SO	58.4	0.12		8	N/A
SCSB-040M-0002-SO	Mercury	0.0064	0.008	mg/kg	J	7471	SCSB-082M-0002-SO	0.0053	0.008	J	N/A	Yes
SCSB-040M-0002-SO	1,2,4-Trichlorobenzene	21	410	ug/kg	U	8270	SCSB-082M-0002-SO	21	400	U	N/A	Yes
SCSB-040M-0002-SO	1,2-Dichlorobenzene	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	1,3-Dichlorobenzene	20	410	ug/kg	U	8270	SCSB-082M-0002-SO	20	400	U	N/A	Yes
SCSB-040M-0002-SO	1,4-Dichlorobenzene	19	410	ug/kg	U	8270	SCSB-082M-0002-SO	19	400	U	N/A	Yes
SCSB-040M-0002-SO	2,4,5-Trichlorophenol	130	510	ug/kg	U	8270	SCSB-082M-0002-SO	130	510	U	N/A	Yes
SCSB-040M-0002-SO	2,4,6-Trichlorophenol	130	510	ug/kg	U	8270	SCSB-082M-0002-SO	130	510	U	N/A	Yes
SCSB-040M-0002-SO	2,4-Dichlorophenol	120	510	ug/kg	U	8270	SCSB-082M-0002-SO	120	510	U	N/A	Yes
SCSB-040M-0002-SO	2,4-Dimethylphenol	100	410	ug/kg	U	8270	SCSB-082M-0002-SO	100	400	U	N/A	Yes
SCSB-040M-0002-SO	2,4-Dinitrophenol	700	2000	ug/kg	U	8270	SCSB-082M-0002-SO	700	2000	U	N/A	Yes
SCSB-040M-0002-SO	2,4-Dinitrotoluene	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	2,6-Dinitrotoluene	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	2-Chloronaphthalene	23	410	ug/kg	U	8270	SCSB-082M-0002-SO	23	400	U	N/A	Yes
SCSB-040M-0002-SO	2-Chlorophenol	350	510	ug/kg	U	8270	SCSB-082M-0002-SO	340	510	U	N/A	Yes
SCSB-040M-0002-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	U	8270	SCSB-082M-0002-SO	270	1000	U	N/A	Yes
SCSB-040M-0002-SO	2-Methylnaphthalene	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	2-Methylphenol	430	1000	ug/kg	U	8270	SCSB-082M-0002-SO	420	1000	U	N/A	Yes
SCSB-040M-0002-SO	2-Nitroaniline	23	410	ug/kg	U	8270	SCSB-082M-0002-SO	23	400	U	N/A	Yes
SCSB-040M-0002-SO	2-Nitrophenol	280	510	ug/kg	U	8270	SCSB-082M-0002-SO	280	510	U	N/A	Yes
SCSB-040M-0002-SO	3,3'-Dichlorobenzidine	150	510	ug/kg	U	8270	SCSB-082M-0002-SO	150	510	U	N/A	Yes
SCSB-040M-0002-SO	3-Nitroaniline	22	1000	ug/kg	U	8270	SCSB-082M-0002-SO	22	1000	U	N/A	Yes
SCSB-040M-0002-SO	4-Bromophenyl phenyl ether	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	4-Chloro-3-methylphenol	390	510	ug/kg	U	8270	SCSB-082M-0002-SO	380	510	U	N/A	Yes
SCSB-040M-0002-SO	4-Chloroaniline	40	410	ug/kg	U	8270	SCSB-082M-0002-SO	39	400	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-040M-0002-SO	4-Chlorophenyl phenyl ether	26	410	ug/kg	U	8270	SCSB-082M-0002-SO	26	400	U	N/A	Yes
SCSB-040M-0002-SO	4-Methylphenol	660	2000	ug/kg	U	8270	SCSB-082M-0002-SO	660	2000	U	N/A	Yes
SCSB-040M-0002-SO	4-Nitroaniline	30	1000	ug/kg	U	8270	SCSB-082M-0002-SO	30	1000	U	N/A	Yes
SCSB-040M-0002-SO	4-Nitrophenol	410	1000	ug/kg	U	8270	SCSB-082M-0002-SO	400	1000	U	N/A	Yes
SCSB-040M-0002-SO	Acenaphthene	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	Acenaphthylene	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	Anthracene	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	Benzo(a)anthracene	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	Benzo(a)pyrene	23	410	ug/kg	U	8270	SCSB-082M-0002-SO	23	400	U	N/A	Yes
SCSB-040M-0002-SO	Benzo(b)fluoranthene	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	Benzo(g,h,i)perylene	22	410	ug/kg	U	8270	SCSB-082M-0002-SO	22	400	U	N/A	Yes
SCSB-040M-0002-SO	Benzo(k)fluoranthene	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	Benzoic acid	300	1000	ug/kg	U	8270	SCSB-082M-0002-SO	290	990	U	N/A	Yes
SCSB-040M-0002-SO	Benzyl alcohol	84	1000	ug/kg	U	8270	SCSB-082M-0002-SO	84	1000	U	N/A	Yes
SCSB-040M-0002-SO	Bis(2-chloroethoxy)methane	23	410	ug/kg	U	8270	SCSB-082M-0002-SO	23	400	U	N/A	Yes
SCSB-040M-0002-SO	Bis(2-chloroethyl) ether	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	Bis(2-chloroisopropyl) ether	30	410	ug/kg	U	8270	SCSB-082M-0002-SO	30	400	U	N/A	Yes
SCSB-040M-0002-SO	Bis(2-ethylhexyl) phthalate	850	1000	ug/kg	J	8270	SCSB-082M-0002-SO	88	1000	U	N/A	Yes
SCSB-040M-0002-SO	Butylbenzyl phthalate	74	410	ug/kg	U	8270	SCSB-082M-0002-SO	74	400	U	N/A	Yes
SCSB-040M-0002-SO	Carbazole	28	410	ug/kg	U	8270	SCSB-082M-0002-SO	28	400	U	N/A	Yes
SCSB-040M-0002-SO	Chrysene	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	Dibenzo(a,h)anthracene	22	410	ug/kg	U	8270	SCSB-082M-0002-SO	22	400	U	N/A	Yes
SCSB-040M-0002-SO	Dibenzofuran	24	410	ug/kg	U	8270	SCSB-082M-0002-SO	24	400	U	N/A	Yes
SCSB-040M-0002-SO	Diethyl phthalate	65	410	ug/kg	U	8270	SCSB-082M-0002-SO	65	400	U	N/A	Yes
SCSB-040M-0002-SO	Dimethyl phthalate	64	410	ug/kg	U	8270	SCSB-082M-0002-SO	64	400	U	N/A	Yes
SCSB-040M-0002-SO	Di-n-butyl phthalate	120	410	ug/kg	J	8270	SCSB-082M-0002-SO	100	400	J	N/A	Yes
SCSB-040M-0002-SO	Di-n-octyl phthalate	60	410	ug/kg	U	8270	SCSB-082M-0002-SO	60	400	U	N/A	Yes
SCSB-040M-0002-SO	Fluoranthene	26	410	ug/kg	U	8270	SCSB-082M-0002-SO	26	400	U	N/A	Yes
SCSB-040M-0002-SO	Fluorene	25	410	ug/kg	U	8270	SCSB-082M-0002-SO	25	400	U	N/A	Yes
SCSB-040M-0002-SO	Hexachlorobenzene	28	410	ug/kg	U	8270	SCSB-082M-0002-SO	28	400	U	N/A	Yes
SCSB-040M-0002-SO	Hexachlorobutadiene	63	410	ug/kg	U	8270	SCSB-082M-0002-SO	63	400	U	N/A	Yes
SCSB-040M-0002-SO	Hexachlorocyclopentadiene	53	410	ug/kg	U	8270	SCSB-082M-0002-SO	53	400	U	N/A	Yes
SCSB-040M-0002-SO	Hexachloroethane	34	410	ug/kg	U	8270	SCSB-082M-0002-SO	33	400	U	N/A	Yes
SCSB-040M-0002-SO	Indeno(1,2,3-cd)pyrene	23	410	ug/kg	U	8270	SCSB-082M-0002-SO	23	400	U	N/A	Yes
SCSB-040M-0002-SO	Isophorone	62	410	ug/kg	J	8270	SCSB-082M-0002-SO	180	400	J	N/A	Yes
SCSB-040M-0002-SO	Naphthalene	21	410	ug/kg	U	8270	SCSB-082M-0002-SO	21	400	U	N/A	Yes
SCSB-040M-0002-SO	Nitrobenzene	60	410	ug/kg	U	8270	SCSB-082M-0002-SO	60	400	U	N/A	Yes
SCSB-040M-0002-SO	N-Nitroso-di-n-propylamine	71	410	ug/kg	U	8270	SCSB-082M-0002-SO	71	400	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-040M-0002-SO	N-Nitrosodiphenylamine	51	810	ug/kg	U	8270	SCSB-082M-0002-SO	51	810	U	N/A	Yes
SCSB-040M-0002-SO	Pentachlorophenol	240	1000	ug/kg	U	8270	SCSB-082M-0002-SO	240	1000	U	N/A	Yes
SCSB-040M-0002-SO	Phenanthrene	26	410	ug/kg	U	8270	SCSB-082M-0002-SO	26	400	U	N/A	Yes
SCSB-040M-0002-SO	Phenol	160	510	ug/kg	U	8270	SCSB-082M-0002-SO	160	510	U	N/A	Yes
SCSB-040M-0002-SO	Pyrene	26	410	ug/kg	U	8270	SCSB-082M-0002-SO	26	400	U	N/A	Yes
SCSB-040M-0002-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.13	0.44	U	N/A	Yes
SCSB-040M-0002-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.079	0.44	U	N/A	Yes
SCSB-040M-0002-SO	2,4,6-Trinitrotoluene	0.089	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.089	0.44	U	N/A	Yes
SCSB-040M-0002-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.2	0.44	U	N/A	Yes
SCSB-040M-0002-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	U	8330B	SCSB-082M-0002-SO	0.069	0.5	U	N/A	Yes
SCSB-040M-0002-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.05	0.44	U	N/A	Yes
SCSB-040M-0002-SO	2-Nitrotoluene	0.089	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.089	0.44	U	N/A	Yes
SCSB-040M-0002-SO	3,5-Dinitroaniline	0.089	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.089	0.44	U	N/A	Yes
SCSB-040M-0002-SO	3-Nitrotoluene	0.07	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.069	0.44	U	N/A	Yes
SCSB-040M-0002-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.069	0.44	U	N/A	Yes
SCSB-040M-0002-SO	4-Nitrotoluene	0.07	0.5	mg/kg	U	8330B	SCSB-082M-0002-SO	0.069	0.5	U	N/A	Yes
SCSB-040M-0002-SO	HMX	0.12	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.12	0.44	U	N/A	Yes
SCSB-040M-0002-SO	Nitrobenzene	0.04	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.04	0.44	U	N/A	Yes
SCSB-040M-0002-SO	Nitroglycerin	0.5	1.5	mg/kg	U	8330B	SCSB-082M-0002-SO	0.5	1.5	U	N/A	Yes
SCSB-040M-0002-SO	PETN	0.5	1.5	mg/kg	U	8330B	SCSB-082M-0002-SO	0.5	1.5	U	N/A	Yes
SCSB-040M-0002-SO	RDX	0.16	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.16	0.44	U	N/A	Yes
SCSB-040M-0002-SO	Tetryl	0.089	0.44	mg/kg	U	8330B	SCSB-082M-0002-SO	0.089	0.44	U	N/A	Yes
SCSB-042M-0003-SO	Aluminum	14000	0.61	mg/kg	J-	6010	SCSB-083M-0003-SO	12400	0.12		12	N/A
SCSB-042M-0003-SO	Antimony	0.4	1.4	mg/kg	R	6010	SCSB-083M-0003-SO	0.081	0.27	U	N/A	N/A
SCSB-042M-0003-SO	Arsenic	15.4	2.3	mg/kg	J-	6010	SCSB-083M-0003-SO	15.1	0.46		2	N/A
SCSB-042M-0003-SO	Barium	69.3	0.14	mg/kg	J-	6010	SCSB-083M-0003-SO	31.2	0.027		76	N/A
SCSB-042M-0003-SO	Beryllium	0.49	0.061	mg/kg	J-	6010	SCSB-083M-0003-SO	0.54	0.024		10	N/A
SCSB-042M-0003-SO	Cadmium	0.03	0.11	mg/kg	UJ	6010	SCSB-083M-0003-SO	0.15	0.021		N/A	No
SCSB-042M-0003-SO	Calcium	5360	2.5	mg/kg	J-	6010	SCSB-083M-0003-SO	6050	0.51		12	N/A
SCSB-042M-0003-SO	Chromium	19.8	0.32	mg/kg	J-	6010	SCSB-083M-0003-SO	29.6	0.064		40	N/A
SCSB-042M-0003-SO	Cobalt	13	0.25	mg/kg	J-	6010	SCSB-083M-0003-SO	11.6	0.05		11	N/A
SCSB-042M-0003-SO	Copper	21	1	mg/kg	J-	6010	SCSB-083M-0003-SO	15.8	0.2		28	N/A
SCSB-042M-0003-SO	Iron	35600	5.1	mg/kg	J-	6010	SCSB-083M-0003-SO	31900	2		11	N/A
SCSB-042M-0003-SO	Lead	11.2	0.71	mg/kg	J-	6010	SCSB-083M-0003-SO	35.7	0.14		104	N/A
SCSB-042M-0003-SO	Magnesium	5490	2	mg/kg	J-	6010	SCSB-083M-0003-SO	6840	0.41		22	N/A
SCSB-042M-0003-SO	Manganese	451	0.25	mg/kg	J-	6010	SCSB-083M-0003-SO	276	0.051		48	N/A
SCSB-042M-0003-SO	Nickel	30.7	0.31	mg/kg	J-	6010	SCSB-083M-0003-SO	30.9	0.062		1	N/A
SCSB-042M-0003-SO	Potassium	1880	36	mg/kg	J-	6010	SCSB-083M-0003-SO	1460	36		25	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-042M-0003-SO	Selenium	0.35	2.1	mg/kg	UJ	6010	SCSB-083M-0003-SO	0.071	0.43	U	N/A	Yes
SCSB-042M-0003-SO	Silver	0.086	0.28	mg/kg	U	6010	SCSB-083M-0003-SO	0.017	0.057	U	N/A	Yes
SCSB-042M-0003-SO	Sodium	92	13	mg/kg	J-	6010	SCSB-083M-0003-SO	71.9	13		25	N/A
SCSB-042M-0003-SO	Thallium	2.1	0.71	mg/kg	J-	6010	SCSB-083M-0003-SO	0.61	0.28		N/A	No
SCSB-042M-0003-SO	Vanadium	20.5	0.17	mg/kg	J-	6010	SCSB-083M-0003-SO	16.1	0.034		24	N/A
SCSB-042M-0003-SO	Zinc	67	0.61	mg/kg	J-	6010	SCSB-083M-0003-SO	56.2	0.12		18	N/A
SCSB-042M-0003-SO	Mercury	0.008	0.008	mg/kg	J-	7471	SCSB-083M-0003-SO	0.0051	0.008	J	N/A	Yes
SCSB-042M-0003-SO	1,2,4-Trichlorobenzene	21	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	21	400	U	N/A	Yes
SCSB-042M-0003-SO	1,2-Dichlorobenzene	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	1,3-Dichlorobenzene	20	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	20	400	U	N/A	Yes
SCSB-042M-0003-SO	1,4-Dichlorobenzene	19	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	19	400	U	N/A	Yes
SCSB-042M-0003-SO	2,4,5-Trichlorophenol	130	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	130	510	U	N/A	Yes
SCSB-042M-0003-SO	2,4,6-Trichlorophenol	130	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	130	510	U	N/A	Yes
SCSB-042M-0003-SO	2,4-Dichlorophenol	120	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	120	510	U	N/A	Yes
SCSB-042M-0003-SO	2,4-Dimethylphenol	100	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	100	400	U	N/A	Yes
SCSB-042M-0003-SO	2,4-Dinitrophenol	700	2000	ug/kg	UJ	8270	SCSB-083M-0003-SO	700	2000	U	N/A	Yes
SCSB-042M-0003-SO	2,4-Dinitrotoluene	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	2,6-Dinitrotoluene	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	2-Chloronaphthalene	23	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	23	400	U	N/A	Yes
SCSB-042M-0003-SO	2-Chlorophenol	340	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	340	510	U	N/A	Yes
SCSB-042M-0003-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	270	1000	U	N/A	Yes
SCSB-042M-0003-SO	2-Methylnaphthalene	49	400	ug/kg	J-	8270	SCSB-083M-0003-SO	58	400	J	N/A	Yes
SCSB-042M-0003-SO	2-Methylphenol	420	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	420	1000	U	N/A	Yes
SCSB-042M-0003-SO	2-Nitroaniline	23	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	23	400	U	N/A	Yes
SCSB-042M-0003-SO	2-Nitrophenol	280	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	280	510	U	N/A	Yes
SCSB-042M-0003-SO	3,3'-Dichlorobenzidine	150	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	150	510	U	N/A	Yes
SCSB-042M-0003-SO	3-Nitroaniline	22	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	22	1000	U	N/A	Yes
SCSB-042M-0003-SO	4-Bromophenyl phenyl ether	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes
SCSB-042M-0003-SO	4-Chloro-3-methylphenol	380	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	380	510	U	N/A	Yes
SCSB-042M-0003-SO	4-Chloroaniline	39	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	39	400	U	N/A	Yes
SCSB-042M-0003-SO	4-Chlorophenyl phenyl ether	26	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	26	400	U	N/A	Yes
SCSB-042M-0003-SO	4-Methylphenol	660	2000	ug/kg	UJ	8270	SCSB-083M-0003-SO	660	2000	U	N/A	Yes
SCSB-042M-0003-SO	4-Nitroaniline	30	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	30	1000	U	N/A	Yes
SCSB-042M-0003-SO	4-Nitrophenol	400	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	400	1000	U	N/A	Yes
SCSB-042M-0003-SO	Acenaphthene	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	Acenaphthylene	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	Anthracene	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	Benzo(a)anthracene	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-042M-0003-SO	Benzo(a)pyrene	23	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	23	400	U	N/A	Yes
SCSB-042M-0003-SO	Benzo(b)fluoranthene	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes
SCSB-042M-0003-SO	Benzo(g,h,i)perylene	22	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	22	400	U	N/A	Yes
SCSB-042M-0003-SO	Benzo(k)fluoranthene	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes
SCSB-042M-0003-SO	Benzoic acid	290	990	ug/kg	UJ	8270	SCSB-083M-0003-SO	290	990	U	N/A	Yes
SCSB-042M-0003-SO	Benzyl alcohol	84	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	84	1000	U	N/A	Yes
SCSB-042M-0003-SO	Bis(2-chloroethoxy)methane	23	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	23	400	U	N/A	Yes
SCSB-042M-0003-SO	Bis(2-chloroethyl) ether	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes
SCSB-042M-0003-SO	Bis(2-chloroisopropyl) ether	30	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	30	400	U	N/A	Yes
SCSB-042M-0003-SO	Bis(2-ethylhexyl) phthalate	88	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	150	1000	J	N/A	Yes
SCSB-042M-0003-SO	Butylbenzyl phthalate	74	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	74	400	U	N/A	Yes
SCSB-042M-0003-SO	Carbazole	28	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	28	400	U	N/A	Yes
SCSB-042M-0003-SO	Chrysene	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes
SCSB-042M-0003-SO	Dibenzo(a,h)anthracene	22	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	22	400	U	N/A	Yes
SCSB-042M-0003-SO	Dibenzofuran	24	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	24	400	U	N/A	Yes
SCSB-042M-0003-SO	Diethyl phthalate	65	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	65	400	U	N/A	Yes
SCSB-042M-0003-SO	Dimethyl phthalate	64	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	64	400	U	N/A	Yes
SCSB-042M-0003-SO	Di-n-butyl phthalate	100	400	ug/kg	J-	8270	SCSB-083M-0003-SO	130	400	J	N/A	Yes
SCSB-042M-0003-SO	Di-n-octyl phthalate	60	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	60	400	U	N/A	Yes
SCSB-042M-0003-SO	Fluoranthene	26	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	26	400	U	N/A	Yes
SCSB-042M-0003-SO	Fluorene	25	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	25	400	U	N/A	Yes
SCSB-042M-0003-SO	Hexachlorobenzene	28	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	28	400	U	N/A	Yes
SCSB-042M-0003-SO	Hexachlorobutadiene	63	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	63	400	U	N/A	Yes
SCSB-042M-0003-SO	Hexachlorocyclopentadiene	53	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	53	400	U	N/A	Yes
SCSB-042M-0003-SO	Hexachloroethane	33	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	33	400	U	N/A	Yes
SCSB-042M-0003-SO	Indeno(1,2,3-cd)pyrene	23	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	23	400	U	N/A	Yes
SCSB-042M-0003-SO	Isophorone	51	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	200	400	J	N/A	Yes
SCSB-042M-0003-SO	Naphthalene	35	400	ug/kg	J-	8270	SCSB-083M-0003-SO	41	400	J	N/A	Yes
SCSB-042M-0003-SO	Nitrobenzene	60	400	ug/kg	R	8270	SCSB-083M-0003-SO	60	400	U	N/A	N/A
SCSB-042M-0003-SO	N-Nitroso-di-n-propylamine	71	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	71	400	U	N/A	Yes
SCSB-042M-0003-SO	N-Nitrosodiphenylamine	51	810	ug/kg	UJ	8270	SCSB-083M-0003-SO	51	810	U	N/A	Yes
SCSB-042M-0003-SO	Pentachlorophenol	240	1000	ug/kg	UJ	8270	SCSB-083M-0003-SO	240	1000	U	N/A	Yes
SCSB-042M-0003-SO	Phenanthrene	34	400	ug/kg	J-	8270	SCSB-083M-0003-SO	36	400	J	N/A	Yes
SCSB-042M-0003-SO	Phenol	160	510	ug/kg	UJ	8270	SCSB-083M-0003-SO	160	510	U	N/A	Yes
SCSB-042M-0003-SO	Pyrene	26	400	ug/kg	UJ	8270	SCSB-083M-0003-SO	26	400	U	N/A	Yes
SCSB-042M-0003-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.13	0.44	U	N/A	Yes
SCSB-042M-0003-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.08	0.44	U	N/A	Yes
SCSB-042M-0003-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.09	0.44	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-042M-0003-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSB-083M-0003-SO	0.2	0.44	U	N/A	N/A
SCSB-042M-0003-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	8330B	SCSB-083M-0003-SO	0.07	0.5	U	N/A	N/A
SCSB-042M-0003-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.05	0.44	U	N/A	Yes
SCSB-042M-0003-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.09	0.44	U	N/A	Yes
SCSB-042M-0003-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.09	0.44	U	N/A	Yes
SCSB-042M-0003-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.07	0.44	U	N/A	Yes
SCSB-042M-0003-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.07	0.44	U	N/A	Yes
SCSB-042M-0003-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.07	0.5	U	N/A	Yes
SCSB-042M-0003-SO	HMX	0.12	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.12	0.44	U	N/A	Yes
SCSB-042M-0003-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.04	0.44	U	N/A	Yes
SCSB-042M-0003-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.5	1.5	U	N/A	Yes
SCSB-042M-0003-SO	PETN	0.5	1.5	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.5	1.5	U	N/A	Yes
SCSB-042M-0003-SO	RDX	0.16	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.16	0.44	U	N/A	Yes
SCSB-042M-0003-SO	Tetryl	0.09	0.44	mg/kg	UJ	8330B	SCSB-083M-0003-SO	0.09	0.44	U	N/A	Yes
SCSB-048M-0001-SO	Aluminum	13000	0.24	mg/kg	J-	6010	SCSB-084M-0001-SO	20800	0.61		46	N/A
SCSB-048M-0001-SO	Antimony	1.5	0.55	mg/kg	J-	6010	SCSB-084M-0001-SO	0.41	1.4	U	N/A	Yes
SCSB-048M-0001-SO	Arsenic	15	0.91	mg/kg	J	6010	SCSB-084M-0001-SO	23.4	2.3		44	N/A
SCSB-048M-0001-SO	Barium	137	0.055	mg/kg	J-	6010	SCSB-084M-0001-SO	228	0.14		50	N/A
SCSB-048M-0001-SO	Beryllium	1.5	0.024	mg/kg		6010	SCSB-084M-0001-SO	2.5	0.061		50	N/A
SCSB-048M-0001-SO	Cadmium	0.012	0.043	mg/kg	UJ	6010	SCSB-084M-0001-SO	0.03	0.11	U	N/A	Yes
SCSB-048M-0001-SO	Calcium	37100	1	mg/kg	J-	6010	SCSB-084M-0001-SO	64800	2.5		54	N/A
SCSB-048M-0001-SO	Chromium	109	0.13	mg/kg	J-	6010	SCSB-084M-0001-SO	36.2	0.32		100	N/A
SCSB-048M-0001-SO	Cobalt	6	0.099	mg/kg	J-	6010	SCSB-084M-0001-SO	8	0.25		29	N/A
SCSB-048M-0001-SO	Copper	44.8	0.4	mg/kg	J-	6010	SCSB-084M-0001-SO	63.3	1		34	N/A
SCSB-048M-0001-SO	Iron	22800	2	mg/kg		6010	SCSB-084M-0001-SO	28200	5.1		21	N/A
SCSB-048M-0001-SO	Lead	34.5	0.28	mg/kg	J+	6010	SCSB-084M-0001-SO	57.2	0.71		50	N/A
SCSB-048M-0001-SO	Magnesium	3580	0.81	mg/kg	J-	6010	SCSB-084M-0001-SO	6280	2		55	N/A
SCSB-048M-0001-SO	Manganese	1150	0.1	mg/kg	J-	6010	SCSB-084M-0001-SO	2010	0.25		54	N/A
SCSB-048M-0001-SO	Nickel	88.1	0.12	mg/kg	J-	6010	SCSB-084M-0001-SO	42.3	0.31		70	N/A
SCSB-048M-0001-SO	Potassium	1020	36	mg/kg	J-	6010	SCSB-084M-0001-SO	584	37		54	N/A
SCSB-048M-0001-SO	Selenium	1.1	0.85	mg/kg		6010	SCSB-084M-0001-SO	1.7	2.1	J	N/A	Yes
SCSB-048M-0001-SO	Silver	0.5	0.11	mg/kg		6010	SCSB-084M-0001-SO	0.74	0.28		N/A	Yes
SCSB-048M-0001-SO	Sodium	227	13	mg/kg	J-	6010	SCSB-084M-0001-SO	20.2	13		N/A	No
SCSB-048M-0001-SO	Thallium	1.6	0.28	mg/kg	J-	6010	SCSB-084M-0001-SO	2.1	0.71		N/A	Yes
SCSB-048M-0001-SO	Vanadium	13.3	0.069	mg/kg		6010	SCSB-084M-0001-SO	17.6	0.17		28	N/A
SCSB-048M-0001-SO	Zinc	41.3	0.24	mg/kg	J-	6010	SCSB-084M-0001-SO	56.3	0.61		31	N/A
SCSB-048M-0001-SO	Hexavalent Chromium	1.9	6.5	mg/kg	UJ	7196	SCSB-084M-0001-SO	1.9	6.5	U	N/A	Yes
SCSB-048M-0001-SO	Mercury	0.046	0.008	mg/kg		7471	SCSB-084M-0001-SO	0.041	0.008		11	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-048M-0001-SO	4,4'-DDD	1.5	12	ug/kg	U	8081	SCSB-084M-0001-SO	1.5	12	U	N/A	Yes
SCSB-048M-0001-SO	4,4'-DDE	5.1	20	ug/kg	J	8081	SCSB-084M-0001-SO	4.6	20	J	N/A	Yes
SCSB-048M-0001-SO	4,4'-DDT	13	12	ug/kg		8081	SCSB-084M-0001-SO	11	12	J	N/A	Yes
SCSB-048M-0001-SO	Aldrin	2.5	12	ug/kg	U	8081	SCSB-084M-0001-SO	2.5	12	U	N/A	Yes
SCSB-048M-0001-SO	alpha-BHC	3.1	20	ug/kg	U	8081	SCSB-084M-0001-SO	3.1	20	U	N/A	Yes
SCSB-048M-0001-SO	alpha-Chlordane	1.5	20	ug/kg	U	8081	SCSB-084M-0001-SO	1.5	20	U	N/A	Yes
SCSB-048M-0001-SO	beta-BHC	3.1	20	ug/kg	U	8081	SCSB-084M-0001-SO	3.1	20	U	N/A	Yes
SCSB-048M-0001-SO	Chlordane (Technical)	20	380	ug/kg	U	8081	SCSB-084M-0001-SO	20	380	U	N/A	Yes
SCSB-048M-0001-SO	delta-BHC	1.5	12	ug/kg	U	8081	SCSB-084M-0001-SO	1.5	12	U	N/A	Yes
SCSB-048M-0001-SO	Dieldrin	1.5	12	ug/kg	U	8081	SCSB-084M-0001-SO	1.5	12	U	N/A	Yes
SCSB-048M-0001-SO	Endosulfan I	3.6	12	ug/kg	U	8081	SCSB-084M-0001-SO	3.6	12	U	N/A	Yes
SCSB-048M-0001-SO	Endosulfan II	3.6	12	ug/kg	J	8081	SCSB-084M-0001-SO	3.6	12	J	N/A	Yes
SCSB-048M-0001-SO	Endosulfan sulfate	4.6	20	ug/kg	U	8081	SCSB-084M-0001-SO	4.6	20	U	N/A	Yes
SCSB-048M-0001-SO	Endrin	2	12	ug/kg	UJ	8081	SCSB-084M-0001-SO	2	12	U	N/A	Yes
SCSB-048M-0001-SO	Endrin aldehyde	5.6	20	ug/kg	U	8081	SCSB-084M-0001-SO	5.6	20	U	N/A	Yes
SCSB-048M-0001-SO	Endrin ketone	4.1	12	ug/kg	U	8081	SCSB-084M-0001-SO	4.1	12	U	N/A	Yes
SCSB-048M-0001-SO	GAMMA-BHC	2.5	12	ug/kg	U	8081	SCSB-084M-0001-SO	2.5	12	U	N/A	Yes
SCSB-048M-0001-SO	gamma-Chlordane	1.5	20	ug/kg	U	8081	SCSB-084M-0001-SO	1.5	20	U	N/A	Yes
SCSB-048M-0001-SO	Heptachlor	2	12	ug/kg	U	8081	SCSB-084M-0001-SO	2	12	U	N/A	Yes
SCSB-048M-0001-SO	Heptachlor epoxide	2.5	20	ug/kg	U	8081	SCSB-084M-0001-SO	2.5	20	U	N/A	Yes
SCSB-048M-0001-SO	Methoxychlor	3.6	12	ug/kg	U	8081	SCSB-084M-0001-SO	3.6	12	U	N/A	Yes
SCSB-048M-0001-SO	Toxaphene	25	250	ug/kg	U	8081	SCSB-084M-0001-SO	25	250	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1016	10	51	ug/kg	U	8082	SCSB-084M-0001-SO	10	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1221	20	51	ug/kg	U	8082	SCSB-084M-0001-SO	20	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1232	27	51	ug/kg	U	8082	SCSB-084M-0001-SO	28	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1242	29	51	ug/kg	U	8082	SCSB-084M-0001-SO	30	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1248	29	51	ug/kg	U	8082	SCSB-084M-0001-SO	30	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1254	23	51	ug/kg	U	8082	SCSB-084M-0001-SO	23	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1260	12	51	ug/kg	U	8082	SCSB-084M-0001-SO	12	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1262	21	51	ug/kg	U	8082	SCSB-084M-0001-SO	21	51	U	N/A	Yes
SCSB-048M-0001-SO	Aroclor 1268	28	51	ug/kg	U	8082	SCSB-084M-0001-SO	29	51	U	N/A	Yes
SCSB-048M-0001-SO	1,2,4-Trichlorobenzene	21	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	21	410	U	N/A	Yes
SCSB-048M-0001-SO	1,2-Dichlorobenzene	24	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	24	410	U	N/A	Yes
SCSB-048M-0001-SO	1,3-Dichlorobenzene	20	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	20	410	U	N/A	Yes
SCSB-048M-0001-SO	1,4-Dichlorobenzene	19	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	19	410	U	N/A	Yes
SCSB-048M-0001-SO	2,4,5-Trichlorophenol	130	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	130	510	U	N/A	Yes
SCSB-048M-0001-SO	2,4,6-Trichlorophenol	130	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	130	510	U	N/A	Yes
SCSB-048M-0001-SO	2,4-Dichlorophenol	120	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	120	510	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-048M-0001-SO	2,4-Dimethylphenol	100	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	100	410	U	N/A	Yes
SCSB-048M-0001-SO	2,4-Dinitrophenol	700	2000	ug/kg	R	8270	SCSB-084M-0001-SO	700	2000	U	N/A	N/A
SCSB-048M-0001-SO	2,4-Dinitrotoluene	24	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	24	410	U	N/A	Yes
SCSB-048M-0001-SO	2,6-Dinitrotoluene	24	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	24	410	U	N/A	Yes
SCSB-048M-0001-SO	2-Chloronaphthalene	23	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	23	410	U	N/A	Yes
SCSB-048M-0001-SO	2-Chlorophenol	340	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	350	510	U	N/A	Yes
SCSB-048M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	R	8270	SCSB-084M-0001-SO	270	1000	U	N/A	N/A
SCSB-048M-0001-SO	2-Methylnaphthalene	490	400	ug/kg	J-	8270	SCSB-084M-0001-SO	500	410		N/A	Yes
SCSB-048M-0001-SO	2-Methylphenol	420	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	430	1000	U	N/A	Yes
SCSB-048M-0001-SO	2-Nitroaniline	23	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	23	410	U	N/A	Yes
SCSB-048M-0001-SO	2-Nitrophenol	280	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	280	510	U	N/A	Yes
SCSB-048M-0001-SO	3,3'-Dichlorobenzidine	150	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	150	510	U	N/A	Yes
SCSB-048M-0001-SO	3-Nitroaniline	22	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	22	1000	U	N/A	Yes
SCSB-048M-0001-SO	4-Bromophenyl phenyl ether	25	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	25	410	U	N/A	Yes
SCSB-048M-0001-SO	4-Chloro-3-methylphenol	380	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	390	510	U	N/A	Yes
SCSB-048M-0001-SO	4-Chloroaniline	39	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	40	410	U	N/A	Yes
SCSB-048M-0001-SO	4-Chlorophenyl phenyl ether	26	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	26	410	U	N/A	Yes
SCSB-048M-0001-SO	4-Methylphenol	660	2000	ug/kg	UJ	8270	SCSB-084M-0001-SO	660	2000	U	N/A	Yes
SCSB-048M-0001-SO	4-Nitroaniline	30	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	30	1000	U	N/A	Yes
SCSB-048M-0001-SO	4-Nitrophenol	400	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	410	1000	U	N/A	Yes
SCSB-048M-0001-SO	Acenaphthene	24	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	24	410	U	N/A	Yes
SCSB-048M-0001-SO	Acenaphthylene	34	400	ug/kg	J-	8270	SCSB-084M-0001-SO	47	410	J	N/A	Yes
SCSB-048M-0001-SO	Anthracene	65	400	ug/kg	J-	8270	SCSB-084M-0001-SO	73	410	J	N/A	Yes
SCSB-048M-0001-SO	Benzo(a)anthracene	120	400	ug/kg	J-	8270	SCSB-084M-0001-SO	160	410	J	N/A	Yes
SCSB-048M-0001-SO	Benzo(a)pyrene	150	400	ug/kg	J-	8270	SCSB-084M-0001-SO	210	410	J	N/A	Yes
SCSB-048M-0001-SO	Benzo(b)fluoranthene	410	400	ug/kg	J-	8270	SCSB-084M-0001-SO	570	410		N/A	Yes
SCSB-048M-0001-SO	Benzo(g,h,i)perylene	22	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	49	410	J	N/A	Yes
SCSB-048M-0001-SO	Benzo(k)fluoranthene	160	400	ug/kg	J	8270	SCSB-084M-0001-SO	260	410	J	N/A	Yes
SCSB-048M-0001-SO	Benzoic acid	290	2000	ug/kg	UJ	8270	SCSB-084M-0001-SO	300	2000	U	N/A	Yes
SCSB-048M-0001-SO	Benzyl alcohol	84	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	84	1000	U	N/A	Yes
SCSB-048M-0001-SO	Bis(2-chloroethoxy)methane	23	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	23	410	U	N/A	Yes
SCSB-048M-0001-SO	Bis(2-chloroethyl) ether	25	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	25	410	U	N/A	Yes
SCSB-048M-0001-SO	Bis(2-chloroisopropyl) ether	30	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	30	410	U	N/A	Yes
SCSB-048M-0001-SO	Bis(2-ethylhexyl) phthalate	88	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	88	1000	U	N/A	Yes
SCSB-048M-0001-SO	Butylbenzyl phthalate	74	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	74	410	U	N/A	Yes
SCSB-048M-0001-SO	Carbazole	35	400	ug/kg	J-	8270	SCSB-084M-0001-SO	37	410	J	N/A	Yes
SCSB-048M-0001-SO	Chrysene	180	400	ug/kg	J-	8270	SCSB-084M-0001-SO	240	410	J	N/A	Yes
SCSB-048M-0001-SO	Dibenzo(a,h)anthracene	22	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	22	410	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-048M-0001-SO	Dibenzofuran	93	400	ug/kg	J-	8270	SCSB-084M-0001-SO	98	410	J	N/A	Yes
SCSB-048M-0001-SO	Diethyl phthalate	65	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	65	410	U	N/A	Yes
SCSB-048M-0001-SO	Dimethyl phthalate	64	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	64	410	U	N/A	Yes
SCSB-048M-0001-SO	Di-n-butyl phthalate	120	400	ug/kg	J-	8270	SCSB-084M-0001-SO	120	410	J	N/A	Yes
SCSB-048M-0001-SO	Di-n-octyl phthalate	60	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	60	410	U	N/A	Yes
SCSB-048M-0001-SO	Fluoranthene	240	400	ug/kg	J-	8270	SCSB-084M-0001-SO	280	410	J	N/A	Yes
SCSB-048M-0001-SO	Fluorene	41	400	ug/kg	J-	8270	SCSB-084M-0001-SO	47	410	J	N/A	Yes
SCSB-048M-0001-SO	Hexachlorobenzene	28	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	28	410	U	N/A	Yes
SCSB-048M-0001-SO	Hexachlorobutadiene	63	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	63	410	U	N/A	Yes
SCSB-048M-0001-SO	Hexachlorocyclopentadiene	52	400	ug/kg	R	8270	SCSB-084M-0001-SO	53	410	U	N/A	N/A
SCSB-048M-0001-SO	Hexachloroethane	33	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	34	410	U	N/A	Yes
SCSB-048M-0001-SO	Indeno(1,2,3-cd)pyrene	49	400	ug/kg	J	8270	SCSB-084M-0001-SO	52	410	J	N/A	Yes
SCSB-048M-0001-SO	Isophorone	50	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	51	410	U	N/A	Yes
SCSB-048M-0001-SO	Naphthalene	330	400	ug/kg	J-	8270	SCSB-084M-0001-SO	360	410	J	N/A	Yes
SCSB-048M-0001-SO	Nitrobenzene	60	400	ug/kg	R	8270	SCSB-084M-0001-SO	60	410	U	N/A	N/A
SCSB-048M-0001-SO	N-Nitroso-di-n-propylamine	71	400	ug/kg	UJ	8270	SCSB-084M-0001-SO	71	410	U	N/A	Yes
SCSB-048M-0001-SO	N-Nitrosodiphenylamine	50	810	ug/kg	UJ	8270	SCSB-084M-0001-SO	51	810	U	N/A	Yes
SCSB-048M-0001-SO	Pentachlorophenol	240	1000	ug/kg	UJ	8270	SCSB-084M-0001-SO	240	1000	U	N/A	Yes
SCSB-048M-0001-SO	Phenanthrene	280	400	ug/kg	J-	8270	SCSB-084M-0001-SO	270	410	J	N/A	Yes
SCSB-048M-0001-SO	Phenol	160	500	ug/kg	UJ	8270	SCSB-084M-0001-SO	160	510	U	N/A	Yes
SCSB-048M-0001-SO	Pyrene	240	400	ug/kg	J-	8270	SCSB-084M-0001-SO	270	410	J	N/A	Yes
SCSB-048M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.13	0.44	U	N/A	Yes
SCSB-048M-0001-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.08	0.44	U	N/A	Yes
SCSB-048M-0001-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.09	0.44	U	N/A	Yes
SCSB-048M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSB-084M-0001-SO	0.2	0.44	U	N/A	N/A
SCSB-048M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	8330B	SCSB-084M-0001-SO	0.07	0.5	U	N/A	N/A
SCSB-048M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.05	0.44	U	N/A	Yes
SCSB-048M-0001-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.09	0.44	U	N/A	Yes
SCSB-048M-0001-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.09	0.44	U	N/A	Yes
SCSB-048M-0001-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.07	0.44	U	N/A	Yes
SCSB-048M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.07	0.44	U	N/A	Yes
SCSB-048M-0001-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.07	0.5	U	N/A	Yes
SCSB-048M-0001-SO	HMX	0.12	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.12	0.44	U	N/A	Yes
SCSB-048M-0001-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.04	0.44	U	N/A	Yes
SCSB-048M-0001-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.5	1.5	U	N/A	Yes
SCSB-048M-0001-SO	Nitroguanidine	0.059	0.16	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.059	0.16	U	N/A	Yes
SCSB-048M-0001-SO	PETN	0.5	1.5	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.5	1.5	U	N/A	Yes
SCSB-048M-0001-SO	RDX	0.16	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.16	0.44	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-048M-0001-SO	Tetryl	0.09	0.44	mg/kg	UJ	8330B	SCSB-084M-0001-SO	0.09	0.44	U	N/A	Yes
SCSB-048M-0001-SO	Cyanide	0.76	0.38	mg/kg		9012A	SCSB-084M-0001-SO	0.64	0.39		N/A	Yes
SCSB-048M-0001-SO	Nitrocellulose	7	23	mg/kg	U	9056M	SCSB-084M-0001-SO	7	23	U	N/A	Yes
SCSB-048D-0001-SO	1,1,1-Trichloroethane	11	53	ug/kg	U	8260	SCSB-084D-0001-SO	10	50	U	N/A	Yes
SCSB-048D-0001-SO	1,1,2,2-Tetrachloroethane	6.3	53	ug/kg	U	8260	SCSB-084D-0001-SO	6	50	U	N/A	Yes
SCSB-048D-0001-SO	1,1,2-Trichloroethane	8.5	53	ug/kg	U	8260	SCSB-084D-0001-SO	8	50	U	N/A	Yes
SCSB-048D-0001-SO	1,1-Dichloroethane	12	53	ug/kg	U	8260	SCSB-084D-0001-SO	11	50	U	N/A	Yes
SCSB-048D-0001-SO	1,1-Dichloroethene	17	53	ug/kg	U	8260	SCSB-084D-0001-SO	16	50	U	N/A	Yes
SCSB-048D-0001-SO	1,2-Dibromoethane	11	53	ug/kg	U	8260	SCSB-084D-0001-SO	10	50	U	N/A	Yes
SCSB-048D-0001-SO	1,2-Dichloroethane	13	53	ug/kg	U	8260	SCSB-084D-0001-SO	12	50	U	N/A	Yes
SCSB-048D-0001-SO	1,2-Dichloropropane	7.4	53	ug/kg	U	8260	SCSB-084D-0001-SO	7	50	U	N/A	Yes
SCSB-048D-0001-SO	2-Butanone	110	530	ug/kg	U	8260	SCSB-084D-0001-SO	100	500	U	N/A	Yes
SCSB-048D-0001-SO	2-Hexanone	72	530	ug/kg	U	8260	SCSB-084D-0001-SO	68	500	U	N/A	Yes
SCSB-048D-0001-SO	4-Methyl-2-pentanone	87	530	ug/kg	U	8260	SCSB-084D-0001-SO	82	500	U	N/A	Yes
SCSB-048D-0001-SO	Acetone	67	1100	ug/kg	U	8260	SCSB-084D-0001-SO	63	1000	U	N/A	Yes
SCSB-048D-0001-SO	Benzene	60	53	ug/kg		8260	SCSB-084D-0001-SO	5	50	U	N/A	No
SCSB-048D-0001-SO	Bromochloromethane	8.5	53	ug/kg	U	8260	SCSB-084D-0001-SO	8	50	U	N/A	Yes
SCSB-048D-0001-SO	Bromodichloromethane	9.5	53	ug/kg	U	8260	SCSB-084D-0001-SO	9	50	U	N/A	Yes
SCSB-048D-0001-SO	Bromoform	6.3	53	ug/kg	U	8260	SCSB-084D-0001-SO	6	50	U	N/A	Yes
SCSB-048D-0001-SO	Bromomethane	32	110	ug/kg	U	8260	SCSB-084D-0001-SO	30	100	U	N/A	Yes
SCSB-048D-0001-SO	Carbon disulfide	16	110	ug/kg	UJ	8260	SCSB-084D-0001-SO	15	100	U	N/A	Yes
SCSB-048D-0001-SO	Carbon tetrachloride	12	53	ug/kg	U	8260	SCSB-084D-0001-SO	11	50	U	N/A	Yes
SCSB-048D-0001-SO	Chlorobenzene	8.5	53	ug/kg	U	8260	SCSB-084D-0001-SO	8	50	U	N/A	Yes
SCSB-048D-0001-SO	Chloroethane	20	110	ug/kg	U	8260	SCSB-084D-0001-SO	19	100	U	N/A	Yes
SCSB-048D-0001-SO	Chloroform	9.5	53	ug/kg	U	8260	SCSB-084D-0001-SO	9	50	U	N/A	Yes
SCSB-048D-0001-SO	Chloromethane	26	110	ug/kg	U	8260	SCSB-084D-0001-SO	25	100	U	N/A	Yes
SCSB-048D-0001-SO	cis-1,2-Dichloroethene	11	53	ug/kg	U	8260	SCSB-084D-0001-SO	10	50	U	N/A	Yes
SCSB-048D-0001-SO	cis-1,3-Dichloropropene	11	53	ug/kg	U	8260	SCSB-084D-0001-SO	10	50	U	N/A	Yes
SCSB-048D-0001-SO	Dibromochloromethane	8.5	53	ug/kg	UJ	8260	SCSB-084D-0001-SO	8	50	U	N/A	Yes
SCSB-048D-0001-SO	Ethylbenzene	150	53	ug/kg		8260	SCSB-084D-0001-SO	21	50	J	N/A	No
SCSB-048D-0001-SO	m,p-Xylenes	360	110	ug/kg		8260	SCSB-084D-0001-SO	63	100	J	N/A	No
SCSB-048D-0001-SO	Methylene chloride	42	110	ug/kg	U	8260	SCSB-084D-0001-SO	40	100	U	N/A	Yes
SCSB-048D-0001-SO	o-Xylene	350	53	ug/kg		8260	SCSB-084D-0001-SO	55	50		N/A	No
SCSB-048D-0001-SO	Styrene	6.3	53	ug/kg	U	8260	SCSB-084D-0001-SO	6	50	U	N/A	Yes
SCSB-048D-0001-SO	Tetrachloroethene	8.5	53	ug/kg	U	8260	SCSB-084D-0001-SO	8	50	U	N/A	Yes
SCSB-048D-0001-SO	Toluene	310	53	ug/kg		8260	SCSB-084D-0001-SO	37	50	J	N/A	No
SCSB-048D-0001-SO	trans-1,2-Dichloroethene	12	53	ug/kg	U	8260	SCSB-084D-0001-SO	11	50	U	N/A	Yes
SCSB-048D-0001-SO	trans-1,3-Dichloropropene	7.4	110	ug/kg	UJ	8260	SCSB-084D-0001-SO	7	100	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSB-048D-0001-SO	Trichloroethene	11	53	ug/kg	U	8260	SCSB-084D-0001-SO	10	50	U	N/A	Yes
SCSB-048D-0001-SO	Vinyl chloride	15	53	ug/kg	U	8260	SCSB-084D-0001-SO	14	50	U	N/A	Yes
SCSS-058M-0001-SO	Aluminum	10400	0.24	mg/kg	J-	6010	SCSS-085M-0001-SO	9250	0.25		12	N/A
SCSS-058M-0001-SO	Antimony	3.1	0.55	mg/kg	J-	6010	SCSS-085M-0001-SO	3.3	0.55		6	N/A
SCSS-058M-0001-SO	Arsenic	4.5	0.92	mg/kg	J	6010	SCSS-085M-0001-SO	5.3	0.92		N/A	Yes
SCSS-058M-0001-SO	Barium	127	0.055	mg/kg	J-	6010	SCSS-085M-0001-SO	83.3	0.055		42	N/A
SCSS-058M-0001-SO	Beryllium	0.66	0.024	mg/kg		6010	SCSS-085M-0001-SO	0.51	0.025		26	N/A
SCSS-058M-0001-SO	Cadmium	1.9	0.043	mg/kg	J-	6010	SCSS-085M-0001-SO	1.7	0.043		11	N/A
SCSS-058M-0001-SO	Calcium	21500	1	mg/kg	J-	6010	SCSS-085M-0001-SO	10400	1		70	N/A
SCSS-058M-0001-SO	Chromium	143	0.13	mg/kg	J-	6010	SCSS-085M-0001-SO	152	0.13		6	N/A
SCSS-058M-0001-SO	Cobalt	6.7	0.1	mg/kg	J-	6010	SCSS-085M-0001-SO	6.9	0.1		3	N/A
SCSS-058M-0001-SO	Copper	33.7	0.41	mg/kg	J-	6010	SCSS-085M-0001-SO	32.3	0.41		4	N/A
SCSS-058M-0001-SO	Iron	27100	2	mg/kg		6010	SCSS-085M-0001-SO	26400	2		3	N/A
SCSS-058M-0001-SO	Lead	139	0.29	mg/kg	J+	6010	SCSS-085M-0001-SO	120	0.29		15	N/A
SCSS-058M-0001-SO	Magnesium	3930	0.82	mg/kg	J-	6010	SCSS-085M-0001-SO	2870	0.82		31	N/A
SCSS-058M-0001-SO	Manganese	729	0.1	mg/kg	J-	6010	SCSS-085M-0001-SO	516	0.1		34	N/A
SCSS-058M-0001-SO	Nickel	21.7	0.12	mg/kg	J-	6010	SCSS-085M-0001-SO	22.9	0.12		5	N/A
SCSS-058M-0001-SO	Potassium	1180	37	mg/kg	J-	6010	SCSS-085M-0001-SO	1120	37		5	N/A
SCSS-058M-0001-SO	Selenium	0.83	0.86	mg/kg	J	6010	SCSS-085M-0001-SO	0.8	0.86	J	N/A	Yes
SCSS-058M-0001-SO	Silver	3.8	0.11	mg/kg		6010	SCSS-085M-0001-SO	4.4	0.11		15	N/A
SCSS-058M-0001-SO	Sodium	99.6	13	mg/kg	J-	6010	SCSS-085M-0001-SO	64.7	13		N/A	No
SCSS-058M-0001-SO	Thallium	1.7	0.29	mg/kg	J-	6010	SCSS-085M-0001-SO	1.7	0.29		0	N/A
SCSS-058M-0001-SO	Vanadium	14.8	0.069	mg/kg		6010	SCSS-085M-0001-SO	15.4	0.07		4	N/A
SCSS-058M-0001-SO	Zinc	269	0.24	mg/kg	J-	6010	SCSS-085M-0001-SO	252	0.25		7	N/A
SCSS-058M-0001-SO	Mercury	11.1	0.81	mg/kg		7471	SCSS-085M-0001-SO	11.1	0.81		0	N/A
SCSS-058M-0001-SO	1,2,4-Trichlorobenzene	21	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	21	410	U	N/A	Yes
SCSS-058M-0001-SO	1,2-Dichlorobenzene	24	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	24	410	U	N/A	Yes
SCSS-058M-0001-SO	1,3-Dichlorobenzene	20	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	20	410	U	N/A	Yes
SCSS-058M-0001-SO	1,4-Dichlorobenzene	22	410	ug/kg	J-	8270	SCSS-085M-0001-SO	19	410	J	N/A	Yes
SCSS-058M-0001-SO	2,4,5-Trichlorophenol	130	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	130	510	U	N/A	Yes
SCSS-058M-0001-SO	2,4,6-Trichlorophenol	130	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	130	510	U	N/A	Yes
SCSS-058M-0001-SO	2,4-Dichlorophenol	120	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	120	510	U	N/A	Yes
SCSS-058M-0001-SO	2,4-Dimethylphenol	100	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	100	410	U	N/A	Yes
SCSS-058M-0001-SO	2,4-Dinitrophenol	700	2000	ug/kg	UJ	8270	SCSS-085M-0001-SO	700	2000	U	N/A	Yes
SCSS-058M-0001-SO	2,4-Dinitrotoluene	24	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	24	410	U	N/A	Yes
SCSS-058M-0001-SO	2,6-Dinitrotoluene	24	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	24	410	U	N/A	Yes
SCSS-058M-0001-SO	2-Chloronaphthalene	23	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	23	410	U	N/A	Yes
SCSS-058M-0001-SO	2-Chlorophenol	350	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	350	510	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-058M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	280	1000	U	N/A	Yes
SCSS-058M-0001-SO	2-Methylnaphthalene	370	410	ug/kg	J-	8270	SCSS-085M-0001-SO	320	410	J	N/A	Yes
SCSS-058M-0001-SO	2-Methylphenol	430	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	430	1000	U	N/A	Yes
SCSS-058M-0001-SO	2-Nitroaniline	23	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	23	410	U	N/A	Yes
SCSS-058M-0001-SO	2-Nitrophenol	280	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	290	510	U	N/A	Yes
SCSS-058M-0001-SO	3,3'-Dichlorobenzidine	150	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	150	510	U	N/A	Yes
SCSS-058M-0001-SO	3-Nitroaniline	22	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	22	1000	U	N/A	Yes
SCSS-058M-0001-SO	4-Bromophenyl phenyl ether	25	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	25	410	U	N/A	Yes
SCSS-058M-0001-SO	4-Chloro-3-methylphenol	390	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	390	510	U	N/A	Yes
SCSS-058M-0001-SO	4-Chloroaniline	40	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	40	410	U	N/A	Yes
SCSS-058M-0001-SO	4-Chlorophenyl phenyl ether	26	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	27	410	U	N/A	Yes
SCSS-058M-0001-SO	4-Methylphenol	660	2000	ug/kg	UJ	8270	SCSS-085M-0001-SO	660	2000	U	N/A	Yes
SCSS-058M-0001-SO	4-Nitroaniline	31	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	31	1000	U	N/A	Yes
SCSS-058M-0001-SO	4-Nitrophenol	410	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	410	1000	U	N/A	Yes
SCSS-058M-0001-SO	Acenaphthene	43	410	ug/kg	J-	8270	SCSS-085M-0001-SO	34	410	J	N/A	Yes
SCSS-058M-0001-SO	Acenaphthylene	160	410	ug/kg	J-	8270	SCSS-085M-0001-SO	43	410	J	N/A	Yes
SCSS-058M-0001-SO	Anthracene	300	410	ug/kg	J-	8270	SCSS-085M-0001-SO	120	410	J	N/A	Yes
SCSS-058M-0001-SO	Benzo(a)anthracene	740	410	ug/kg	J-	8270	SCSS-085M-0001-SO	380	410	J	N/A	Yes
SCSS-058M-0001-SO	Benzo(a)pyrene	590	410	ug/kg	J-	8270	SCSS-085M-0001-SO	330	410	J	N/A	Yes
SCSS-058M-0001-SO	Benzo(b)fluoranthene	1000	410	ug/kg	J-	8270	SCSS-085M-0001-SO	580	410		N/A	No
SCSS-058M-0001-SO	Benzo(g,h,i)perylene	170	410	ug/kg	J-	8270	SCSS-085M-0001-SO	120	410	J	N/A	Yes
SCSS-058M-0001-SO	Benzo(k)fluoranthene	330	410	ug/kg	J-	8270	SCSS-085M-0001-SO	180	410	J	N/A	Yes
SCSS-058M-0001-SO	Benzoic acid	300	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	300	1000	U	N/A	Yes
SCSS-058M-0001-SO	Benzyl alcohol	84	1000	ug/kg	R	8270	SCSS-085M-0001-SO	85	1000	U	N/A	N/A
SCSS-058M-0001-SO	Bis(2-chloroethoxy)methane	23	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	23	410	U	N/A	Yes
SCSS-058M-0001-SO	Bis(2-chloroethyl) ether	25	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	25	410	U	N/A	Yes
SCSS-058M-0001-SO	Bis(2-chloroisopropyl) ether	31	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	31	410	U	N/A	Yes
SCSS-058M-0001-SO	Bis(2-ethylhexyl) phthalate	89	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	89	1000	U	N/A	Yes
SCSS-058M-0001-SO	Butylbenzyl phthalate	74	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	74	410	U	N/A	Yes
SCSS-058M-0001-SO	Carbazole	78	410	ug/kg	J-	8270	SCSS-085M-0001-SO	69	410	J	N/A	Yes
SCSS-058M-0001-SO	Chrysene	700	410	ug/kg	J-	8270	SCSS-085M-0001-SO	360	410	J	N/A	Yes
SCSS-058M-0001-SO	Dibenzo(a,h)anthracene	75	410	ug/kg	J-	8270	SCSS-085M-0001-SO	50	410	J	N/A	Yes
SCSS-058M-0001-SO	Dibenzofuran	140	410	ug/kg	J-	8270	SCSS-085M-0001-SO	86	410	J	N/A	Yes
SCSS-058M-0001-SO	Diethyl phthalate	65	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	65	410	U	N/A	Yes
SCSS-058M-0001-SO	Dimethyl phthalate	64	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	64	410	U	N/A	Yes
SCSS-058M-0001-SO	Di-n-butyl phthalate	120	410	ug/kg	J-	8270	SCSS-085M-0001-SO	130	410	J	N/A	Yes
SCSS-058M-0001-SO	Di-n-octyl phthalate	60	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	60	410	U	N/A	Yes
SCSS-058M-0001-SO	Fluoranthene	1800	410	ug/kg	J-	8270	SCSS-085M-0001-SO	800	410		N/A	No

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-058M-0001-SO	Fluorene	190	410	ug/kg	J-	8270	SCSS-085M-0001-SO	46	410	J	N/A	Yes
SCSS-058M-0001-SO	Hexachlorobenzene	28	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	29	410	U	N/A	Yes
SCSS-058M-0001-SO	Hexachlorobutadiene	63	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	63	410	U	N/A	Yes
SCSS-058M-0001-SO	Hexachlorocyclopentadiene	53	410	ug/kg	R	8270	SCSS-085M-0001-SO	53	410	U	N/A	N/A
SCSS-058M-0001-SO	Hexachloroethane	34	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	34	410	U	N/A	Yes
SCSS-058M-0001-SO	Indeno(1,2,3-cd)pyrene	180	410	ug/kg	J-	8270	SCSS-085M-0001-SO	100	410	J	N/A	Yes
SCSS-058M-0001-SO	Isophorone	110	410	ug/kg	J-	8270	SCSS-085M-0001-SO	79	410	J	N/A	Yes
SCSS-058M-0001-SO	Naphthalene	240	410	ug/kg	J-	8270	SCSS-085M-0001-SO	200	410	J	N/A	Yes
SCSS-058M-0001-SO	Nitrobenzene	60	410	ug/kg	R	8270	SCSS-085M-0001-SO	60	410	U	N/A	N/A
SCSS-058M-0001-SO	N-Nitroso-di-n-propylamine	71	410	ug/kg	UJ	8270	SCSS-085M-0001-SO	71	410	U	N/A	Yes
SCSS-058M-0001-SO	N-Nitrosodiphenylamine	51	810	ug/kg	UJ	8270	SCSS-085M-0001-SO	51	820	U	N/A	Yes
SCSS-058M-0001-SO	Pentachlorophenol	240	1000	ug/kg	UJ	8270	SCSS-085M-0001-SO	240	1000	U	N/A	Yes
SCSS-058M-0001-SO	Phenanthrene	1200	410	ug/kg	J-	8270	SCSS-085M-0001-SO	520	410		N/A	No
SCSS-058M-0001-SO	Phenol	160	510	ug/kg	UJ	8270	SCSS-085M-0001-SO	160	510	U	N/A	Yes
SCSS-058M-0001-SO	Pyrene	1300	410	ug/kg	J-	8270	SCSS-085M-0001-SO	680	410		N/A	No
SCSS-058M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.13	0.44	U	N/A	Yes
SCSS-058M-0001-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.08	0.44	U	N/A	Yes
SCSS-058M-0001-SO	2,4,6-Trinitrotoluene	0.26	0.44	mg/kg	J-	8330B	SCSS-085M-0001-SO	0.21	0.44	J	N/A	Yes
SCSS-058M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSS-085M-0001-SO	0.2	0.44	U	N/A	N/A
SCSS-058M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	8330B	SCSS-085M-0001-SO	0.07	0.5	U	N/A	N/A
SCSS-058M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.05	0.44	U	N/A	Yes
SCSS-058M-0001-SO	2-Nitrotoluene	0.09	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-058M-0001-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-058M-0001-SO	3-Nitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.07	0.44	U	N/A	Yes
SCSS-058M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.07	0.44	U	N/A	Yes
SCSS-058M-0001-SO	4-Nitrotoluene	0.07	0.5	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.07	0.5	U	N/A	Yes
SCSS-058M-0001-SO	HMX	0.12	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.12	0.44	U	N/A	Yes
SCSS-058M-0001-SO	Nitrobenzene	0.04	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.04	0.44	U	N/A	Yes
SCSS-058M-0001-SO	Nitroglycerin	0.5	1.5	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.5	1.5	U	N/A	Yes
SCSS-058M-0001-SO	PETN	0.5	1.5	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.5	1.5	U	N/A	Yes
SCSS-058M-0001-SO	RDX	0.16	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.16	0.44	U	N/A	Yes
SCSS-058M-0001-SO	Tetryl	0.09	0.44	mg/kg	UJ	8330B	SCSS-085M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-068D-0001-SO	1,1,1-Trichloroethane	11	55	ug/kg	U	8260	SCSS-086D-0001-SO	12	61	U	N/A	Yes
SCSS-068D-0001-SO	1,1,2,2-Tetrachloroethane	6.6	55	ug/kg	U	8260	SCSS-086D-0001-SO	7.3	61	U	N/A	Yes
SCSS-068D-0001-SO	1,1,2-Trichloroethane	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	1,1-Dichloroethane	12	55	ug/kg	U	8260	SCSS-086D-0001-SO	13	61	U	N/A	Yes
SCSS-068D-0001-SO	1,1-Dichloroethene	18	55	ug/kg	U	8260	SCSS-086D-0001-SO	19	61	U	N/A	Yes
SCSS-068D-0001-SO	1,2-Dibromoethane	11	55	ug/kg	U	8260	SCSS-086D-0001-SO	12	61	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-068D-0001-SO	1,2-Dichloroethane	13	55	ug/kg	U	8260	SCSS-086D-0001-SO	15	61	U	N/A	Yes
SCSS-068D-0001-SO	1,2-Dichloropropane	7.7	55	ug/kg	U	8260	SCSS-086D-0001-SO	8.5	61	U	N/A	Yes
SCSS-068D-0001-SO	2-Butanone	110	550	ug/kg	U	8260	SCSS-086D-0001-SO	120	610	U	N/A	Yes
SCSS-068D-0001-SO	2-Hexanone	75	550	ug/kg	U	8260	SCSS-086D-0001-SO	82	610	U	N/A	Yes
SCSS-068D-0001-SO	4-Methyl-2-pentanone	90	550	ug/kg	U	8260	SCSS-086D-0001-SO	99	610	U	N/A	Yes
SCSS-068D-0001-SO	Acetone	69	1100	ug/kg	U	8260	SCSS-086D-0001-SO	76	1200	U	N/A	Yes
SCSS-068D-0001-SO	Benzene	5.5	55	ug/kg	U	8260	SCSS-086D-0001-SO	6.1	61	U	N/A	Yes
SCSS-068D-0001-SO	Bromochloromethane	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	Bromodichloromethane	9.9	55	ug/kg	U	8260	SCSS-086D-0001-SO	11	61	U	N/A	Yes
SCSS-068D-0001-SO	Bromoform	6.6	55	ug/kg	U	8260	SCSS-086D-0001-SO	7.3	61	U	N/A	Yes
SCSS-068D-0001-SO	Bromomethane	33	110	ug/kg	U	8260	SCSS-086D-0001-SO	36	120	U	N/A	Yes
SCSS-068D-0001-SO	Carbon disulfide	16	110	ug/kg	U	8260	SCSS-086D-0001-SO	18	120	U	N/A	Yes
SCSS-068D-0001-SO	Carbon tetrachloride	12	55	ug/kg	U	8260	SCSS-086D-0001-SO	13	61	U	N/A	Yes
SCSS-068D-0001-SO	Chlorobenzene	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	Chloroethane	21	110	ug/kg	U	8260	SCSS-086D-0001-SO	23	120	U	N/A	Yes
SCSS-068D-0001-SO	Chloroform	9.9	55	ug/kg	U	8260	SCSS-086D-0001-SO	11	61	U	N/A	Yes
SCSS-068D-0001-SO	Chloromethane	27	110	ug/kg	U	8260	SCSS-086D-0001-SO	30	120	U	N/A	Yes
SCSS-068D-0001-SO	cis-1,2-Dichloroethene	11	55	ug/kg	U	8260	SCSS-086D-0001-SO	12	61	U	N/A	Yes
SCSS-068D-0001-SO	cis-1,3-Dichloropropene	11	55	ug/kg	U	8260	SCSS-086D-0001-SO	12	61	U	N/A	Yes
SCSS-068D-0001-SO	Dibromochloromethane	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	Ethylbenzene	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	m,p-Xylenes	20	110	ug/kg	U	8260	SCSS-086D-0001-SO	22	120	U	N/A	Yes
SCSS-068D-0001-SO	Methylene chloride	44	110	ug/kg	U	8260	SCSS-086D-0001-SO	49	120	U	N/A	Yes
SCSS-068D-0001-SO	o-Xylene	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	Styrene	6.6	55	ug/kg	U	8260	SCSS-086D-0001-SO	7.3	61	U	N/A	Yes
SCSS-068D-0001-SO	Tetrachloroethene	8.8	55	ug/kg	U	8260	SCSS-086D-0001-SO	9.7	61	U	N/A	Yes
SCSS-068D-0001-SO	Toluene	7.7	55	ug/kg	U	8260	SCSS-086D-0001-SO	8.5	61	U	N/A	Yes
SCSS-068D-0001-SO	trans-1,2-Dichloroethene	12	55	ug/kg	U	8260	SCSS-086D-0001-SO	13	61	U	N/A	Yes
SCSS-068D-0001-SO	trans-1,3-Dichloropropene	7.7	110	ug/kg	U	8260	SCSS-086D-0001-SO	8.5	120	U	N/A	Yes
SCSS-068D-0001-SO	Trichloroethene	11	55	ug/kg	U	8260	SCSS-086D-0001-SO	12	61	U	N/A	Yes
SCSS-068D-0001-SO	Vinyl chloride	15	55	ug/kg	U	8260	SCSS-086D-0001-SO	17	61	U	N/A	Yes
SCSS-068M-0001-SO	Aluminum	9150	0.12	mg/kg	J-	6010	SCSS-086M-0001-SO	8350	0.12		9	N/A
SCSS-068M-0001-SO	Antimony	0.082	0.28	mg/kg	R	6010	SCSS-086M-0001-SO	0.76	0.27		N/A	N/A
SCSS-068M-0001-SO	Arsenic	11.2	0.46	mg/kg	J-	6010	SCSS-086M-0001-SO	8.6	0.46		26	N/A
SCSS-068M-0001-SO	Barium	49.7	0.028	mg/kg	J-	6010	SCSS-086M-0001-SO	47	0.027		6	N/A
SCSS-068M-0001-SO	Beryllium	0.41	0.024	mg/kg	J-	6010	SCSS-086M-0001-SO	0.4	0.024		2	N/A
SCSS-068M-0001-SO	Cadmium	0.057	0.021	mg/kg	J-	6010	SCSS-086M-0001-SO	0.039	0.021		N/A	Yes
SCSS-068M-0001-SO	Calcium	1650	0.51	mg/kg	J-	6010	SCSS-086M-0001-SO	1210	0.51		31	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-068M-0001-SO	Chromium	24.2	0.064	mg/kg	J-	6010	SCSS-086M-0001-SO	116	0.064		131	N/A
SCSS-068M-0001-SO	Cobalt	7.6	0.05	mg/kg	J-	6010	SCSS-086M-0001-SO	6.8	0.05		11	N/A
SCSS-068M-0001-SO	Copper	11	0.2	mg/kg	J-	6010	SCSS-086M-0001-SO	10.4	0.2		6	N/A
SCSS-068M-0001-SO	Iron	22500	1	mg/kg	J-	6010	SCSS-086M-0001-SO	20500	1		9	N/A
SCSS-068M-0001-SO	Lead	29.8	0.14	mg/kg	J-	6010	SCSS-086M-0001-SO	29.2	0.14		2	N/A
SCSS-068M-0001-SO	Magnesium	2320	0.41	mg/kg	J-	6010	SCSS-086M-0001-SO	1980	0.41		16	N/A
SCSS-068M-0001-SO	Manganese	395	0.051	mg/kg	J-	6010	SCSS-086M-0001-SO	350	0.051		12	N/A
SCSS-068M-0001-SO	Nickel	20.9	0.062	mg/kg	J-	6010	SCSS-086M-0001-SO	28.7	0.062		31	N/A
SCSS-068M-0001-SO	Potassium	693	37	mg/kg	J-	6010	SCSS-086M-0001-SO	850	37		20	N/A
SCSS-068M-0001-SO	Selenium	0.24	0.43	mg/kg	J-	6010	SCSS-086M-0001-SO	0.22	0.43	J	N/A	Yes
SCSS-068M-0001-SO	Silver	0.017	0.057	mg/kg	U	6010	SCSS-086M-0001-SO	0.035	0.11	U	N/A	Yes
SCSS-068M-0001-SO	Sodium	20.5	13	mg/kg	J-	6010	SCSS-086M-0001-SO	36.8	13		N/A	No
SCSS-068M-0001-SO	Thallium	0.62	0.29	mg/kg	J-	6010	SCSS-086M-0001-SO	0.62	0.28		N/A	Yes
SCSS-068M-0001-SO	Vanadium	14.8	0.035	mg/kg	J-	6010	SCSS-086M-0001-SO	13.8	0.035		7	N/A
SCSS-068M-0001-SO	Zinc	48.2	0.12	mg/kg	J-	6010	SCSS-086M-0001-SO	43.4	0.12		10	N/A
SCSS-068M-0001-SO	Mercury	0.031	0.008	mg/kg	J-	7471	SCSS-086M-0001-SO	0.032	0.008		N/A	Yes
SCSS-068M-0001-SO	1,2,4-Trichlorobenzene	21	410	ug/kg	U	8270	SCSS-086M-0001-SO	21	410	U	N/A	Yes
SCSS-068M-0001-SO	1,2-Dichlorobenzene	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	1,3-Dichlorobenzene	20	410	ug/kg	U	8270	SCSS-086M-0001-SO	20	410	U	N/A	Yes
SCSS-068M-0001-SO	1,4-Dichlorobenzene	19	410	ug/kg	U	8270	SCSS-086M-0001-SO	19	410	U	N/A	Yes
SCSS-068M-0001-SO	2,4,5-Trichlorophenol	130	510	ug/kg	U	8270	SCSS-086M-0001-SO	130	510	U	N/A	Yes
SCSS-068M-0001-SO	2,4,6-Trichlorophenol	130	510	ug/kg	U	8270	SCSS-086M-0001-SO	130	510	U	N/A	Yes
SCSS-068M-0001-SO	2,4-Dichlorophenol	120	510	ug/kg	U	8270	SCSS-086M-0001-SO	120	510	U	N/A	Yes
SCSS-068M-0001-SO	2,4-Dimethylphenol	100	410	ug/kg	U	8270	SCSS-086M-0001-SO	100	410	U	N/A	Yes
SCSS-068M-0001-SO	2,4-Dinitrophenol	700	2000	ug/kg	U	8270	SCSS-086M-0001-SO	700	2000	U	N/A	Yes
SCSS-068M-0001-SO	2,4-Dinitrotoluene	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	2,6-Dinitrotoluene	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	2-Chloronaphthalene	23	410	ug/kg	U	8270	SCSS-086M-0001-SO	23	410	U	N/A	Yes
SCSS-068M-0001-SO	2-Chlorophenol	340	510	ug/kg	U	8270	SCSS-086M-0001-SO	350	510	U	N/A	Yes
SCSS-068M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	U	8270	SCSS-086M-0001-SO	280	1000	U	N/A	Yes
SCSS-068M-0001-SO	2-Methylnaphthalene	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	2-Methylphenol	430	1000	ug/kg	U	8270	SCSS-086M-0001-SO	430	1000	U	N/A	Yes
SCSS-068M-0001-SO	2-Nitroaniline	23	410	ug/kg	U	8270	SCSS-086M-0001-SO	23	410	U	N/A	Yes
SCSS-068M-0001-SO	2-Nitrophenol	280	510	ug/kg	U	8270	SCSS-086M-0001-SO	290	510	U	N/A	Yes
SCSS-068M-0001-SO	3,3'-Dichlorobenzidine	150	510	ug/kg	U	8270	SCSS-086M-0001-SO	150	510	U	N/A	Yes
SCSS-068M-0001-SO	3-Nitroaniline	22	1000	ug/kg	UJ	8270	SCSS-086M-0001-SO	22	1000	U	N/A	Yes
SCSS-068M-0001-SO	4-Bromophenyl phenyl ether	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	4-Chloro-3-methylphenol	390	510	ug/kg	U	8270	SCSS-086M-0001-SO	390	510	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-068M-0001-SO	4-Chloroaniline	40	410	ug/kg	UJ	8270	SCSS-086M-0001-SO	40	410	U	N/A	Yes
SCSS-068M-0001-SO	4-Chlorophenyl phenyl ether	26	410	ug/kg	U	8270	SCSS-086M-0001-SO	27	410	U	N/A	Yes
SCSS-068M-0001-SO	4-Methylphenol	660	2000	ug/kg	U	8270	SCSS-086M-0001-SO	660	2000	U	N/A	Yes
SCSS-068M-0001-SO	4-Nitroaniline	30	1000	ug/kg	U	8270	SCSS-086M-0001-SO	31	1000	U	N/A	Yes
SCSS-068M-0001-SO	4-Nitrophenol	410	1000	ug/kg	U	8270	SCSS-086M-0001-SO	410	1000	U	N/A	Yes
SCSS-068M-0001-SO	Acenaphthene	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	Acenaphthylene	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	Anthracene	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	Benzo(a)anthracene	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	Benzo(a)pyrene	23	410	ug/kg	U	8270	SCSS-086M-0001-SO	23	410	U	N/A	Yes
SCSS-068M-0001-SO	Benzo(b)fluoranthene	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	Benzo(g,h,i)perylene	22	410	ug/kg	U	8270	SCSS-086M-0001-SO	22	410	U	N/A	Yes
SCSS-068M-0001-SO	Benzo(k)fluoranthene	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	Benzoic acid	290	990	ug/kg	U	8270	SCSS-086M-0001-SO	300	1000	U	N/A	Yes
SCSS-068M-0001-SO	Benzyl alcohol	84	1000	ug/kg	U	8270	SCSS-086M-0001-SO	85	1000	U	N/A	Yes
SCSS-068M-0001-SO	Bis(2-chloroethoxy)methane	23	410	ug/kg	U	8270	SCSS-086M-0001-SO	23	410	U	N/A	Yes
SCSS-068M-0001-SO	Bis(2-chloroethyl) ether	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	Bis(2-chloroisopropyl) ether	30	410	ug/kg	U	8270	SCSS-086M-0001-SO	31	410	U	N/A	Yes
SCSS-068M-0001-SO	Bis(2-ethylhexyl) phthalate	100	1000	ug/kg	U	8270	SCSS-086M-0001-SO	130	1000	J	N/A	Yes
SCSS-068M-0001-SO	Butylbenzyl phthalate	74	410	ug/kg	U	8270	SCSS-086M-0001-SO	74	410	U	N/A	Yes
SCSS-068M-0001-SO	Carbazole	28	410	ug/kg	U	8270	SCSS-086M-0001-SO	29	410	U	N/A	Yes
SCSS-068M-0001-SO	Chrysene	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	Dibenzo(a,h)anthracene	22	410	ug/kg	U	8270	SCSS-086M-0001-SO	22	410	U	N/A	Yes
SCSS-068M-0001-SO	Dibenzofuran	24	410	ug/kg	U	8270	SCSS-086M-0001-SO	24	410	U	N/A	Yes
SCSS-068M-0001-SO	Diethyl phthalate	65	410	ug/kg	U	8270	SCSS-086M-0001-SO	65	410	U	N/A	Yes
SCSS-068M-0001-SO	Dimethyl phthalate	64	410	ug/kg	U	8270	SCSS-086M-0001-SO	64	410	U	N/A	Yes
SCSS-068M-0001-SO	Di-n-butyl phthalate	88	410	ug/kg	J	8270	SCSS-086M-0001-SO	81	410	U	N/A	Yes
SCSS-068M-0001-SO	Di-n-octyl phthalate	60	410	ug/kg	U	8270	SCSS-086M-0001-SO	60	410	U	N/A	Yes
SCSS-068M-0001-SO	Fluoranthene	26	410	ug/kg	U	8270	SCSS-086M-0001-SO	27	410	U	N/A	Yes
SCSS-068M-0001-SO	Fluorene	25	410	ug/kg	U	8270	SCSS-086M-0001-SO	26	410	U	N/A	Yes
SCSS-068M-0001-SO	Hexachlorobenzene	28	410	ug/kg	U	8270	SCSS-086M-0001-SO	29	410	U	N/A	Yes
SCSS-068M-0001-SO	Hexachlorobutadiene	63	410	ug/kg	U	8270	SCSS-086M-0001-SO	63	410	U	N/A	Yes
SCSS-068M-0001-SO	Hexachlorocyclopentadiene	53	410	ug/kg	UJ	8270	SCSS-086M-0001-SO	53	410	U	N/A	Yes
SCSS-068M-0001-SO	Hexachloroethane	33	410	ug/kg	U	8270	SCSS-086M-0001-SO	34	410	U	N/A	Yes
SCSS-068M-0001-SO	Indeno(1,2,3-cd)pyrene	23	410	ug/kg	U	8270	SCSS-086M-0001-SO	23	410	U	N/A	Yes
SCSS-068M-0001-SO	Isophorone	51	410	ug/kg	J	8270	SCSS-086M-0001-SO	140	410	J	N/A	Yes
SCSS-068M-0001-SO	Naphthalene	21	410	ug/kg	U	8270	SCSS-086M-0001-SO	21	410	U	N/A	Yes
SCSS-068M-0001-SO	Nitrobenzene	60	410	ug/kg	R	8270	SCSS-086M-0001-SO	60	410	U	N/A	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-068M-0001-SO	N-Nitroso-di-n-propylamine	71	410	ug/kg	U	8270	SCSS-086M-0001-SO	71	410	U	N/A	Yes
SCSS-068M-0001-SO	N-Nitrosodiphenylamine	51	810	ug/kg	U	8270	SCSS-086M-0001-SO	51	820	U	N/A	Yes
SCSS-068M-0001-SO	Pentachlorophenol	240	1000	ug/kg	U	8270	SCSS-086M-0001-SO	240	1000	U	N/A	Yes
SCSS-068M-0001-SO	Phenanthrene	26	410	ug/kg	U	8270	SCSS-086M-0001-SO	27	410	U	N/A	Yes
SCSS-068M-0001-SO	Phenol	160	510	ug/kg	U	8270	SCSS-086M-0001-SO	160	510	U	N/A	Yes
SCSS-068M-0001-SO	Pyrene	26	410	ug/kg	U	8270	SCSS-086M-0001-SO	27	410	U	N/A	Yes
SCSS-068M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.13	0.44	U	N/A	Yes
SCSS-068M-0001-SO	1,3-Dinitrobenzene	0.08	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.08	0.44	U	N/A	Yes
SCSS-068M-0001-SO	2,4,6-Trinitrotoluene	0.09	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-068M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSS-086M-0001-SO	0.2	0.44	U	N/A	N/A
SCSS-068M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	8330B	SCSS-086M-0001-SO	0.07	0.5	U	N/A	N/A
SCSS-068M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.05	0.44	U	N/A	Yes
SCSS-068M-0001-SO	2-Nitrotoluene	0.09	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-068M-0001-SO	3,5-Dinitroaniline	0.09	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-068M-0001-SO	3-Nitrotoluene	0.07	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.07	0.44	U	N/A	Yes
SCSS-068M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.07	0.44	U	N/A	Yes
SCSS-068M-0001-SO	4-Nitrotoluene	0.07	0.5	mg/kg	U	8330B	SCSS-086M-0001-SO	0.07	0.5	U	N/A	Yes
SCSS-068M-0001-SO	HMX	0.12	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.12	0.44	U	N/A	Yes
SCSS-068M-0001-SO	Nitrobenzene	0.04	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.04	0.44	U	N/A	Yes
SCSS-068M-0001-SO	Nitroglycerin	0.5	1.5	mg/kg	U	8330B	SCSS-086M-0001-SO	0.5	1.5	U	N/A	Yes
SCSS-068M-0001-SO	PETN	0.5	1.5	mg/kg	U	8330B	SCSS-086M-0001-SO	0.5	1.5	U	N/A	Yes
SCSS-068M-0001-SO	RDX	0.16	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.16	0.44	U	N/A	Yes
SCSS-068M-0001-SO	Tetryl	0.09	0.44	mg/kg	U	8330B	SCSS-086M-0001-SO	0.09	0.44	U	N/A	Yes
SCSS-073M-0001-SO	Aluminum	9480	0.24	mg/kg		6010	SCSS-087M-0001-SO	8210	0.24		14	N/A
SCSS-073M-0001-SO	Antimony	2.9	0.55	mg/kg	J+	6010	SCSS-087M-0001-SO	2.2	0.55		N/A	No
SCSS-073M-0001-SO	Arsenic	21.8	0.92	mg/kg		6010	SCSS-087M-0001-SO	23	0.92		5	N/A
SCSS-073M-0001-SO	Barium	94.3	0.055	mg/kg		6010	SCSS-087M-0001-SO	91.7	0.055		3	N/A
SCSS-073M-0001-SO	Beryllium	0.77	0.024	mg/kg		6010	SCSS-087M-0001-SO	0.72	0.024		7	N/A
SCSS-073M-0001-SO	Cadmium	0.63	0.043	mg/kg		6010	SCSS-087M-0001-SO	0.58	0.043		8	N/A
SCSS-073M-0001-SO	Calcium	10300	1	mg/kg		6010	SCSS-087M-0001-SO	7340	1		34	N/A
SCSS-073M-0001-SO	Chromium	130	0.13	mg/kg		6010	SCSS-087M-0001-SO	86.1	0.13		41	N/A
SCSS-073M-0001-SO	Cobalt	10.8	0.1	mg/kg		6010	SCSS-087M-0001-SO	11.3	0.1		5	N/A
SCSS-073M-0001-SO	Copper	24.3	0.41	mg/kg		6010	SCSS-087M-0001-SO	26.2	0.41		8	N/A
SCSS-073M-0001-SO	Iron	24800	2	mg/kg		6010	SCSS-087M-0001-SO	23300	2		6	N/A
SCSS-073M-0001-SO	Lead	50.3	0.29	mg/kg		6010	SCSS-087M-0001-SO	61.2	0.29		20	N/A
SCSS-073M-0001-SO	Magnesium	3040	0.82	mg/kg		6010	SCSS-087M-0001-SO	2710	0.82		11	N/A
SCSS-073M-0001-SO	Manganese	576	0.1	mg/kg		6010	SCSS-087M-0001-SO	520	0.1		10	N/A
SCSS-073M-0001-SO	Nickel	32.7	0.12	mg/kg		6010	SCSS-087M-0001-SO	26.9	0.12		19	N/A

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-073M-0001-SO	Potassium	1350	37	mg/kg		6010	SCSS-087M-0001-SO	1080	37		22	N/A
SCSS-073M-0001-SO	Selenium	2.4	0.86	mg/kg	J+	6010	SCSS-087M-0001-SO	2.2	0.86		N/A	Yes
SCSS-073M-0001-SO	Silver	2	0.11	mg/kg		6010	SCSS-087M-0001-SO	3	0.11		40	N/A
SCSS-073M-0001-SO	Sodium	101	13	mg/kg		6010	SCSS-087M-0001-SO	79.8	13		23	N/A
SCSS-073M-0001-SO	Thallium	0.082	0.29	mg/kg	UJ	6010	SCSS-087M-0001-SO	0.47	0.29		N/A	No
SCSS-073M-0001-SO	Vanadium	19.8	0.069	mg/kg		6010	SCSS-087M-0001-SO	20.3	0.069		2	N/A
SCSS-073M-0001-SO	Zinc	86.1	0.24	mg/kg		6010	SCSS-087M-0001-SO	86.1	0.24		0	N/A
SCSS-073M-0001-SO	Mercury	0.27	0.008	mg/kg		7471	SCSS-087M-0001-SO	0.21	0.008		25	N/A
SCSS-073M-0001-SO	1,2,4-Trichlorobenzene	21	410	ug/kg	U	8270	SCSS-087M-0001-SO	21	410	U	N/A	Yes
SCSS-073M-0001-SO	1,2-Dichlorobenzene	39	410	ug/kg	J	8270	SCSS-087M-0001-SO	100	410	J	N/A	Yes
SCSS-073M-0001-SO	1,3-Dichlorobenzene	20	410	ug/kg	U	8270	SCSS-087M-0001-SO	26	410	J	N/A	Yes
SCSS-073M-0001-SO	1,4-Dichlorobenzene	19	410	ug/kg	U	8270	SCSS-087M-0001-SO	48	410	J	N/A	Yes
SCSS-073M-0001-SO	2,4,5-Trichlorophenol	130	510	ug/kg	U	8270	SCSS-087M-0001-SO	130	510	U	N/A	Yes
SCSS-073M-0001-SO	2,4,6-Trichlorophenol	130	510	ug/kg	U	8270	SCSS-087M-0001-SO	130	510	U	N/A	Yes
SCSS-073M-0001-SO	2,4-Dichlorophenol	120	510	ug/kg	U	8270	SCSS-087M-0001-SO	120	510	U	N/A	Yes
SCSS-073M-0001-SO	2,4-Dimethylphenol	100	410	ug/kg	U	8270	SCSS-087M-0001-SO	100	410	U	N/A	Yes
SCSS-073M-0001-SO	2,4-Dinitrophenol	700	2000	ug/kg	U	8270	SCSS-087M-0001-SO	710	2000	U	N/A	Yes
SCSS-073M-0001-SO	2,4-Dinitrotoluene	24	410	ug/kg	U	8270	SCSS-087M-0001-SO	92	410	J	N/A	Yes
SCSS-073M-0001-SO	2,6-Dinitrotoluene	24	410	ug/kg	U	8270	SCSS-087M-0001-SO	25	410	U	N/A	Yes
SCSS-073M-0001-SO	2-Chloronaphthalene	23	410	ug/kg	U	8270	SCSS-087M-0001-SO	24	410	U	N/A	Yes
SCSS-073M-0001-SO	2-Chlorophenol	350	510	ug/kg	U	8270	SCSS-087M-0001-SO	350	510	U	N/A	Yes
SCSS-073M-0001-SO	2-Methyl-4,6-dinitrophenol	270	1000	ug/kg	U	8270	SCSS-087M-0001-SO	280	1000	U	N/A	Yes
SCSS-073M-0001-SO	2-Methylnaphthalene	240	410	ug/kg	J	8270	SCSS-087M-0001-SO	330	410	J	N/A	Yes
SCSS-073M-0001-SO	2-Methylphenol	430	1000	ug/kg	U	8270	SCSS-087M-0001-SO	430	1000	U	N/A	Yes
SCSS-073M-0001-SO	2-Nitroaniline	23	410	ug/kg	U	8270	SCSS-087M-0001-SO	24	410	U	N/A	Yes
SCSS-073M-0001-SO	2-Nitrophenol	290	510	ug/kg	U	8270	SCSS-087M-0001-SO	290	510	U	N/A	Yes
SCSS-073M-0001-SO	3,3'-Dichlorobenzidine	150	510	ug/kg	U	8270	SCSS-087M-0001-SO	150	510	U	N/A	Yes
SCSS-073M-0001-SO	3-Nitroaniline	22	1000	ug/kg	U	8270	SCSS-087M-0001-SO	22	1000	U	N/A	Yes
SCSS-073M-0001-SO	4-Bromophenyl phenyl ether	25	410	ug/kg	U	8270	SCSS-087M-0001-SO	26	410	U	N/A	Yes
SCSS-073M-0001-SO	4-Chloro-3-methylphenol	390	510	ug/kg	U	8270	SCSS-087M-0001-SO	390	510	U	N/A	Yes
SCSS-073M-0001-SO	4-Chloroaniline	40	410	ug/kg	U	8270	SCSS-087M-0001-SO	40	410	U	N/A	Yes
SCSS-073M-0001-SO	4-Chlorophenyl phenyl ether	26	410	ug/kg	U	8270	SCSS-087M-0001-SO	27	410	U	N/A	Yes
SCSS-073M-0001-SO	4-Methylphenol	660	2000	ug/kg	U	8270	SCSS-087M-0001-SO	660	2000	U	N/A	Yes
SCSS-073M-0001-SO	4-Nitroaniline	31	1000	ug/kg	U	8270	SCSS-087M-0001-SO	31	1000	U	N/A	Yes
SCSS-073M-0001-SO	4-Nitrophenol	410	1000	ug/kg	UJ	8270	SCSS-087M-0001-SO	410	1000	U	N/A	Yes
SCSS-073M-0001-SO	Acenaphthene	35	410	ug/kg	J	8270	SCSS-087M-0001-SO	64	410	J	N/A	Yes
SCSS-073M-0001-SO	Acenaphthylene	29	410	ug/kg	J	8270	SCSS-087M-0001-SO	25	410	U	N/A	Yes
SCSS-073M-0001-SO	Anthracene	93	410	ug/kg	J	8270	SCSS-087M-0001-SO	150	410	J	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-073M-0001-SO	Benzo(a)anthracene	370	410	ug/kg	J	8270	SCSS-087M-0001-SO	390	410	J	N/A	Yes
SCSS-073M-0001-SO	Benzo(a)pyrene	350	410	ug/kg	J	8270	SCSS-087M-0001-SO	350	410	J	N/A	Yes
SCSS-073M-0001-SO	Benzo(b)fluoranthene	580	410	ug/kg		8270	SCSS-087M-0001-SO	520	410		N/A	Yes
SCSS-073M-0001-SO	Benzo(g,h,i)perylene	190	410	ug/kg	J	8270	SCSS-087M-0001-SO	210	410	J	N/A	Yes
SCSS-073M-0001-SO	Benzo(k)fluoranthene	200	410	ug/kg	J	8270	SCSS-087M-0001-SO	170	410	J	N/A	Yes
SCSS-073M-0001-SO	Benzoic acid	300	2000	ug/kg	U	8270	SCSS-087M-0001-SO	300	2000	U	N/A	Yes
SCSS-073M-0001-SO	Benzyl alcohol	85	1000	ug/kg	U	8270	SCSS-087M-0001-SO	85	1000	U	N/A	Yes
SCSS-073M-0001-SO	Bis(2-chloroethoxy)methane	23	410	ug/kg	U	8270	SCSS-087M-0001-SO	24	410	U	N/A	Yes
SCSS-073M-0001-SO	Bis(2-chloroethyl) ether	25	410	ug/kg	U	8270	SCSS-087M-0001-SO	26	410	U	N/A	Yes
SCSS-073M-0001-SO	Bis(2-chloroisopropyl) ether	31	410	ug/kg	U	8270	SCSS-087M-0001-SO	31	410	U	N/A	Yes
SCSS-073M-0001-SO	Bis(2-ethylhexyl) phthalate	190	1000	ug/kg	J	8270	SCSS-087M-0001-SO	950	1000	J	N/A	Yes
SCSS-073M-0001-SO	Butylbenzyl phthalate	74	410	ug/kg	U	8270	SCSS-087M-0001-SO	75	410	U	N/A	Yes
SCSS-073M-0001-SO	Carbazole	58	410	ug/kg	J	8270	SCSS-087M-0001-SO	99	410	J	N/A	Yes
SCSS-073M-0001-SO	Chrysene	400	410	ug/kg	J	8270	SCSS-087M-0001-SO	390	410	J	N/A	Yes
SCSS-073M-0001-SO	Dibenzo(a,h)anthracene	69	410	ug/kg	J	8270	SCSS-087M-0001-SO	92	410	J	N/A	Yes
SCSS-073M-0001-SO	Dibenzofuran	72	410	ug/kg	J	8270	SCSS-087M-0001-SO	100	410	J	N/A	Yes
SCSS-073M-0001-SO	Diethyl phthalate	65	410	ug/kg	U	8270	SCSS-087M-0001-SO	65	410	U	N/A	Yes
SCSS-073M-0001-SO	Dimethyl phthalate	64	410	ug/kg	U	8270	SCSS-087M-0001-SO	64	410	U	N/A	Yes
SCSS-073M-0001-SO	Di-n-butyl phthalate	140	410	ug/kg	J	8270	SCSS-087M-0001-SO	130	410	J	N/A	Yes
SCSS-073M-0001-SO	Di-n-octyl phthalate	60	410	ug/kg	U	8270	SCSS-087M-0001-SO	60	410	U	N/A	Yes
SCSS-073M-0001-SO	Fluoranthene	760	410	ug/kg		8270	SCSS-087M-0001-SO	890	410		N/A	Yes
SCSS-073M-0001-SO	Fluorene	33	410	ug/kg	J	8270	SCSS-087M-0001-SO	55	410	J	N/A	Yes
SCSS-073M-0001-SO	Hexachlorobenzene	29	410	ug/kg	U	8270	SCSS-087M-0001-SO	29	410	U	N/A	Yes
SCSS-073M-0001-SO	Hexachlorobutadiene	63	410	ug/kg	U	8270	SCSS-087M-0001-SO	63	410	U	N/A	Yes
SCSS-073M-0001-SO	Hexachlorocyclopentadiene	53	410	ug/kg	U	8270	SCSS-087M-0001-SO	53	410	U	N/A	Yes
SCSS-073M-0001-SO	Hexachloroethane	34	410	ug/kg	U	8270	SCSS-087M-0001-SO	34	410	U	N/A	Yes
SCSS-073M-0001-SO	Indeno(1,2,3-cd)pyrene	170	410	ug/kg	J	8270	SCSS-087M-0001-SO	210	410	J	N/A	Yes
SCSS-073M-0001-SO	Isophorone	51	410	ug/kg	U	8270	SCSS-087M-0001-SO	51	410	U	N/A	Yes
SCSS-073M-0001-SO	Naphthalene	170	410	ug/kg	J	8270	SCSS-087M-0001-SO	240	410	J	N/A	Yes
SCSS-073M-0001-SO	Nitrobenzene	60	410	ug/kg	R	8270	SCSS-087M-0001-SO	60	410	U	N/A	N/A
SCSS-073M-0001-SO	N-Nitroso-di-n-propylamine	71	410	ug/kg	U	8270	SCSS-087M-0001-SO	72	410	U	N/A	Yes
SCSS-073M-0001-SO	N-Nitrosodiphenylamine	51	810	ug/kg	U	8270	SCSS-087M-0001-SO	51	820	U	N/A	Yes
SCSS-073M-0001-SO	Pentachlorophenol	240	1000	ug/kg	U	8270	SCSS-087M-0001-SO	250	1000	U	N/A	Yes
SCSS-073M-0001-SO	Phenanthrene	450	410	ug/kg		8270	SCSS-087M-0001-SO	700	410		N/A	Yes
SCSS-073M-0001-SO	Phenol	160	510	ug/kg	U	8270	SCSS-087M-0001-SO	160	510	U	N/A	Yes
SCSS-073M-0001-SO	Pyrene	620	410	ug/kg		8270	SCSS-087M-0001-SO	630	410		N/A	Yes
SCSS-073M-0001-SO	1,3,5-Trinitrobenzene	0.13	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.13	0.43	U	N/A	Yes
SCSS-073M-0001-SO	1,3-Dinitrobenzene	0.081	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.079	0.43	U	N/A	Yes

Sand Creek Field Duplicate Comparisons

Sample	Analyte	Result	LOQ	Units	Qualifier	Method	Sample	Result	LOQ	Qualifier	RPD	W/In LOQ
SCSS-073M-0001-SO	2,4,6-Trinitrotoluene	0.091	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.089	0.43	U	N/A	Yes
SCSS-073M-0001-SO	2,4-Dinitrotoluene	0.2	0.44	mg/kg	R	8330B	SCSS-087M-0001-SO	0.2	0.43	U	N/A	N/A
SCSS-073M-0001-SO	2,6-Dinitrotoluene	0.07	0.5	mg/kg	R	8330B	SCSS-087M-0001-SO	0.069	0.49	U	N/A	N/A
SCSS-073M-0001-SO	2-Amino-4,6-dinitrotoluene	0.05	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.049	0.43	U	N/A	Yes
SCSS-073M-0001-SO	2-Nitrotoluene	0.091	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.089	0.43	U	N/A	Yes
SCSS-073M-0001-SO	3,5-Dinitroaniline	0.091	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.089	0.43	U	N/A	Yes
SCSS-073M-0001-SO	3-Nitrotoluene	0.07	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.069	0.43	U	N/A	Yes
SCSS-073M-0001-SO	4-Amino-2,6-dinitrotoluene	0.07	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.069	0.43	U	N/A	Yes
SCSS-073M-0001-SO	4-Nitrotoluene	0.07	0.5	mg/kg	U	8330B	SCSS-087M-0001-SO	0.069	0.49	U	N/A	Yes
SCSS-073M-0001-SO	HMX	0.12	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.12	0.43	U	N/A	Yes
SCSS-073M-0001-SO	Nitrobenzene	0.04	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.04	0.43	U	N/A	Yes
SCSS-073M-0001-SO	Nitroglycerin	0.5	1.5	mg/kg	U	8330B	SCSS-087M-0001-SO	0.49	1.5	U	N/A	Yes
SCSS-073M-0001-SO	PETN	0.5	1.5	mg/kg	U	8330B	SCSS-087M-0001-SO	0.49	1.5	U	N/A	Yes
SCSS-073M-0001-SO	RDX	0.16	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.16	0.43	U	N/A	Yes
SCSS-073M-0001-SO	Tetryl	0.091	0.44	mg/kg	U	8330B	SCSS-087M-0001-SO	0.089	0.43	U	N/A	Yes

APPENDIX D

Validator Checklists

POLY CHLORINATED BIPHENYLS (PCB/AROCLORS) CHECKLIST

Project Name: Ravenna ODA1 / Sand Creek

Laboratory: CT Laboratories

Batch Number(s): 34836, 34839

Sample Delivery Group: 81575, 81670

	Yes	No
1. Holding Time:		
(a) Were samples extracted within holding time?	[✓]	[ ]
(b) Were samples analyzed within holding time?	[✓]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of five standards?	[✓]	[ ]
• Did Aroclors 1016 and 1260 meet the RSD ≤ 20% or the r ≥ 0.99?	[✓]	[ ]
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[✓]
• Was the manual integration necessary? N/A	[ ]	[ ]
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**		
3. QCMDL:		
• Was MDL Check performed?	[✓]	[ ]
4. QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[✓]	[ ]
• Was the QC/MRL between 70-130% R avg.	[✓]	[ ]
5. Initial Calibration Verification (ICV):		
Is the mid level (2nd source) recovery within ~~85 - 115~~% @SM ±20%?	[✓]	[ ]

	Yes	No
6. Continuing Calibration Verification (CCV):		
• Was CCV conducted every 12 hours?	[✓]	[ ]
≤20% QSM		
• Was Drift or D ~~≤15%~~ from the initial calibration with a maximum %D < 20% for a specific compound?	[✓]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires?	[✓]	[ ]
• Were samples with levels higher than the calibration range (E), diluted and re-analyzed? N/A	[ ]	[ ]
• Were identified Aroclors confirmed on a second GC column? QC - N/A for samples	[✓]	[ ]
• Were individual Aroclor standards used to determine the pattern of the peaks? (Individual Aroclors are 1221, 1232, 1242, 1248, and 1254. Both Aroclor 1016, and 1260 can be used from the mixed calibration standards.)	[✓]	[ ]
• Was RPD of target analyte conformation ≤ 40? (N/A for samples)	[✓]	[ ]
8. Sample Quality Control:		
• Method Blanks: Were target analytes ≤ 1/2 MRL? ND	[✓]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?	[✓]	[ ]
• MS/MSD: Were the percent recoveries within limits?	[✓]	[ ]
Were the RPDs within control limits?	[✓]	[ ]
• System Monitoring Compounds (Surrogates): are surrogate recoveries within QC limits?	[✓]	[ ]

9. Comments (attach additional sheets if necessary):

No dilutions.

Validated/Reviewed by:

Signature: D C Calvin

Date: 03.12.2013

Name: D.S. Calvin

ORGANOCHLORINE PESTICIDES ANALYSIS CHECKLIST

Project Name: Ravenna ODA1 / Sand Creek

Laboratory: CT Laboratories

Batch Number(s): 34839, 34954

Sample Delivery Group: 81575, 81670

	Yes	No
1. Holding Time:		
(a) Were samples extracted within holding time?	[✓]	[ ]
(b) Were samples analyzed within holding time?	[✓]	[ ]
2. DDT/Endrin Breakdown:		
• Was breakdown ≤ 15%?	[✓]	[ ]
3. Initial Calibration:		
• Did the initial calibration consist of five standards?	[✓]	[ ]
• Did all compounds meet the RSD ≤ 20% or r ≥ 0.99?	[✓]	[ ]
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[✓]
• Was the manual integration necessary? N/A	[ ]	[ ]
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**		
4. QCMDL:		
• Was MDL Check performed?	[✓]	[ ]
5. QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[✓]	[ ]
• Was the QC/MRL between 70-130% R	[ ]	[✓]

endrin 60.8%, 59.5%[182] on 2° col both MRLs for sample 48M-0001 (Sand Creek)
UJ/C

	Yes	No
6. Initial Calibration Verification (ICV): QSM 40-120% • Is the mid level (2nd source) recovery within ~~85 - 115%~~?	[✓]	[ ]
7. Continuing Calibration Verification (CCV):		
• Was CCV conducted every 12 hours?	[✓]	[ ]
• Was Drift or D ~~≤ 15%~~ ≤20% QSM from the initial calibration with a maximum D ≤ 20% for a specific compound?	[✓]	[ ]
8. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires?	[✓]	[ ]
• Were samples with levels higher than the calibration range (E), diluted and re-analyzed? N/A	[ ]	[ ]
• Were identified compounds confirmed on a second GC column?	[✓]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[✓]	[ ]
9. Sample Quality Control:		
• Method Blanks: Were target analytes ≤ 1/2 MRL? ND	[✓]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?	[✓]	[ ]
• MS/MSD: Were the percent recoveries within limits? MS/SD 5QM-0201 ODA1 endrin aldehyde 18%, 16% (35-145)	[ ]	[✓]
Were the RPD within control limits?	[✓]	[ ]
• System Monitoring Compounds (Surrogates): are surrogate recoveries within QC limits? JAC	[✓]	[ ]

10. Comments (attach additional sheets if necessary):

SCSB-048M-0001 Sand Creek analyzed @ 5X due to sample matrix

Validated/Reviewed by:

Signature: L.S. Calvin

Date: 03.12.2013

Name: L.S. Calvin

VOLATILE ORGANIC ANALYSIS CHECKLIST

Project Name: Ravenna ODA1/Sand Creek

Laboratory: CT Laboratories

Batch Number(s): 34800, 34868, 34867

Sample Delivery Group (SDG): 81575, 81623, 81670

	Yes	No
1. Holding Time:		
(a) Were samples preserved?	[✓]	[ ]
(b) Were samples analyzed within holding time?	[✓]	[ ]
2. Was the BFB tune performed at the beginning of each 12-hour period during which samples were analyzed?	[✓]	[ ]
3. Was mass assignment based on m/z 95?	[✓]	[ ]
4. Indicate if BFB ions abundance relative to m/z 95 base peak met the ions abundance criteria:		

m/z	Acceptance Criteria		
50	15.0 - 40.0 %	[✓]	[ ]
75	30.0 - 66.0 %	[✓]	[ ]
95	**100%, Base Peak**	[✓]	[ ]
96	5.0 - 9.0%	[✓]	[ ]
173	<2.0% of m/z 174	[✓]	[ ]
174	>50%	[✓]	[ ]
175	5.0 - 9.0% of mass 174	[✓]	[ ]
176	95.0 - 101.0% of m/z 174	[✓]	[ ]
177	5.0 - 9.0% of m/z 176	[✓]	[ ]

The relative ion abundance of m/z 95/96, m/z 174/176, and 176/177 are of critical importance.

The relative ion abundance of m/z 50 and 75 are of lower importance.

	Yes	No
5. Initial Calibration:		
• Did the initial calibration consist of five standards?	[✓]	[ ]
• Did the System Performance Check Compounds (SPCC) meet the minimum mean response factor (RF)?		
RF		
Chloromethane 0.1	[✓]	[ ]
1,1-Dichloroethane 0.1	[✓]	[ ]
Bromoform 0.1	[✓]	[ ]
Chlorobenzene 0.3	[✓]	[ ]
1,1,2,2-Tetrachloroethane 0.3	[✓]	[ ]
• Did the RSD meet the criteria ≤ 30% for each individual Calibration Check Compound (CCC)?		
1,1-Dichloroethene	[✓]	[ ]
Chloroform	[✓]	[ ]
1,2-Dichloropropane	[✓]	[ ]
Toluene	[✓]	[ ]
Ethylbenzene	[✓]	[ ]
Vinyl chloride	[✓]	[ ]
• Are the RSDs for the remaining target analytes ≤ 15% or r ≥ 0.99 with a mean RSD ≤ 15% with a maximum RSD ≤ 20%?	[✓]	[ ]
If the answer is "No", are the mean RSDs ≤ 15%? NA	[ ]	[ ]
• Was manual integration "M" performed?	[ ]	[✓]
If the answer is "Yes", check for supporting documents. N/A	[ ]	[ ]
• Was the manual integration necessary?	[ ]	[ ]
If the answer is "No", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons**.		
6. QCMDL:	[✓]	[ ]
• Was MDL Check performed?		
7. QCMRL:	[✓]	[ ]

	Yes	No
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours?	[✓]	[ ]
• Was the QC/MRL between 70-130% R see comments	[ ]	[✓]
• For the non-contaminants of concern was the QC/MRL between 60-140% (Sporadic Marginal Failure) N/A	[ ]	[ ]
8. Initial Calibration Verification (ICV):	[✓]	[ ]
• Is the mid level (2nd source) recovery within 80 - 120% for contaminants of concern ?		
• Is the mid level (2nd source) recovery within 60-140% for non-contaminants of concern (Sporadic Marginal Failure)?		
9. Continuing Calibration Verification (CCV):		
• Was CCV conducted every 12 hours?	[✓]	[ ]
• Did SPCC meet the RF values?	[✓]	[ ]
RF		
Chloromethane 0.1	[✓]	[ ]
1,1-Dichloroethane 0.1	[✓]	[ ]
Bromoform 0.1	[✓]	[ ]
Chlorobenzene 0.3	[✓]	[ ]
1,1,2,2-Tetrachloroethane 0.3	[ ]	[ ]
• Did the CCC meet the minimum requirements (D ≤ 20%)?	[✓]	[ ]
1,1-Dichloroethene	[✓]	[ ]
Chloroform	[✓]	[ ]
1,2-Dichloropropane	[✓]	[ ]
Toluene	[✓]	[ ]
Ethylbenzene	[✓]	[ ]
Vinyl chloride	[ ]	[ ]
• Primary Evaluation: Was the mean, Drift or D ≤ 20% from the initial calibration?	[✓]	[ ]
• Alternative Evaluation: Maximum allowable Drift/D for		

	Yes	No
each target analyte is ≤ 30% when mean D ≤ 20%? N/A	[ ]	[ ]

10. Sample Analysis:

• Was the RRT of an identified component within ± 0.06 RRT units of the RRT of the standard component?	[✓]	[ ]
• Did the abundance of ions in the sample spectra agree within 30% of the major ions (> 10% of the base ion) in the standard spectra?	[✓]	[ ]
• Were the internal standard areas within the QC limits (from -50% to +200%)?	[✓]	[ ]

11. Sample Quality Control:

• Method Blanks: Were target analytes ≤ 1/2 MRL? ND	[✓]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?	[✓]	[ ]
• MS/MSD: Were the percent recoveries within limits?	[✓]	[ ]
Were the RPD within control limits?	[ ]	[✓]
70D-0201 (ODA1) 2but, 2hex 36%, acet 37% UJ/Q System Monitoring Compounds (Surrogates): are surrogate recoveries within QC limits (50-150%)?	[✓]	[ ]

12. Comments (attach additional sheets if necessary):

see attached for MRL outliers and quals

Validated/Reviewed by:
Signature: LS Calvin

Date: 03.12.2013

Name: L.S. Calvin

Samples qualified for MRL recovery outliers		
Analyte	**MRL %Rs Begin / End**	**Qualified Samples**
2-hexanone	37% / 62%	DA1SB-059D-0201-SO
chloroethane	**5% / 4%**	
chloromethane	**0% / 0%**	
2-hexanone	**38% / 3%**	DA1SB-068D-0201-SO
chloroethane	**0% / 17%**	
chloromethane	**0% / 0%**	
4-methyl-2-pentanone	--- / 69%	
acetone	--- / 67%	
m,p-xylenes	--- / 11%	

Samples qualified for MRL recovery outliers		
Analyte	***MRL %Rs Begin / End***	***Qualified Samples***
carbon disulfide	*--- / 68%*	*SCSB-048D-0001-SO*
dibromochloromethane	--- / 63%	
trans-1,3-dichloropropene	--- / 69%	

NITROAROMATICS & NITRAMINE DATA ANALYSIS (EXPLOSIVE RESIDUES) CHECKLIST

triplicate
9/22 DA1SB-055M-0001-SO (851518)
+ 9/23 DA1SB-059M-0201-SO (851582)
9/23 + DA1SB-063M-0202-SO (851881)
triplicate

Project Name: ODA1 / Sand Creek

Laboratory: CT

Batch Number(s): 35052 (63), 35050 (59, 55)

Sample Delivery Group: 81575

	Yes	No	
1. Holding Time: Were samples analyzed within holding time?	[ ]	[X]	5 055M - 8d past 059M - 4d 063M - 9d NG + Ex
2. Initial Calibration:			
• Did the initial calibration consist of five standards?	[X]	[ ]	
• Did the RSD meet the criteria ≤ 20% for each individual Calibration Compound or r ≥ 0.99?	[X]	[ ]	
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[X]	
• Was the manual integration necessary?	[ ]	[ ]	
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**			
3. QCMDL:			
• Was MDL Check performed?	[X]	[ ]	
4. QCMRL:			
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[X]	[ ]	
• Was the percentage "D" for QC/MRL ≤ 30%?	[X]	[ ]	
5. Initial Calibration Verification (ICV):	[X]	[ ]	

	Yes	No
• Was the ICV made of a 2nd source?	[N]	[ ]
• Was the mid level (2nd source) recovery within 85 - 115%?		
6. Continuing Calibration Verification (CCV): {Daily calibration}		
• Was midpoint calibration standard conducted at the beginning of the day?	[N]	[ ]
• Was midpoint calibration standard conducted every ten samples or every twelve hours?	[N]	[ ]
• Was midpoint calibration standard conducted after the last sample of the day?	[N]	[ ]
• Did the CCV meet the minimum requirements (D ≤ 15% with a maximum D ≤ 20% for a specific compound if the mean D ≤ 15%)?	[N]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires?	N/A [ ]	[ ]
• Were all identified hits, above the initial calibration curve, diluted and reanalyzed?	[ ]	[ ]
• Were all identified hits confirmed on a second column?	[ ]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[ ]	[ ]
• Was there a shoulder on the 2,4,6-TNT peak?	[ ]	[ ]
If the answer is "Yes", then tetryl decomposition is suspected. Peak height rather than peak area should be used for calculating TNT concentration. If teryl was identified in aqueous samples, was pH adjusted to <3? If the answer is "No", then check for tetryl decomposition, and qualify hits with **"J"** accordingly.	[ ]	[ ]
8. Sample Quality Control:	[N]	[ ]
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[N]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?		

	Yes	No
• MS/MSD: Were the percent recoveries within limits?	[ ]	[X]
Were the RPDs within control limits?	[X]	[ ]
• System Monitoring Compounds (Surrogates): Were surrogate recoveries within QC limits?	[X]	[ ]

9. Comments (attach additional sheets if necessary):

MS/D 055M 4A (79, –) RPD 4A = 22 24DNT = 22%

~~063M NG + EX 4A (76~~

NG MRLs poorly integrated – includes more than peak; may be ↓ based on re-int

NC ~~MS/D 063M~~ 0201 ~~56%/50%~~

Validated/Reviewed by:

Signature: P. Meeks Date: 3/6/13

Name: P. Meeks

NITROAROMATICS & NITRAMINE DATA ANALYSIS (EXPLOSIVE RESIDUES) CHECKLIST

9/21 SCSB-037M-0001-SO (851488)
9/22 SCSB-038M-0005-SO (851510)
9/21 SCSB-042M-0003-SO (851552)
9/21 SCSS-068M-0001-SO (850426)

Project Name: ODA1/Sand Creek

Laboratory: CT

Batch Number(s): 35049, 34934, 34878
(57/38 68 42)

Sample Delivery Group: _____

042M 8d
037M 8d
038M 7d

	Yes	No
1. Holding Time: Were samples analyzed within holding time?	[N]	[N]
2. Initial Calibration:		
• Did the initial calibration consist of five standards?	[N]	[ ]
• Did the RSD meet the criteria ≤ 20% for each individual Calibration Compound or r ≥ 0.99?	[N]	[ ]
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[N]
• Was the manual integration necessary?	[ ]	[ ]
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**		
3. QCMDL:		
• Was MDL Check performed?	[N]	[ ]
4. QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[N]	[ ]
• Was the percentage "D" for QC/MRL ≤ 30%?	[ ]	[ ]
5. Initial Calibration Verification (ICV):	[N]	[ ]

	Yes	No
• Was the ICV made of a 2nd source?	[N]	[ ]
• Was the mid level (2nd source) recovery within 85 - 115%?		
6. Continuing Calibration Verification (CCV): {Daily calibration}		
• Was midpoint calibration standard conducted at the beginning of the day?	[N]	[ ]
• Was midpoint calibration standard conducted every ten samples or every twelve hours?	[N]	[ ]
• Was midpoint calibration standard conducted after the last sample of the day?	[N]	[ ]
• Did the CCV meet the minimum requirements (D ≤ 15% with a maximum D ≤ 20% for a specific compound if the mean D ≤ 15%)?	[ ]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires? N/A	[ ]	[ ]
• Were all identified hits, above the initial calibration curve, diluted and reanalyzed?	[ ]	[ ]
• Were all identified hits confirmed on a second column?	[ ]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[ ]	[ ]
• Was there a shoulder on the 2,4,6-TNT peak?	[ ]	[ ]
If the answer is "Yes", then tetryl decomposition is suspected. Peak height rather than peak area should be used for calculating TNT concentration. If teryl was identified in aqueous samples, was pH adjusted to <3? If the answer is "No", then check for tetryl decomposition, and qualify hits with **"J"** accordingly.	[ ]	[ ]
8. Sample Quality Control:	[N]	[ ]
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[N]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?		

	Yes	No
• MS/MSD: Were the percent recoveries within limits? N/A	[ ]	[ ]
Were the RPDs within control limits?		
• System Monitoring Compounds (Surrogates): Were surrogate recoveries within QC limits?	[N]	[ ]

9. Comments (attach additional sheets if necessary):

~~LCS 4A = 74% w/ 03M/038M~~
CCV 4A = 18%D UJ 042M

Validated/Reviewed by:

Signature: P. Meeks Date: 3/6/13

Name: P. Meeks

NITROAROMATICS & NITRAMINE DATA ANALYSIS (EXPLOSIVE RESIDUES) CHECKLIST

NG 10/18
+ DA1SB-068M-0201 (852373) 9/24
DA1SB-070M-0204 (852383) 9/24
DA1SB-072M-0204 (852390) 9/24
DA1SS-050M-0201 (852568) 9/27
Triplicate

Project Name: ODA1 / Sand Creek

Laboratory: CT

Batch Number(s): 050M 35123, 070/072M 35122, 068M 35121

Sample Delivery Group: 81623

	Yes	No	
1. Holding Time: Were samples analyzed within holding time?	[ ]	[N]	068M NG 10d EX 9d 070M 9d 072M 9d 050M 6d
2. Initial Calibration:			
• Did the initial calibration consist of five standards?	[N]	[ ]	
• Did the RSD meet the criteria ≤ 20% for each individual Calibration Compound or r ≥ 0.99?	[ ]	[ ]	
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[N]	
• Was the manual integration necessary?	[ ]	[ ]	
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**			
3. QCMDL:			
• Was MDL Check performed?	[N]	[ ]	
4. QCMRL:			
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[N]	[ ]	
• Was the percentage "D" for QC/MRL ≤ 30%?	[N]	[ ]	
5. Initial Calibration Verification (ICV):	[ ]	[ ]	

	Yes	No
• Was the ICV made of a 2nd source?	[N]	[ ]
• Was the mid level (2nd source) recovery within 85 - 115%?		
6. Continuing Calibration Verification (CCV): {Daily calibration}		
• Was midpoint calibration standard conducted at the beginning of the day?	[N]	[ ]
• Was midpoint calibration standard conducted every ten samples or every twelve hours?	[N]	[ ]
• Was midpoint calibration standard conducted after the last sample of the day?	[N]	[ ]
• Did the CCV meet the minimum requirements (D ≤ 15% with a maximum D ≤ 20% for a specific compound if the mean D ≤ 15%)?	[N]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires? N/A	[ ]	[ ]
• Were all identified hits, above the initial calibration curve, diluted and reanalyzed?	[ ]	[ ]
• Were all identified hits confirmed on a second column?	[ ]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[ ]	[ ]
• Was there a shoulder on the 2,4,6-TNT peak?	[ ]	[ ]
If the answer is "Yes", then tetryl decomposition is suspected. Peak height rather than peak area should be used for calculating TNT concentration. If teryl was identified in aqueous samples, was pH adjusted to <3? If the answer is "No", then check for tetryl decomposition, and qualify hits with **"J"** accordingly.	[ ]	[ ]
8. Sample Quality Control:	[N]	[ ]
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[N]
• LCS: Were the percent recoveries for LCS within the limits?		

	Yes	No
• MS/MSD: Were the percent recoveries within limits?	[N]	[ ]
Were the RPDs within control limits?		
• System Monitoring Compounds (Surrogates): Were surrogate recoveries within QC limits?	[ ]	[N]

9. Comments (attach additional sheets if necessary):

MS/D DA155-050M-0201-50 RPD 24DNT=24%
LCS 4A=77% w/ 070M + 072M

CCV 24DNT =18.8 UJ / 068M

Validated/Reviewed by:

Signature: P. Meeks Date: 3/6/13

Name: P. Meeks

Need raw EX data

NITROAROMATICS & NITRAMINE DATA ANALYSIS (EXPLOSIVE RESIDUES) CHECKLIST

+SCSB-048M-0001 (854011) 9/29
SCSD-070M-0001 (854000) 9/28
SCSS-058M-0001 (852322) 9/23

Project Name: ODA1 / Sand Creek

Laboratory: CT

Batch Number(s): 35121 (058M), 35123 (070M, 048M), 35126 (NG)

Sample Delivery Group: 81670

	Yes	No
1. Holding Time: Were samples analyzed within holding time?	[ ]	[N] 058M 10d, 070M 5d, 048M NG 4d, Ex 3d
2. Initial Calibration:		
• Did the initial calibration consist of five standards?	[N]	[ ]
• Did the RSD meet the criteria ≤ 20% for each individual Calibration Compound or r ≥ 0.99?	[N]	[ ]
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[N]
• Was the manual integration necessary?	[ ]	[ ]
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**		
3. QCMDL:		
• Was MDL Check performed?	[N]	[ ]
4. QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[N]	[ ]
• Was the percentage "D" for QC/MRL ≤ 30%?	[N]	[ ]
5. Initial Calibration Verification (ICV):	[N]	[ ]

	Yes	No
• Was the ICV made of a 2nd source?	[ ]	[ ]
• Was the mid level (2nd source) recovery within 85 - 115%?		
6. Continuing Calibration Verification (CCV): {Daily calibration}		
• Was midpoint calibration standard conducted at the beginning of the day?	[ ]	[ ]
• Was midpoint calibration standard conducted every ten samples or every twelve hours?	[ ]	[ ]
• Was midpoint calibration standard conducted after the last sample of the day?	[ ]	[ ]
• Did the CCV meet the minimum requirements (D ≤ 15% with a maximum D ≤ 20% for a specific compound if the mean D ≤ 15%)?	[ ]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires?	[ ]	[ ]
• Were all identified hits, above the initial calibration curve, diluted and reanalyzed? N/A	[ ]	[ ]
• Were all identified hits confirmed on a second column?	[ ]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[ ]	[ ]
• Was there a shoulder on the 2,4,6-TNT peak?	[ ]	[ ]
If the answer is "Yes", then tetryl decomposition is suspected. Peak height rather than peak area should be used for calculating TNT concentration. If teryl was identified in aqueous samples, was pH adjusted to <3? If the answer is "No", then check for tetryl decomposition, and qualify hits with **"J"** accordingly.	[ ]	[ ]
8. Sample Quality Control:	[ ]	[ ]
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?		

	Yes	No
• MS/MSD: Were the percent recoveries within limits? N/A	[ ]	[ ]
Were the RPDs within control limits?		
• System Monitoring Compounds (Surrogates): Were surrogate recoveries within QC limits?	[N]	[ ]

9. Comments (attach additional sheets if necessary): 3
Intercolumn %RPD 246 in 058M = 75%

Validated/Reviewed by:

Signature: P. Mee Date: 3/7/13

Name: P. Meeks

NITROAROMATICS & NITRAMINE DATA ANALYSIS (EXPLOSIVE RESIDUES) CHECKLIST

869558
SCSS-673M-0001 11/9
SCSS-076M-0001 11/9
869562

Project Name: ODA1 / Sand Creek

Laboratory: CT

Batch Number(s): 35491

Sample Delivery Group: 82400

	Yes	No
1. Holding Time: Were samples analyzed within holding time?	[N]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of five standards?	[ ]	[ ]
• Did the RSD meet the criteria ≤ 20% for each individual Calibration Compound or r ≥ 0.99?	[N]	[ ]
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	[N]
• Was the manual integration necessary?	[ ]	[ ]
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**		
3. QCMDL:		
• Was MDL Check performed?	[N]	[ ]
4. QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[N]	[ ]
• Was the percentage "D" for QC/MRL ≤ 30%?	[ ]	[N]
5. Initial Calibration Verification (ICV):	[N]	[ ]

	Yes	No
• Was the ICV made of a 2nd source?	[ ]	[ ]
• Was the mid level (2nd source) recovery within 85 - 115%?		
6. Continuing Calibration Verification (CCV): {Daily calibration}		
• Was midpoint calibration standard conducted at the beginning of the day?	[ ]	[ ]
• Was midpoint calibration standard conducted every ten samples or every twelve hours?	[ ]	[ ]
• Was midpoint calibration standard conducted after the last sample of the day?	[ ]	[ ]
• Did the CCV meet the minimum requirements (D ≤ 15% with a maximum D ≤ 20% for a specific compound if the mean D ≤ 15%)?	[ ]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires? N/A	[ ]	[ ]
• Were all identified hits, above the initial calibration curve, diluted and reanalyzed?	[ ]	[ ]
• Were all identified hits confirmed on a second column?	[ ]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[ ]	[ ]
• Was there a shoulder on the 2,4,6-TNT peak?	[ ]	[ ]
If the answer is "Yes", then tetryl decomposition is suspected. Peak height rather than peak area should be used for calculating TNT concentration. If teryl was identified in aqueous samples, was pH adjusted to <3? If the answer is "No", then check for tetryl decomposition, and qualify hits with **"J"** accordingly.	[ ]	[ ]
8. Sample Quality Control:	[ ]	[ ]
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?		

	Yes	No
• MS/MSD: Were the percent recoveries within limits? N/A	[ ]	[ ]
Were the RPDs within control limits?		
• System Monitoring Compounds (Surrogates): Were surrogate recoveries within QC limits?	[N]	[ ]

9. Comments (attach additional sheets if necessary):

MRL 2,6-DNT 60% UJ 076M

Validated/Reviewed by:

Signature: P. Meeks Date: 3/7/13

Name: P. Meeks

NITROAROMATICS & NITRAMINE DATA ANALYSIS (EXPLOSIVE RESIDUES) CHECKLIST

DA15B-074M-0202 (871039) 11/10
DA15S-054M-0201 (871020) 11/10

Project Name: ODA1 / Sand Creek

Laboratory: CT

Batch Number(s): 35490

Sample Delivery Group: 82452

	Yes	No	
1. Holding Time: Were samples analyzed within holding time?	[ ]	N	074M Id
2. Initial Calibration:			
• Did the initial calibration consist of five standards?	N	[ ]	
• Did the RSD meet the criteria ≤ 20% for each individual Calibration Compound or r ≥ 0.99?	N	[ ]	
• Was manual integration "M" performed? If the answer is "Yes", check for supporting documents.	[ ]	N	
• Was the manual integration necessary?	[ ]	[ ]	
If the answer is "no", contact the laboratory inquiring about the reasons behind the manual integration, and **inform the District Chemist immediately if there were no valid reasons.**			
3. QCMDL:			
• Was MDL Check performed?	N	[ ]	
4. QCMRL:			
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	N	[ ]	
• Was the percentage "D" for QC/MRL ≤ 30%?	[ ]	N	
5. Initial Calibration Verification (ICV):	N	[ ]	

	Yes	No
• Was the ICV made of a 2nd source?	[ ]	[ ]
• Was the mid level (2nd source) recovery within 85 - 115%?		
6. Continuing Calibration Verification (CCV): {Daily calibration}		
• Was midpoint calibration standard conducted at the beginning of the day?	[ ]	[ ]
• Was midpoint calibration standard conducted every ten samples or every twelve hours?	[ ]	[ ]
• Was midpoint calibration standard conducted after the last sample of the day?	[ ]	[ ]
• Did the CCV meet the minimum requirements (D ≤ 15% with a maximum D ≤ 20% for a specific compound if the mean D ≤ 15%)?	[ ]	[ ]
7. Sample Analysis:		
• Was the RRT of an identified component within the retention time window created as SW-846 requires? N/A	[ ]	[ ]
• Were all identified hits, above the initial calibration curve, diluted and reanalyzed?	[ ]	[ ]
• Were all identified hits confirmed on a second column?	[ ]	[ ]
• Was RPD of target analyte confirmation ≤ 40?	[ ]	[ ]
• Was there a shoulder on the 2,4,6-TNT peak?	[ ]	[ ]
If the answer is "Yes", then tetryl decomposition is suspected. Peak height rather than peak area should be used for calculating TNT concentration. If teryl was identified in aqueous samples, was pH adjusted to <3? If the answer is "No", then check for tetryl decomposition, and qualify hits with **"J"** accordingly.	[ ]	[ ]
8. Sample Quality Control:		
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?	[ ]	[ ]

	Yes	No
• MS/MSD: Were the percent recoveries within limits? N/A	[ ]	[ ]
Were the RPDs within control limits?		
• System Monitoring Compounds (Surrogates): Were surrogate recoveries within QC limits?	[ ]	[ ]

9. Comments (attach additional sheets if necessary):

MRL 2,6 DNT ~~35~~ 60% UJ both
2H 64% } UJ 074
NG 58%

Validated/Reviewed by:

Signature: _____ Date: _____

Name: _____

ICP METALS ANALYSIS (6010) CHECKLIST

SCSB -048M-0001-SO (852322) 4011
SCSD -070M-0001-SD (854000)
SCSS-058M -0001-SO (852322)

Project Name: ODAI / Sand Creek

Laboratory: CT

Batch Number(s): _____

Sample Delivery Group: 81670

	Yes	No
1. Holding Time:		
• Were samples analyzed within holding time (6-Months)?	[N]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of		
One calibration standard and a blank?	[N]	[ ]
three calibration standards and a blank?	[ ]	[ ]
• Was R ≥ 0.995	[N]	[ ]
3. QCMDL:		
• Was MDL Check performed?	[ ]	[N]
QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[N]	[ ]
• Was the QC/MRL between 70-130% R? Common Elements can be between the MRL and 2X MRL level (Fe, Al, Mg and Ca)	[ ]	[N]
4. Initial Calibration Verification (ICV):		
• Is the mid level (2nd source) recovery within 90 - 110%?	[N]	[ ]
5. Initial Calibration Blank (ICP):		

	Yes	No
• Were analytes in the blank ≤ 1/2 MRL?	[ ]	[N]
6. Interelement Check Standard:		
• Was ICS-A (interferents only) conducted at the beginning of analytical sequence?	[N]	[ ]
• Was ICS-AB results within QC limits (80-120)?	[N]	[ ]
7. Continuing calibration Blank (CCB):		
• Was CCB conducted every 10 samples?	[N]	[ ]
• Was CCB conducted at end of the analytical sequence?	[N]	[ ]
• Were analytes ≤ 1/2 MRL?	[ ]	[N]
8. Continuing Calibration Verification (CCV):		
• Was CCV conducted every 10 samples?	[N]	[ ]
• Was CCV conducted at end of the analytical sequence?	[N]	[ ]
• Was the %R between 90-110?	[N]	[ ]
9. Sample Analysis:		
• Were samples with levels higher than the calibration range (E), diluted and re-analyzed?	[N]	[ ]
10. Sample Quality Control:		
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[N]
• LCS: Were the percent recoveries for LCS within the limits?	[N]	[ ]
• MS: Were the percent recoveries within limits?	[ ]	[N]
• MD: Were the RPDs within control limits?	[ ]	[N]
11. Serial Dilution:		
• Was serial dilution (1:4) conducted when needed?	[N]	[ ]

	Yes	No
• Was there an agreement between diluted and undiluted results (<10%)?	[ ]	[X]

12. Method of Standard Addition (MSA):

• Was MSA performed on samples suspected of matrix effect (R ≥ 0.995)? N/A	[ ]	[ ]

13. Comments (attach additional sheets if necessary):
MRL Na = 73% 048m ~~+ 070m~~ detects too ↑

MS/D SCSS-057M-0001-SO Sb (26, 29), K (67, 59), Na (72, 72)

SCSB-051M-0001-SO Al (28, 23), Sb (24, 18), Pb (179, —)
Tl (69, 63), Cd (—, 69), Co (—, 75), Cu (—, 55), Ni (—, 75)
Zn (—, 55)

Dup SCSS-057M As (32), Tl (LOQ)

MS/D RPDs SCSB-051M Sb (27), Cd (30), Pb (57)

SDs: SCSS-057M Al (16), ~~Ba (18?)~~, Ca (16), Cr (15), Mg (16), Mn (15), Ni (11) Zn (17)

SCSB-051M Zn (16)

Validated/Reviewed by:

Signature: P. Meeks Date: 3/5/13

Name: P. Meeks

ICP METALS ANALYSIS (6010) CHECKLIST

SCSS-073M-0001-SO (869558)
SCSS-076M-0001-SO (869562)

Project Name: ODA1 / Sand Creeks

Laboratory: CT

Batch Number(s): _____

Sample Delivery Group: 82400

	Yes	No
1. Holding Time:		
• Were samples analyzed within holding time (6-Months)?	[Y]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of		
One calibration standard and a blank?	[ ]	[ ]
three calibration standards and a blank?	[Y]	[ ]
• Was R ≥ 0.995	[Y]	[ ]
3. QCMDL:		
• Was MDL Check performed?	[ ]	[N]
QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[Y]	[ ]
	[ ]	[N]
• Was the QC/MRL between 70-130% R? Common Elements can be between the MRL and 2X MRL level (Fe, Al, Mg and Ca)	[Y]	[ ]
4. Initial Calibration Verification (ICV):		
• Is the mid level (2nd source) recovery within 90 - 110%?		
5. Initial Calibration Blank (ICP):		

	Yes	No
• Were analytes in the blank ≤ 1/2 MRL?	[ ]	[ ]

6. Interelement Check Standard:

• Was ICS-A (interferents only) conducted at the beginning of analytical sequence?	[ ]	[ ]
• Was ICS-AB results within QC limits (80-120)?	[ ]	[ ]

7. Continuing calibration Blank (CCB):

• Was CCB conducted every 10 samples?	[ ]	[ ]
• Was CCB conducted at end of the analytical sequence?	[ ]	[ ]
• Were analytes ≤ 1/2 MRL?	[ ]	[ ]

8. Continuing Calibration Verification (CCV):

• Was CCV conducted every 10 samples?	[ ]	[ ]
• Was CCV conducted at end of the analytical sequence?	[ ]	[ ]
• Was the %R between 90-110?	[ ]	[ ]

9. Sample Analysis:

• Were samples with levels higher than the calibration range (E), diluted and re-analyzed?	[ ]	[ ]

10. Sample Quality Control:

• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?	[ ]	[ ]
• MS: Were the percent recoveries within limits?	[ ]	[ ] N/A
• MD: Were the RPDs within control limits?	[ ]	[ ] ↓

11. Serial Dilution:

• Was serial dilution (1:4) conducted when needed?	[ ]	[ ] N/A

	Yes	No
• Was there an agreement between diluted and undiluted results (<10%)?	[N]	[ ]

12. Method of Standard Addition (MSA):

• Was MSA performed on samples suspected of matrix effect ($R \geq 0.995$)? N/A	[ ]	[ ]

13. Comments (attach additional sheets if necessary):

MRL 073M Sb = 121, Se = 129, ~~Zn = 60~~ detect too large
076M Se = 78
~~Hg both~~ 076M Hg = 75

CCB TI = -4.91 UJ 073M
-8.33 J 076M

Validated/Reviewed by:

Signature: [signature] Date: 3/5/13

Name: P. Meeks

ICP METALS ANALYSIS (6010) CHECKLIST

Project Name: OPAI / Sand Creek

Laboratory: CT

Batch Number(s): SCSB-037M-0001-SO (851488)
SCSB-038M-0005-SO (851510)
SCSB-042M-0003-SO (851552)
SCSS-068M-0001-SO (850426)

Sample Delivery Group: 81578

	Yes	No
1. Holding Time:		
• Were samples analyzed within holding time (6-Months)?	[X]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of		
One calibration standard and a blank?	[X]	[ ]
three calibration standards and a blank?	[X]	[ ]
• Was R ≥ 0.995	[ ]	[ ]
3. QCMDL:		
• Was MDL Check performed?	[ ]	[X]
QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[X]	[ ]
	[ ]	[X]
• Was the QC/MRL between 70-130% R? Common Elements can be between the MRL and 2X MRL level (Fe, Al, Mg and Ca)	[X]	[ ]
4. Initial Calibration Verification (ICV):		
• Is the mid level (2nd source) recovery within 90 - 110%?		
5. Initial Calibration Blank (ICP):		

	Yes	No
• Were analytes in the blank ≤ 1/2 MRL?	[X]	[ ]
6. Interelement Check Standard:		
• Was ICS-A (interferents only) conducted at the beginning of analytical sequence?	[ ]	[ ]
• Was ICS-AB results within QC limits (80-120)?	[X]	[ ]
7. Continuing calibration Blank (CCB):		
• Was CCB conducted every 10 samples?	[X]	[ ]
• Was CCB conducted at end of the analytical sequence?	[X]	[ ]
• Were analytes ≤ 1/2 MRL?	[ ]	[X]
8. Continuing Calibration Verification (CCV):		
• Was CCV conducted every 10 samples?	[X]	[ ]
• Was CCV conducted at end of the analytical sequence?	[X]	[ ]
• Was the %R between 90-110?	[ ]	[ ]
9. Sample Analysis:		
• Were samples with levels higher than the calibration range (E), diluted and re-analyzed?	[X]	[ ]
10. Sample Quality Control:		
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[X]
• LCS: Were the percent recoveries for LCS within the limits?	[X]	[ ]
• MS: Were the percent recoveries within limits?	[ ]	[X]
• MD: Were the RPDs within control limits?	[ ]	[X]
11. Serial Dilution:		
• Was serial dilution (1:4) conducted when needed?	[ ]	[ ]

	Yes	No
• Was there an agreement between diluted and undiluted results (<10%)?	[ ]	[X]

12. Method of Standard Addition (MSA):

• Was MSA performed on samples suspected of matrix effect (R ≥ 0.995)? N/A	[ ]	[ ]

13. Comments (attach additional sheets if necessary):

MRL Th=78% 042M
CCB Tl

SCSB-041M-0002-SO Sb(24,23), Co(12,10), Cu(69,63), Ni(72,67), V(79,74)
Zn(74,68), Mn(14,10), Tl(74,73), Al(52,37), K(76,72), Cd(-,76)
Pb(-,72), Mg(-,75), ~~Ni(-,67)~~ Se(-,78)

SCSB-039M-0002-SO Sb(0,0), Cd(78,78), Co(50,50), Cu(71,70), Se(71,70)
V(68,66), Zn(77,67), Tl(70,75), K(78,-), Ni(-,78)

SCSB-038M-0001-SO Sb(0,0), Cd(56,0), Cr(0,0), Co(63,0), Cu(46,0)
Ni(74,0), Se(71,4), Tl(56,2), V(75,-), Zn(74,0), As(-,7), Pb(-,0)
RPDs As(200), Cd(200), Co(199), Cu(200), Pb(200), Ni(200), Tl(174), Zn(200)

SCSS-057M-0001-SO Sb(26,29), K(67,59), Na(72,72)
Sb PDS = 71%

Dups 038M As(38), Cu(22), Pb(28), Ni(21), Tl(22), V(24), Zn(22)
057M As (±LOQ), Tl (±LOQ)

Validated/Reviewed by:

Signature: P. Meeks Date: 3/1/13

Name: P. Meeks

SD: ~~041~~ 039M Al(11), Ba(11), Be(12), Ca(13), Cr(16), Co(27), Cu(29), Pb(73), Mg(12)
Mn(16), Ni(18), V(18), Zn(78), Al(18)

041M Sb(21), As(11), Co(20), Cu(19), Pb(79), Mg(11), Ni(17), V(24)
Zn(21), Fe(18), Al(13)

038M ~~As~~Cr(112), Co(23), Cu(26), Pb(31), Mg(13), Ni(25), ~~K~~(17), Zn(19)
Hg(42)

057M Al(16), Ba(18), Ca(16), Cr(15), Mg(16), Mn(15), Ni(11), ~~Zn~~(17)

ICP METALS ANALYSIS (6010) CHECKLIST

DA15B-074M-0202-SO (871039)
DA155-054M-0201-SO (871020)

Project Name: ODA1/Sand Creek

Laboratory: CT

Batch Number(s): _____

Sample Delivery Group: 82452

	Yes	No
1. Holding Time:		
• Were samples analyzed within holding time (6-Months)?	[X]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of		
One calibration standard and a blank?	[ ]	[ ]
three calibration standards and a blank?	[X]	[ ]
• Was $R \geq 0.995$	[X]	[ ]
3. QCMDL:		
• Was MDL Check performed?	[ ]	[X]
QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[X]	[ ]
• Was the QC/MRL between 70-130% R? Common Elements can be between the MRL and 2X MRL level (Fe, Al, Mg and Ca)	[X]	[ ]
4. Initial Calibration Verification (ICV):		
• Is the mid level (2nd source) recovery within 90 - 110%?	[X]	[ ]
5. Initial Calibration Blank (ICP):		

	Yes	No
• Were analytes in the blank ≤ 1/2 MRL?	[X]	[ ]
6. Interelement Check Standard:		
• Was ICS-A (interferents only) conducted at the beginning of analytical sequence?	[ ]	[ ]
• Was ICS-AB results within QC limits (80-120)?	[X]	[ ]
7. Continuing calibration Blank (CCB):		
• Was CCB conducted every 10 samples?	[X]	[ ]
• Was CCB conducted at end of the analytical sequence?	[X]	[ ]
• Were analytes ≤ 1/2 MRL?	[ ]	[X]
8. Continuing Calibration Verification (CCV):		
• Was CCV conducted every 10 samples?	[X]	[ ]
• Was CCV conducted at end of the analytical sequence?	[X]	[ ]
• Was the %R between 90-110?	[X]	[ ]
9. Sample Analysis:		
• Were samples with levels higher than the calibration range (E), diluted and re-analyzed?	[ ]	[ ]
10. Sample Quality Control:		
• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[X]
• LCS: Were the percent recoveries for LCS within the limits?	[X]	[ ]
• MS: Were the percent recoveries within limits?	[ ]	[X]
• MD: Were the RPDs within control limits?	[ ]	[X]
11. Serial Dilution:		
• Was serial dilution (1:4) conducted when needed?	[X]	[ ]

	Yes	No
• Was there an agreement between diluted and undiluted results (<10%)?	[ ]	[N]

12. Method of Standard Addition (MSA):

• Was MSA performed on samples suspected of matrix effect (R ≥ 0.995)? N/A	[ ]	[ ]

13. Comments (attach additional sheets if necessary):

MRL Sb = 74% 074M
Hg = 75% 074M
Sb (121), Se (129), Zn (60) 054M
Hg = 78% 054M

CCB Tl = -4.91 B 020M
= -3.03 B 074M

MS/D DA15B-073M-0201-S0 Al (77, 46), Sb (24, 24), Fe (53, 21), Mg (11, -) Zn (128, -), Pb (-, 75), Se (7, 79), Tl (-, 75)

DA15S-053M-0201-S0 Sb (4, 21), As (78, -), Cd (72, -), Co (24, -) Pb (69, -), Ni (64, -), Se (75, -), Ag (60, 64), Tl (65, 70)
RPDs: Sb (77), Co (38), Pb (29)

Dup 073M Sb (38), Cd (28), Cu (22), Hg (27)
053M Na (36)

SD 053M Al (20), Ba (12), Cd (29), Cr (17), Co (23), Cu (23), Fe (17) Mg (23), Mn (17), Ni (22), V (18), Zn (21), Hg (33)
073M Al (12), Cd (36), Cr (12), Co (16), Cu (17), Fe (12), Pb (12), Ni (16) Zn (12)

CCB Tl = -3.03 J 074M Hg = -0.08 J/074
-4.91 J 054M
Se = -2.68 UJ 074M

Validated/Reviewed by:

Signature: P. Meeks Date: 3/1/13

Name: P. Meeks

ICP METALS ANALYSIS (6010) CHECKLIST

DA1SB-068M-0201 (852373)
DA1SB-070M-0204 (852388)
DA1SB-072M-0204 (852390)
DA1SS-050M-0201 (852568)

Project Name: ODA1 / Sand Creek

Laboratory: CT

Batch Number(s): _____

Sample Delivery Group: 81623

	Yes	No
1. Holding Time:		
• Were samples analyzed within holding time (6-Months)? 28d	N	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of		
One calibration standard and a blank?	N	[ ]
three calibration standards and a blank?	N	[ ]
• Was R ≥ 0.995	N	[ ]
3. QCMDL:		
• Was MDL Check performed?	[ ]	N
QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	N	[ ]
	[ ]	[ ]
• Was the QC/MRL between 70-130% R? Common Elements can be between the MRL and 2X MRL level (Fe, Al, Mg and Ca)	[ ]	N
4. Initial Calibration Verification (ICV):		
• Is the mid level (2nd source) recovery within 90 - 110%?	/	
5. Initial Calibration Blank (ICP):		

	Yes	No
• Were analytes in the blank ≤ 1/2 MRL?	[N]	[ ]

6. Interelement Check Standard:

• Was ICS-A (interferents only) conducted at the beginning of analytical sequence?	[ ]	[ ]
• Was ICS-AB results within QC limits (80-120)?	[ ]	[ ]

7. Continuing calibration Blank (CCB):

• Was CCB conducted every 10 samples?	[ ]	[ ]
• Was CCB conducted at end of the analytical sequence?	[ ]	[ ]
• Were analytes ≤ 1/2 MRL?	[ ]	[ ]

8. Continuing Calibration Verification (CCV):

• Was CCV conducted every 10 samples?	[ ]	[ ]
• Was CCV conducted at end of the analytical sequence?	[ ]	[ ]
• Was the %R between 90-110?	[ ]	[ ]

9. Sample Analysis:

• Were samples with levels higher than the calibration range (E), diluted and re-analyzed? N/A	[ ]	[ ]

10. Sample Quality Control:

• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[ ]
• LCS: Were the percent recoveries for LCS within the limits?	[ ]	[ ]
• MS: Were the percent recoveries within limits?	[ ]	[ ]
• MD: Were the RPDs within control limits?	[ ]	[ ]

11. Serial Dilution:

• Was serial dilution (1:4) conducted when needed?	[ ]	[ ]

	Yes	No
• Was there an agreement between diluted and undiluted results (<10%)?	[ ]	[N]

12. Method of Standard Addition (MSA):

• Was MSA performed on samples suspected of matrix effect (R ≥ 0.995)? N/A	[ ]	[ ]

13. Comments (attach additional sheets if necessary):

Dup : SBSS-057m-0001-SO As (BOQ), Tl (LOQ), Cd (58)
~~Cd (LOQ)~~

MS/D RPDs : SCSB-051M-0001-SO Sb (27), Cd (30), Pb (57)

SD : SCSS:057m Al (16), Ba (18), Ca (16), Cr (15), Mg (16), Mn (15)
Ni (11), Zn (17)
DA1SB-070m As (20), Be (16), Ca (19), Cr (16), Co (19), Cu (23)
Pb (22), Mg (13), Ni (21), V (13), Zn (20), Hg (24)
SCSB-051M Zn (16)

CCB Cd = -0.939 UJ/B 070M, 072M

Validated/Reviewed by:

Signature: P. Meeks Date: 2/28/13

Name: Pete

MRL Na = 70% 10/21 08:53 — 070M, 072M, 050M
75% 10/21 14:49

MS/D SCSS-057m-001-SO Sb (26, 29), K (67, 59), Na (72, 72) & Cr (-, 39)
PDS (71)

DA1SB-070M-0201-SO Al (13, 36), Sb (19, 23), As (79, -), Cd (73, 77), Cr (69, -), Co (70, 79)
Mn (0, 2), Ni (69, -), Se (77, -), Ag (73, -), Tl (60, 65), V (73, -), Zn (68, -), K (78, -)
Na (73, 78) PDS Tl (60)

SCSB-051M-0001-SO Al (28, 23), Sb (24, 18), Pb (179,), Tl (69,), Cd (-, 69), Co (-, 75) J
PDS Tl (58) Cu (55,), Ni (70,), Tl (63,), Zn (55,)

ICP METALS ANALYSIS (6010) CHECKLIST

DA1SB-055M-0001 (851518)
059M-0201 (851528)
063M-0202 (851882)

Project Name: ODA1/Sand Creek

Laboratory: CT

SESB-037M-0001
038M-0005
042M-0003
SESS-068M-0001

Batch Number(s):

Sample Delivery Group: ~~81543~~ 81575 & 81578

	Yes	No
1. Holding Time:		
• Were samples analyzed within holding time (6-Months)? ≤ 28d	[N]	[ ]
2. Initial Calibration:		
• Did the initial calibration consist of		
One calibration standard and a blank?	[N]	[ ]
three calibration standards and a blank?	[N]	[ ]
• Was $R \geq 0.995$	[N]	[ ]
3. QCMDL:		
• Was MDL Check performed?	[ ]	[N]
QCMRL:		
• Were QC/MRL run at the beginning and end of every daily sequence or every 12 hours??	[N]	[ ]
• Was the QC/MRL between 70-130% R? Common Elements can be between the MRL and 2X MRL level (Fe, Al, Mg and Ca)	[ ]	[N]
4. Initial Calibration Verification (ICV):	[N]	[ ]
• Is the mid level (2nd source) recovery within 90 - 110%?		
5. Initial Calibration Blank (ICP):		

2/17

	Yes	No
• Were analytes in the blank ≤ 1/2 MRL?	[ ]	[N]

6. Interelement Check Standard:

• Was ICS-A (interferents only) conducted at the beginning of analytical sequence?	[N]	[ ]
• Was ICS-AB results within QC limits (80-120)?	[N]	[ ]

7. Continuing calibration Blank (CCB):

• Was CCB conducted every 10 samples?	[N]	[ ]
• Was CCB conducted at end of the analytical sequence?	[N]	[ ]
• Were analytes ≤ 1/2 MRL?	[ ]	[N]

8. Continuing Calibration Verification (CCV):

• Was CCV conducted every 10 samples?	[N]	[ ]
• Was CCV conducted at end of the analytical sequence?	[N]	[ ]
• Was the %R between 90-110?	[N]	[ ]

9. Sample Analysis:

• Were samples with levels higher than the calibration range (E), diluted and re-analyzed? N/A	[ ]	[ ]

10. Sample Quality Control:

• Method Blanks: Were target analytes ≤ 1/2 MRL?	[ ]	[N]
• LCS: Were the percent recoveries for LCS within the limits?	[ ]	[ ]
• MS: Were the percent recoveries within limits?	[ ]	[ ]
• MD: Were the RPDs within control limits?	[ ]	[ ]

11. Serial Dilution:

• Was serial dilution (1:4) conducted when needed?	[ ]	[ ]

	Yes	No
• Was there an agreement between diluted and undiluted results (<10%)?	[ ]	[ ]

12. Method of Standard Addition (MSA):

• Was MSA performed on samples suspected of matrix effect (R ≥ 0.995)?	[ ]	[ ]

13. Comments (attach additional sheets if necessary):

MS/D SCSB-041M-0002-SO Sb (24,23), Co (12,10), Cu (69,63)
Ni (72,67), V (79,74), Zn (74,68), Mn (14,10)
Tl (74,73), Al (52,37), K (76,76), Cd (-,76), Cr (57)
Pb (-,72), Mg (-,75), ~~Ni (-,67)~~, Se (-,78)
SCSB-039M-002-SO Sb (0,0), Cd (78,78), Co (50,50)
Cu (71,70), Se (71,70), V (68,66), Zn (71,67), Tl (70,75)
K (78,-), Ni (-,78)

SCSB-038M-0001-SO Al (125,-), Sb (0,0), Cd (56,0)
Cr (0,0), Co (63,0), Cu (46,0), Ni (74,0), Se (71,4)
Tl (56,0), V (75,-), Zn (74,0), As (-,0), Pb (-,0)

DA1SB-055M-0001-SO ~~Al (0,0)~~, Sb (19,19), Cd (64,72)
Cr (0,0), Co (76,76), Cu (66,66), Mn (0,0), Se (78,-)
Tl (54,55), Zn (64,66), Mg (-,78)

DA1SB-063M-0201 Al (14,-), Sb (21,19), Cd (72,68), Cr (0,0) Ca 79
Se (-,77) Mg (-,76) Co (79,73), Cu (76,64), Mn (1,0), Tl (55,52) Zn (78,62)
SCSS-057M-0001-SO Sb (26,29), ~~Cr (59,-)~~, K (67,59), Na (72,72)
Ag (124,)

Validated/Reviewed by:

Signature: P. Meeks Date: 2/27/13

Name: P. Meeks

MRL Tl = 78% 059M-0201

MB Se = 0.1 mg/kg U/B 55M + 63M 10/12 17:16

Dups: SCSB-038M As (34), Cu (22), Pb (28), Ni (21), Tl (22), V (24), Zn (22)
SCSS-057M-0001 As (32), Tl (98)

MS/D RPDs SCSB-038M Tl (174), Zn (200,)

SD: SCSB-039M Al (11) Ba (11) Be (12) 193, Ca (13), Cr (16), Co (27), Cu (29), Pb (73)
Mg (12), Mn (16), Ni (18), V (18), Zn (28), Fe (18)
SCSB-041M As (11), Co (20), Pb (79), Mg (11), Ni (17), V (24), Zn (21), Fe (18), Al (13) →

055m → 10/12 @ 17:51 most
→ 10/11 16:02 Na+K
10/3 13:20 Hg 0.56g/25ml

059m → 10/19 13:54 most – Ag
10/20 16:17 Ag

063m → 10/11 16:37 Na+K
10/13 13:50 Hg 0.56g/25mL
→ 10/12 23:19 most
→ 10/11 19:46 Na+K
10/13 15:03 Hg 0.58g/25mL

SD ~~B~~AISB – 063m Al (19), Ba (30), Be (29), Ca (25), Cr (39), Co (42), Cu (45), Mg (34), (Mn (20), Ni (44) V (33), Zn (41)

DAISB-055m Ba (14), Be (11), Ca (11), Cr (22), Co (22) Cu (25), Pb (54), Ni (23), V (18), Zn (22)

SCSB – 038m As (41), Cr (112), Co (23), Cu (26), Pb (31) Mg (13), Ni (25), V (17), Zn (19)

SCSS – 057m Al (16), Ba (18), Cd (29), Ca (16), Cr (15) Cr (15), ~~Co (7~~ Mg (16), Mn (15) Ni (11), Zn (17)

~~10/11 run starts p 6247~~ N/K OK

055m on p 6569 10/12 run
Ag = –1.60
Cd = –5.25

063m on p 6605 10/12 run
Ag = –1.94
Cd = –4.15

059m on p 6705 10/19 run
OK

	MDL
Al, Sb, As	– 4
Ba	– 0.26
Be	– 0.13
Cd	– 0.11
Ca	15
Cr	0.7
Co	1.3
Cu	1.2
Fe	9
Pb	1.5
Mg	3
Mn	0.7
Ni	0.6
K	280
Se	2.3
Ag	0.7
Na	100
Tl	1.6
V	0.5
Zn	1.8
Hg	0.04

7/95

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USACE Chemical Data Usability Assessment

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MEMORANDUM FOR RECORD 16 June 2013

SUBJECT: CHEMICAL DATA USABILITY ASSESSMENT

PROJECT: Ravenna Army Ammunition Plant, Ravenna, Ohio
RVAAP 03 Open Demolition Area #1 and RVAAP-34 Sand Creek Disposal Road Landfill
Phase 1 Remedial Investigation

1. Purpose:

This memorandum represents and documents the evaluation of the quality and usability of the analytical data obtained during the Phase I Remedial Investigation (RI) of the Sand Creek Disposal Road Landfill (RVAAP-34). This includes determination of contract compliance, data usability, and data quality objective attainment in accordance with EM 200-1-6, Chapter 5 (October 2006).

2. References:

2.1 *Final Data Validation Report, Ravenna Army Ammunition Plan, Sand Creek Disposal Road Landfill and Open Demolition Area #1 2010 Sampling, Ravenna, Ohio*, prepared by MEC^{x}, LP, April 2013.

2.2 Data Validation Report, Appendix C of the *Draft Phase 1Remedial Investigation Report for RVAAP-34 Sand Creek Disposal Road Landfill*, prepared by Shaw, July 19, 2012.

2.3 *Final Sampling and Analysis Plan Addendum No. 1 for Environmental Services at RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area #1, and RVAAP-28 Mustard Agent Burial Site, Version 1.0, Ravenna Army Ammunition Plant, Ravenna, Ohio* (SAP Addendum), prepared by Shaw, February 2010.

2.4 *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, QAPP Appendix, Ravenna, Ohio* (FWQAPP), prepared by SAIC, March 2001.

2.5 *Louisville Chemistry Guideline* (LCG), prepared by the U.S. Army Corps of Engineers - Louisville District, June 2002

2.6 *Louisville DoD Quality Systems Manual Supplement, Version 1,* prepared by USACE – Louisville District, March 2007.

2.7 *DoD Quality Systems Manual for Environmental Laboratories*, Department of Defense (DoD QSM), Environmental Data Quality Workgroup, Version 4.1, 2009.

2.8 *National Functional Guidelines for Inorganic Superfund Data Review* (NFG), U.S. Environmental Protection Agency, 2004

2.9 EM 200-1-6, Chapter 5, Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste (HTRW) Projects, October 1997.

3. Project Description:

The purpose of the Phase I Remedial Investigation at the Sand Creek Disposal Road Landfill was to conduct soil and sediment sampling to further define the nature and extent of contamination. The

data would be used to support the preparation of a feasibility study and to support a Record of Decision.

Sampling was conducted by Shaw Environmental & Infrastructure, Inc. (Shaw) between September and November 2010. A total of 28 surface soil samples, 78 subsurface soil samples and 3 sediment samples were collected using incremental sampling method (ISM) procedures. Samples were analyzed for one or more of the following parameters: metals, explosives, propellants, pesticides, polychlorinated biphenyls (PCBs), semivolatile organic compounds (SVOCs), volatiles (VOCs), cyanide, and hexavalent chromium. Analytical services were provided by CT Laboratories located in Baraboo, Wisconsin.

4. Analytical Program Overview:
Below are excerpts from the Quality Assurance Project Plan (QAPP) provided as Part 2 in the SAP Addendum:

4.1 Data Quality Objectives

Data quality objective (DQO) summaries for this investigation will follow Tables 3-1 and 3-2 in the Facility-Wide QAPP. All QC parameters stated in the specific U.S. Environmental Protection Agency (USEPA) SW-846 methods will be adhered to for each chemical listed. The SW-846 method references found in the Facility-Wide QAPP have been revised to the Final Update IV methods, as appropriate. Laboratories are required to comply with all methods as written; recommendations are considered requirements. Concurrence with the DoD QSM for Environmental Laboratories (DoD, 2009), and the Louisville Chemistry Guidance (USACE, 2002) is expected.

4.2 Level of Quality Control Effort

QC efforts will follow Section 3.2 of the Facility-Wide QAPP. Field QC measurements will include field source water blanks, trip blanks, field duplicates, surrogates, and equipment rinsate blanks. Laboratory QC measurements will include method blanks, laboratory control samples (LCSs), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples or matrix spike/matrix duplicate (MS/MD) samples for metals.

4.3 Accuracy, Precision, and Sensitivity of Analysis

Accuracy, precision, and sensitivity goals identified in Section 3.3 and Tables 3-1 through 3-9 of the Facility-Wide QAPP will be imposed for this investigation. As stated above, some of the analytical methods numbers have been updated (refer to Table 1-1 of this QAPP addendum). Quality objectives related to individual method QC protocol will also follow requirements given in the QSM and the LCG. Laboratories will make all reasonable attempts to meet the program and project reporting levels in Tables 3-1 through 3-9 of the Facility-Wide QAPP for each individual sample analysis.

4.4 Completeness, Representativeness, and Comparability

Completeness, representativeness, and comparability goals identified in Section 3.4 and Tables 3-1 and 3-2 of the Facility-Wide QAPP will be imposed for this investigation. The completeness goal for analytical data is 90%, as defined in Tables 3-1 and 3-2 of the FWQAPP.

5. Chemical Data Quality and Usability Assessment:
This assessment of the overall quality and usability of project data was based upon a thorough review of the associated Data Validation Reports as presented in Appendix C of the *Draft Phase 1 Remedial Investigation Report for RVAAP-34 Sand Creek Disposal Road Landfill* (Shaw, 2012) and Section 5 of the *Final Data Validation Report, Ravenna Army Ammunition Plant Sand Creek Disposal Road Landfill and Open Demolition Area #1, 2010 Sampling* (MEC^{x}, 2013).

Shaw performed a Level III validation of 100% of the project data. During the review process, data were assigned data qualifiers in accordance with the DoD QSM 4.1 to indicate the usability of the data.

Additionally, data validation was performed by MEC^{x}, a USACE-Louisville District contracted third-party. The associated Data Validation Report details their findings from the Level IV validation of 10% of the primary sample data, analysis of field duplicate results, and the determination of data usability. This evaluation includes review of the same QC elements as the primary contractor's review in addition to an in-depth look into the verification of sample results, target compound identification, and raw data. The intent is to verify the quality and the reliability of the primary data for its intended use.

The data were evaluated in the context of the data quality objective (DQOs) and measurement quality objectives (MQOs) as specified in the project specific SAP addendum and the FWQAPP referenced in item 2.

The subsections below present the U.S. Army Corps of Engineers – Louisville District's assessment of the chemical data quality for the Sand Creek RI including determination of contract compliance, data usability, and data quality objective attainment.

5.1 Contract Compliance
Samples were collected and analyzed in accordance with the procedures specified in the project QAPPs. With minor exceptions, data met the QC specifications outlined in the DoD QSM and project QAPPs. Specific non-conformances and their impact on data usability are noted and described in the associated data evaluation reports.

Detection limits (DLs) for some analytes exceeded applicable screening criteria. Results with DLs exceeding project criteria may still be usable during risk assessment; however, it is incumbent upon the final data user to make this determination on a case by case basis.

5.2 Data Quality Attainment
The quality of data generated for the Sand Creek RI met the project DQOs. Completeness surpassed the goal of 90%.

Some data were rejected during third party validation that was not rejected during the contractor's review. These were relegated to two 2,4-dinitrophenol, three hexachlorocyclopentadiene, two 4,6-dinitro-2-methylphenol and one benzyl alcohol SVOC results and two antimony results for the

samples depicted below.

Sand Creek
Rejected Data

Sample	SDG	Analyte	Reason	Review
SCSB-048M-0001-SO SCSD-070M-0001-SD	81607 82400	2,4-Dinitrophenol	MRL Recoveries (<10%)	Level IV
		Hexachlorocyclopentadiene		
		4,6-Dinitro-2-methylphenol		
SCSS-058M-0001-SO	81670	Benzyl alcohol	MRL Recoveries (<10%)	
		Hexachlorocyclopentadiene		
SCSB-042M-0003-SO	81578	Antimony	MS/MSD Recovery (<30%)	
SCSS-068M-0001-SO				

Three variances, as outlined below, were noted during USACE's review of the respective data validations. These were primarily due to differences in professional opinion and/or discrepancies within the guidance documents, particularly as the project transitions to newer updated guidance (i.e., from the LCG and NFG to the QSM). The qualification of some data depended on which document was assigned precedence; however, the professional judgments of both validators were within the purview of the guidance documents used.

- MRL recoveries:
  This was primarily associated with VOC and SVOC analyses. During third party validation data associated with MRL recoveries of < 10% were rejected (R) for use. Shaw did not reject this data if the laboratory ran an MDL check standard and the analytes were detected. This is consistent with the protocol established in the LCG.
- Several explosive analytes were reported by both Method 8270 for semivolatiles and Method 8330 for explosives. MECx selected (rejected) one result over another for use. However, both met reporting limit requirements and QC criteria. Therefore, both were reported and used by Shaw.
- MECx qualified antimony results associated with MS/MSD recovery failures on a batch/ sample delivery group basis allowed under the NFG (2004) and the LCG. Shaw qualified the results for the parent sample only in accordance with the QSM (Version 4.1). Additionally, if the laboratory subsequently performed a post digestion spike which met criteria, Shaw qualified results as estimated (J) rather than unusable (R).

5.3 Data Usability

Data were consistently reviewed and qualified by both the primary contractor and the third-party validator. Overall findings were compatible with the exceptions noted above. In a few instances differences in professional opinion and/or guidance utilized resulted in data being rejected (R) as unusable by one reviewer and not the other. This occurred most notably in regards to qualification of data due to low MRL recovery and MS failures.

6.0 Conclusion:

Through the proper implementation of the project data review, verification, and validation process that is outlined in the FWQAPP, the data for the Sand Creek RI are deemed acceptable for use. Based upon this assessment, all analytical results are usable to meet the project DQOs as qualified and presented by Shaw; can withstand scientific scrutiny; are technically defensible; and are of known and acceptable quality in terms of sensitivity, precision, and accuracy.

Kathy Krantz
Project Chemist
USACE – Louisville District

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Appendix D
Laboratory Analytical Results

(Note: Data submitted on compact disc.)

Appendix E
Fate and Transport Modeling Results

Table E-1
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Surface Soils to SSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	Background Criteria (mg/kg)	SRC ?	SRC Justification	GSSL (DAF=1) (mg/kg)	RSL (mg/kg)	MCL based SSL (mg/kg)	Initial CMCOPC ?
Explosives and Propellants												
2,4,6-Trinitrotoluene	118-96-7	2/18	0.26 J	3.9	0.41	---	Yes	Detected organic	NF	0.013		Yes
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/18	0.26 J	0.26 J	0.22	---	Yes	Detected organic	NF	0.056		Yes
Nitroguanidine	556-88-7	1/2	0.64	1.2	0.4	---	Yes	Detected organic	NF	0.88		Yes
Inorganics												
Aluminum	7429-90-5	18/18	26.1	16,700	10,123	17,700	No	Below	No further evaluation needed			No
Antimony	7440-36-0	11/18	0.75	17.1	2.4	0.96	Yes	Above	0.3			Yes
Arsenic	7440-38-2	17/18	4.5	36.6	14	15.4	Yes	Above	1			Yes
Barium	7440-39-3	18/18	1.5	764	128	88.4	Yes	Above	82			Yes
Beryllium	7440-41-7	17/18	0.41	1.1	0.59	0.88	Yes	Above	3			No
Cadmium	7440-43-9	16/18	0.057	12.9	1.61	0	Yes	Above	0.4			Yes
Calcium	7440-70-2	18/18	26.5	32,500	9,844	15,800	No	Essential nutrient	No further evaluation needed			No
Chromium	7440-47-3	18/18	0.26	188	79	17.4	Yes	Above	2			Yes
Cobalt	7440-48-4	17/18	6.7	19.7	9.3	10.4	Yes	Above	NF	0.49		Yes
Copper	7440-50-8	18/18	0.49	726	77	17.7	Yes	Above	NF	51	46	Yes
Iron	7439-89-6	18/18	86.8	34,800	24,483	23,100	No	Essential nutrient	No further evaluation needed			No
Lead	7439-92-1	18/18	0.88	405	81	26.1	Yes	Above	400			Yes
Magnesium	7439-95-4	18/18	6.6	8,130	3,312	3,030	No	Essential nutrient	No further evaluation needed			No
Manganese	7439-96-5	18/18	2.2	920	511	1,450	No	Below	No further evaluation needed			No
Mercury	7439-97-6	18/18	0.026	24.6	3.6	0.036	Yes	Above	NF	0.03	0.1	Yes
Nickel	7440-02-0	18/18	0.08 J	48.2	25.8	21.1	Yes	Above	7			Yes
Potassium	7440-9-7	18/18	693	1,650	1,094	927	No	Essential nutrient	No further evaluation needed			No
Selenium	7782-49-2	15/18	0.13	3.1	1.2	1.4	Yes	Above	0.3			Yes
Silver	7440-22-4	14/18	0.095	256	42.3	0	Yes	Above	2			Yes
Sodium	7440-23-5	18/18	20.5	221	68	123	No	Essential nutrient	No further evaluation needed			No
Thallium	7440-28-0	16/18	0.14 J	3.2 J	1.2	0	Yes	Above	0.04			Yes
Vanadium	7440-62-2	17/18	11.5	23.8	17.8	31.1	No	Below	No further evaluation needed			No
Zinc	7440-66-6	18/18	0.96	373	127	61.8	Yes	Above	620			No
Semivolatile Organic Compounds												
1,4-Dichlorobenzene	106-46-7	6/18	0.022 J	0.27 J	0.168	---	Yes	Detected organic	0.1			Yes
Bis(2-Ethylhexyl)phthalate	117-81-7	7/18	0.1 J	1.7	0.519	---	Yes	Detected organic	180			No
Anthracene	120-12-7	10/18	0.026 J	1.1	0.275	---	Yes	Detected organic	590			No

Table E-1
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Surface Soils to SSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	Background Criteria (mg/kg)	SRC ?	SRC Justification	GSSL (DAF=1) (mg/kg)	RSL (mg/kg)	MCL based SSL (mg/kg)	Initial CMCOPC ?
1,2,4-Trichlorobenzene	120-82-1	1/18	0.027 J	0.027 J	0.197	---	Yes	Detected organic	0.3			No
Pyrene	129-00-0	15/18	0.035 J	4	0.683	---	Yes	Detected organic	210			No
Dibenzofuran	132-64-9	10/18	0.027 J	0.33 J	0.1715	---	Yes	Detected organic	NF	0.68		No
Benzo(ghi)perylene	191-24-2	11/18	0.026 J	0.69	0.223	---	Yes	Detected organic	NF	NF	NF	No
Indeno(1,2,3-cd)pyrene	193-39-5	11/18	0.025 J	0.81	0.233	---	Yes	Detected organic	0.7			Yes
Benzo(b)fluoranthene	205-99-2	15/18	0.039 J	4.8	0.715	---	Yes	Detected organic	0.2			Yes
Fluoranthene	206-44-0	16/18	0.04 J	4.3	0.877	---	Yes	Detected organic	210			No
Benzo(k)fluoranthene	207-08-9	14/18	0.027 J	1.4	0.275	---	Yes	Detected organic	2			No
Acenaphthylene	208-96-8	8/18	0.029 J	0.16 J	0.155	---	Yes	Detected organic	NF	NF	NF	No
Chrysene	218-01-9	14/18	0.027 J	2.7	0.479	---	Yes	Detected organic	8			No
Benzo(a)pyrene	50-32-8	15/18	0.026 J	2.4	0.419	---	Yes	Detected organic	0.4			Yes
Dibenzo(a,h)anthracene	53-70-3	7/18	0.055 J	0.28 J	0.176	---	Yes	Detected organic	0.08			Yes
1,3-Dichlorobenzene	541-73-1	1/18	0.031 J	0.031 J	0.197	---	Yes	Detected organic	NF	NF	NF	No
Benzo(a)anthracene	56-55-3	15/18	0.027 J	2.6	0.472	---	Yes	Detected organic	0.08			Yes
Benzoic Acid	65-85-0	4/18	0.39 J	0.57 J	0.721	---	Yes	Detected organic	20			No
Isophorone	78-59-1	6/18	0.051 J	0.2 J	0.179	---	Yes	Detected organic	0.03			Yes
Acenaphthene	83-32-9	7/18	0.029 J	0.44	0.184	---	Yes	Detected organic	29			No
Diethyl Phthalate	84-66-2	2/18	0.069 J	0.14 J	0.196	---	Yes	Detected organic	23			No
Di-n-Butyl Phthalate	84-74-2	17/18	0.082 J	0.47	0.17	---	Yes	Detected organic	270			No
Phenanthrene	85-01-8	15/18	0.026 J	3.4	0.611	---	Yes	Detected organic	NF	NF	NF	No
Fluorene	86-73-7	8/18	0.031 J	0.47	0.191	---	Yes	Detected organic	28			No
Carbazole	86-74-8	9/18	0.034 J	0.61	0.197	---	Yes	Detected organic	0.03			Yes
Pentachlorophenol	87-86-5	2/18	0.4 J	0.52 J	0.499	---	Yes	Detected organic	0.001			Yes
Naphthalene	91-20-3	11/18	0.028 J	0.33 J	0.184	---	Yes	Detected organic	4			No
2-Methylnaphthalene	91-57-6	11/18	0.043 J	0.53	0.249	---	Yes	Detected organic	NF	0.75		No
1,2-Dichlorobenzene	95-50-1	17/18	0.028 J	0.11 J	0.14415	---	Yes	Detected organic	0.9			No
Pesticides												
4,4'-DDD	72-54-8	2/2	0.0014	0.0023	0.002	---	Yes	Detected organic	3			No
4,4'-DDT	50-29-3	2/2	0.0015	0.0017	0.002	---	Yes	Detected organic	2			No
alpha-Chlordane	5103-71-9	1/2	0.0015	0.0015	0.002	---	Yes	Detected organic	NF	NF	NF	No
Heptachlor	76-44-8	2/2	0.001	0.0081	0.005	---	Yes	Detected organic	1	0.0012	0.033	No

Table E-1
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Surface Soils to SSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	Background Criteria (mg/kg)	SRC ?	SRC Justification	GSSL (DAF=1) (mg/kg)	RSL (mg/kg)	MCL based SSL (mg/kg)	Initial CMCOPC ?
Lindane	58-89-9	1/2	0.0013	0.0013	0.001	---	Yes	Detected organic	0.0005			Yes
Methoxychlor	72-43-5	1/2	0.0016	0.0016	0.001	---	Yes	Detected organic	8	9.9	2.2	No

Notes:

CMCOPC = Contaminant Migration Contaminant of Potential Concern
SRC = Site Related Contaminant
SSL = Soil Screening Level (USEPA, 1996)
GSSL = Generic Soil Screening Level
MCL = Maximum Contaminant Level
RSL = Risk Based Screening Level (USEPA 2010)
Shaded cells indicate SRCs that exceed the GSSL screen.

Validation Qualifiers:
J = The reported result is an estimated value.

Table E-2
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Subsurface Soils to SSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	Background Criteria (mg/kg)	SRC ?	SRC Justification	Generic SSL (DAF=1) (mg/kg)	Risk Based SSL (mg/kg)	MCL based SSL (mg/kg)	Initial CMCOPC ?
Explosives and Propellants												
2,4,6-Trinitrotoluene	118-96-7	1/1	0.1 J	0.1 J	0.218	---	Yes	Detected organic	NF	0.013		Yes
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/1	0.26 J	0.26 J	0.221	---	Yes	Detected organic	NF	0.056		Yes
m-Nitrotoluene	99-08-1	1/1	0.32 J	0.32 J	0.222	---	Yes	Detected organic	NF	0.88		Yes
Inorganics												
Aluminum	7429-90-5	58/58	7,050	18,200	11,991	19,500	No	Below	No further evaluation needed			No
Antimony	7440-36-0	39/58	0.11 J	11.2	0.74	0.96	Yes	Above	0.3			Yes
Arsenic	7440-38-2	57/58	2	182	18.27	19.8	Yes	Above	1			Yes
Barium	7440-39-3	58/58	33.4	932	85.7	124	Yes	Above	82			Yes
Beryllium	7440-41-7	58/58	0.31	3.9	0.71	0.88	Yes	Above	3			Yes
Cadmium	7440-43-9	38/58	0.039	5.5	0.52	0	Yes	Above	0.4			Yes
Calcium	7440-70-2	58/58	507	82,400	10,221	35,500	No	Essential nutrient	No further evaluation needed			No
Chromium	7440-47-3	58/58	14	186	64.6	27.2	Yes	Above	2			Yes
Cobalt	7440-48-4	58/58	4.4	22.3	10.4	23.2	No	Below	No further evaluation needed			No
Copper	7440-50-8	58/58	11.5	2,020	59.6	32.3	Yes	Above	NF	51	46	Yes
Iron	7439-89-6	58/58	19,500	79,400	32,672	35,200	No	Essential nutrient	No further evaluation needed			No
Lead	7439-92-1	58/58	5.3	907	60.8	19.1	Yes	Above	400			Yes
Magnesium	7439-95-4	58/58	1,880	8,830	5,247	8,790	No	Essential nutrient	No further evaluation needed			No
Manganese	7439-96-5	58/58	244	1,640	512	3,030	No	Below	No further evaluation needed			No
Mercury	7439-97-6	58/58	0.0042 J	2	0.077	0.044	Yes	Above	NF	0.03	0.1	Yes
Nickel	7440-02-0	58/58	10.4	88.1	28.2	60.7	Yes	Above	7			Yes
Potassium	7440-9-7	58/58	650	4,600	1,625	3,350	No	Essential nutrient	No further evaluation needed			No
Selenium	7782-49-2	26/58	0.14 J	5.7	0.47	1.5	Yes	Above	0.3			Yes
Silver	7440-22-4	14/58	0.13	13.5	0.5	0	Yes	Above	2			Yes
Sodium	7440-23-5	58/58	22.8	264	95.2	145	No	Essential nutrient	No further evaluation needed			Yes
Thallium	7440-28-0	41/58	0.19	17.3	1.36	0.91	Yes	Above	0.04			Yes
Vanadium	7440-62-2	58/58	12.3	173	19.2	37.6	Yes	Above	300			No
Zinc	7440-66-6	58/58	38.9	1,350	96.5	93.3	Yes	Above	620			Yes
Semi volatile Organic Compounds												
1,4-Dichlorobenzene	106-46-7	1/58	0.022 J	0.022 J	0.199	---	Yes	Detected organic	0.1			Yes

Table E-2
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Subsurface Soils to SSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	Background Criteria (mg/kg)	SRC ?	SRC Justification	Generic SSL (DAF=1) (mg/kg)	Risk Based SSL (mg/kg)	MCL based SSL (mg/kg)	Initial CMCOPC ?
Bis(2-Ethylhexyl)phthalate	117-81-7	10/58	0.088 J	0.85 J	0.447	---	Yes	Detected organic	180			Yes
Anthracene	120-12-7	8/58	0.03 J	3.1	0.242	---	Yes	Detected organic	590			No
Pyrene	129-00-0	14/58	0.029 J	13	0.56	---	Yes	Detected organic	210			No
Dibenzofuran	132-64-9	14/58	0.024 J	0.84	0.1859	---	Yes	Detected organic	NF	0.68		Yes
Benzo(ghi)perylene	191-24-2	15/58	0.022 J	1.7	0.22302	---	Yes	Detected organic	NF	NF	NF	No
Indeno(1,2,3-cd)pyrene	193-39-5	10/58	0.024 J	1.6 Q	0.23783	---	Yes	Detected organic	0.7			Yes
Benzo(b)fluoranthene	205-99-2	14/58	0.039 J	13	0.5501	---	Yes	Detected organic	0.2			Yes
Fluoranthene	206-44-0	14/58	0.027 J	17	0.65869	---	Yes	Detected organic	210			No
Benzo(k)fluoranthene	207-08-9	11/58	0.027 J	4.4 Q	0.29283	---	Yes	Detected organic	2			Yes
Acenaphthylene	208-96-8	5/58	0.034 J	0.14 J	0.19219	---	Yes	Detected organic	NF	NF	NF	No
Chrysene	218-01-9	12/58	0.034 J	7.6	0.39829	---	Yes	Detected organic	8			No
Benzo(a)pyrene	50-32-8	13/58	0.035 J	8.3	0.37993	---	Yes	Detected organic	0.4			Yes
Dibenzo(a,h)anthracene	53-70-3	6/58	0.032 J	0.55 Q	0.2	---	Yes	Detected organic	0.08			Yes
Benzo(a)anthracene	56-55-3	11/58	0.046 J	8.2	0.37	---	Yes	Detected organic	0.08			Yes
2,6-Dinitrotoluene	606-20-2	1/58	0.047 J	0.047	0.1996	---	Yes	Detected organic	0.000025			Yes
Benzoic Acid	65-85-0	1/58	0.32 J	0.32 J	0.581	---	Yes	Detected organic	20			Yes
Isophorone	78-59-1	29/58	0.053 J	1.2	0.211	---	Yes	Detected organic	0.03			Yes
Acenaphthene	83-32-9	6/58	0.029 J	0.7	0.198	---	Yes	Detected organic	29			No
Di-n-Butyl Phthalate	84-74-2	37/58	0.081 J	0.27 J	0.158	---	Yes	Detected organic	270			Yes
Phenanthrene	85-01-8	33/58	0.027 J	11	0.484	---	Yes	Detected organic	NF	NF	NF	No
Fluorene	86-73-7	9/58	0.034 J	1.1	0.197	---	Yes	Detected organic	28			No
Carbazole	86-74-8	8/58	0.033 J	2.2	0.23	---	Yes	Detected organic	0.03			Yes
Pentachlorophenol	87-86-5	1/58	0.38 J	0.38 J	0.499	---	Yes	Detected organic	0.001			Yes
Naphthalene	91-20-3	31/58	0.021 J	0.98	0.167	---	Yes	Detected organic	4			No
2-Methylnaphthalene	91-57-6	33/58	0.026 J	0.7	0.174	---	Yes	Detected organic	NF	0.75		No
1,2-Dichlorobenzene	95-50-1	4/58	0.024 J	0.049 J	0.191	---	Yes	Detected organic	0.9			Yes
Volatile Organic Compounds												
Ethylbenzene	100-41-4	1/5	0.15	0.15	0.053	---	Yes	Detected organic	0.7			No
Toluene	108-88-3	2/5	0.012 J	0.31	0.081	---	Yes	Detected organic	0.6			No
Xylene (Total)	1330-20-7	1/5	0.36	0.36	0.119	---	Yes	Detected organic	10			No

Table E-2
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Subsurface Soils to SSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	Background Criteria (mg/kg)	SRC ?	SRC Justification	Generic SSL (DAF=1) (mg/kg)	Risk Based SSL (mg/kg)	MCL based SSL (mg/kg)	Initial CMCOPC ?
Benzene	71-43-2	1/5	0.06	0.06	0.035	---	Yes	Detected organic	0.002			Yes
1,2-Dimethylbenzene	95-47-6	2/5	0.013 J	0.35	0.089	---	Yes	Detected organic	NF	NF	NF	No
Pesticides												
4,4'-DDE	72-55-9	1/5	0.0051	0.0051	0.0051	---	Yes	Detected organic	3	0.047		No
4,4'-DDT	50-29-3	2/5	0.013	0.013	0.013	---	Yes	Detected organic	2	0.067		No
Aldrin	309-00-2	1/5	0.0012 JQ	0.0012 JQ	0.00159	---	Yes	Detected organic	0.02			
alpha-BHC	319-84-6	2/5	0.0013 J	0.011 JQ	0.00358	---	Yes	Detected organic	0.00003			Yes
beta-BHC	319-85-7	1/5	0.0032 JQ	0.0032 JQ	0.00182	---	Yes	Detected organic	0.0001			Yes
delta-BHC	319-86-8	1/5	0.0016 JQ	0.0016 JQ	0.00161	---	Yes	Detected organic	NF	NF	NF	No
Dieldrin	60-57-1	1/5	0.0034 JQ	0.0034 JQ	0.00985	---	Yes	Detected organic	0.0002	0.00017		Yes
Endosulfan II	33213-65-9	1/1	0.0036	0.0036	0.013	---	Yes	Detected organic	NF	NF	NF	No
Endrin Aldehyde	7421-93-4	1/5	0.005 JQ	0.005 JQ	0.00233	---	Yes	Detected organic	NF	NF	NF	No
gamma-Chlordane	5566-34-7	1/5	0.0054 JQ	0.0054 JQ	0.00217	---	Yes	Detected organic	NF	NF	NF	No
Heptachlor	76-44-8	4/5	0.0009 J	0.0058 JQ	0.00232	---	Yes	Detected organic	1	0.0012	0.033	No
Heptachlor epoxide	1024-57-3	1/5	0.00071 JQ	0.00071 JQ	0.00129	---	Yes	Detected organic	0.03	0.00015	0.0041	No
Methoxychlor	72-43-5	2/5	0.001 J	0.0058 JQ	0.0021	---	Yes	Detected organic	8	9.9	2.2	
Polychlorinated Biphenyls												
Arochlor-1254	11097-69-1	1/5	0.14 J	0.14 J	0.03	---	Yes	Detected organic	NF	NF	NF	No

Notes:

CMCOPC = Contaminant Migration Contaminant of Potential Concern

SRC = Site Related Contaminant

SSL = Soil Screening Level

GSSL = Generic Soil Screening Level

MCL = Maximum Contaminant Level

RSL = Risk Based Screening Level (EPA 2010)

Shaded cells indicate SRCs that exceed the GSSL screen.

Validation Qualifiers:

J = The reported result is an estimated value.

Q = One or more quality control criteria failed (e.g., Laboratory Control Sample recovery, surrogate spike recovery or Continuing Calibration Verification)

Table E-3
Site Specific Dilution Attenuation (DAF) Calculation for the Sand Creek Landfill

$$DAF = 1 + \{ (Kid))/IL \}$$

$$d = \sqrt{(0.012\ L^2)} + d_a \{1 - \exp [(-LI)/(Kid_a)] \}$$

Parameter	Symbol	Value	Units	Data Source
Dilution attenuation factor	DAF	1.08	unit less	Calculated suing the DAF equation shown above
Aquifer Hydraulic conductivity	K	3.16	m/yr	Literature value based on lithology type (silts, sands and clayey sands), from Fetter C. W., 1992.
Horizontal hydraulic gradient	i	1.04×10^{-1}	m/m	Estimated based on site topography
Infiltration rate	I	0.09	m/yr	10% of annual precipitation from Youngstown WSO AP, Ohio weather station
Source length parallel top groundwater flow	L	40	m	Based on surface area of area with soil impacts
Mixing zone depth	d	0.84	m	determine from the lower value between d calculated by equation above and aquifer thickness
Aquifer thickness	da	0.84	m	Based on water level detected in the boring logs and the depth of clay lens

Notes:
Equations are from EPA, 1996, Soil Screening Guidance: Technical Background Document, EPA Document Number: EPA/540/R-95/128, July, http://www.epa.gov/superfund/health/conmedia/soil/toc.htm#p5

Table E-4
Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Surface Soils to SSSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	SSL (mg/kg)	SSSL (DAF=1.08) (mg/kg)	Refined CMCOPC ?
Explosives and Propellants								
2,4,6-Trinitrotoluene	118-96-7	2/18	0.26 J	3.9	0.41	0.013	0.014	Yes
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/18	0.26 J	0.26 J	0.22	0.056	0.060	Yes
Nitroguanidine	556-88-7	1/2	0.64	1.2	0.4	0.88	0.950	Yes
Inorganics								
Antimony	7440-36-0	11/18	0.75	17.1	2.4	0.3	0.32	Yes
Arsenic	7440-38-2	17/18	4.5	36.6	14	1	1.08	Yes
Barium	7440-39-3	18/18	1.5	764	128	82	88.56	Yes
Cadmium	7440-43-9	16/18	0.057	12.9	1.61	0.4	0.43	Yes
Chromium	7440-47-3	18/18	0.26	188	79	2	2.16	Yes
Cobalt	7440-48-4	17/18	6.7	19.7	9.3	0.49	0.53	Yes
Copper	7440-50-8	18/18	0.49	726	77	51	55.08	Yes
Lead	7439-92-1	18/18	0.88	405	81	400	432	No
Mercury	7439-97-6	18/18	0.026	24.6	3.6	0.1	0.11	Yes
Nickel	7440-02-0	18/18	0.08 J	48.2	25.8	7	7.56	Yes
Selenium	7782-49-2	15/18	0.13	3.1	1.3	0.3	0.32	Yes
Silver	7440-22-4	14/18	0.095	256	42.3	2	2.16	Yes
Thallium	7440-28-0	16/18	0.14 J	3.2 J	1.2	0.04	0.043	Yes
Semivolatile Organic Compounds								
1,4-Dichlorobenzene	106-46-7	6/18	0.022 J	0.27 J	0.168	0.1	0.108	Yes
Indeno(1,2,3-cd)pyrene	193-39-5	11/18	0.025 J	0.81	0.233	0.7	0.756	Yes
Benzo(b)fluoranthene	205-99-2	15/18	0.039 J	4.8	0.715	0.2	0.216	Yes
Benzo(a)pyrene	50-32-8	15/18	0.026 J	2.4	0.419	0.4	0.432	Yes
Dibenzo(a,h)anthracene	53-70-3	7/18	0.055 J	0.28 J	0.176	0.08	0.086	Yes
Benzo(a)anthracene	56-55-3	15/18	0.027 J	2.6	0.472	0.08	0.086	Yes
Isophorone	78-59-1	6/18	0.051 J	0.2 J	0.179	0.03	0.032	Yes
Carbazole	86-74-8	9/18	0.034 J	0.61	0.197	0.03	0.032	Yes
Pentachlorophenol	87-86-5	2/18	0.4 J	0.52 J	0.499	0.001	0.0011	Yes
Pesticides								
Lindane	58-89-9	1/2	0.0013	0.0013	0.001	0.0005	0.00054	Yes

Notes:

CMCOPC = Contaminant Migration Contaminant of Potential Concern
SRC = Site Related Contaminant
SSL = Soil Screening Level
SSSL = Site-specific Soil Screening Level
Shaded cells indicated SRCs that were eliminated by screening against SSSLs.

Validation Qualifiers:
J = The reported result is an estimated value.

Table E-5

Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Subsurface Soils to SSSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	SSL (mg/kg)	SSSL (DAF=1.08) (mg/kg)	Refined CMCOPC ?
Explosives and Propellants								
2,4,6-Trinitrotoluene	118-96-7	1/1	0.1	0.1	0.218	0.013	0.014	Yes
Dinitrotoluene	35572-78-2	1/1	0.26	0.26	0.221	0.056	0.060	Yes
Inorganics								
Antimony	7440-36-0	39/58	0.11 J	11.2	0.74	0.3	0.32	Yes
Arsenic	7440-38-2	57/58	2	182	18.24	1	1.08	Yes
Barium	7440-39-3	58/58	33.4	932	85.7	82	88.56	Yes
Beryllium	7440-41-7	58/58	0.31	3.9	0.71	3	3.24	Yes
Cadmium	7440-43-9	38/58	0.039	5.5	0.52	0.4	0.43	Yes
Chromium	7440-47-3	58/58	14	186	64.5	2	2.16	Yes
Copper	7440-50-8	58/58	11.5	2,020	59.6	51	55.08	Yes
Lead	7439-92-1	58/58	4.9	907	60.8	400	432	Yes
Mercury	7439-97-6	58/58	0.0042 J	2	0.076	0.1	0.11	Yes
Nickel	7440-02-0	58/58	10.4	88.1	28.1	7	7.56	Yes
Selenium	7782-49-2	26/58	0.14 J	5.7	0.47	0.3	0.32	Yes
Silver	7440-22-4	14/58	0.13	13.5	0.5	2	2.16	Yes
Thallium	7440-28-0	41/58	0.19	17.3	1.36	0.04	0.04	Yes
Zinc	7440-66-6	58/58	38.9	1,350	96.5	620	670	Yes
Semivolatile Organic Compounds								
Dibenzofuran	132-64-9	14/58	0.024	0.84	0.1859	0.68	0.73	Yes
Indeno(1,2,3-cd)pyrene	193-39-5	10/58	0.024	1.6	0.23783	0.7	0.76	Yes
Benzo(b)fluoranthene	205-99-2	14/58	0.039	13	0.5501	0.2	0.22	Yes
Benzo(k)fluoranthene	207-08-9	11/58	0.027	4.4	0.29283	2	2.16	Yes
Benzo(a)pyrene	50-32-8	13/58	0.035	8.3	0.37993	0.4	0.43	Yes
Dibenzo(a,h)anthracene	53-70-3	6/58	0.032	0.55	0.2	0.08	0.09	Yes
Benzo(a)anthracene	56-55-3	11/58	0.046	8.2	0.37	0.08	0.09	Yes
2,6-Dinitrotoluene	606-20-2	1/58	0.047	0.047	0.1996	0.000025	0.000027	Yes
Isophorone	78-59-1	29/58	0.053	1.2	0.211	0.03	0.03	Yes
Carbazole	86-74-8	8/58	0.033	2.2	0.23	0.03	0.03	Yes
Pentachlorophenol	87-86-5	1/58	0.38	0.38	0.499	0.001	0.0011	Yes

Table E-5

Initial CMCOPCs Based on Comparison of SRC Maximum Concentrations in Subsurface Soils to SSSLs

Analyte	CAS Number	Frequency of Detection	Minimum Detect (mg/kg)	Maximum Detect (mg/kg)	Average Result (mg/kg)	SSL (mg/kg)	SSSL (DAF=1.08) (mg/kg)	Refined CMCOPC ?
Volatile Organic Compounds								
Benzene	71-43-2	1/5	0.06	0.06	0.035	0.002	0.0022	Yes
Pesticides								
alpha-BHC	319-84-6	2/5	0.0013 J	0.011 JQ	0.00358	0.00003	0.000032	Yes
beta-BHC	319-85-7	1/5	0.0032 JQ	0.0032 JQ	0.00182	0.0001	0.00011	Yes
Dieldrin	60-57-1	1/5	0.0034 JQ	0.0034 JQ	0.00985	0.0002	0.00022	Yes

Notes:

CMCOPC = Contaminant Migration Contaminant of Potential Concern

SRC = Site Related Contaminant

SSL = Soil Screening Level (USEPA, 2010)

SSSL = Site-specific Soil Screening Level (USEPA, 2010)

Shading indicates SRCs that were eliminated by screening against SSSLs.

Table E-6
CMCOPCs Based on Arrival Time to Groundwater from Surface Soils

Analyte	CAS Number	Frequency of Detection	Maximum Detect (mg/kg)	Sample ID	Koc (L/Kg)		Kd (L/Kg)		R	T (year)	CMCOPC (T<1000)
Explosives and Propellants											
2,4,6-Trinitrotoluene	118-96-7	2/18	3.9	SCSS-069M-0001-SO	2810	a	7.31E+00		44.8	521	Yes
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/18	0.26 J	SCSS-069M-0001-SO	283	c	7.36E-01		5.4	63	Yes
Nitroguanidine	556-88-7	1/2	1.2	SCSD-071M-0001-SD	20.65	c	5.37E-02		1.3	15	Yes
Inorganics											
Antimony	7440-36-0	11/18	17.1	SCSS-061M-0001-SO	NA		4.50E+01	a	271	3,147	No
Arsenic	7440-38-2	17/18	36.6	SCSS-062M-0001-SO	NA		2.00E+02	a	1201	13,947	No
Barium	7440-39-3	11/18	764	SCSS-061M-0001-SO	NA		6.00E+01	a	361	4,192	No
Cadmium	7440-43-9	16/18	12.9	SCSS-061M-0001-SO	NA		6.40E+00	a	39	458	Yes
Chromium	7440-47-3	18/18	188	SCSS-076M-0001-SO	NA		8.50E+02	a	5101	59,237	No
Cobalt	7440-48-4	17/18	19.7	SCSS-074M-0001-SO	NA		4.50E+01	b	271	3,147	No
Copper	7440-50-8	18/18	726	SCSS-064M-0001-SO	NA		3.50E+01	b	211	2,450	No
Lead	7439-92-1	18/18	405	SCSS-061M-0001-SO	NA		9.00E+02	b	5401	62,721	No
Mercury	7439-97-6	18/18	24.6	SCSS-059M-0001-SO	NA		1.00E+01	a	61	708	Yes
Nickel	7440-02-0	18/18	48.2	SCSS-064M-0001-SO	NA		1.50E+02	a	901	10,463	No
Selenium	7782-49-2	15/18	3.1	SCSS-062M-0001-SO	NA		3.00E+02	a	1801	20,915	No
Silver	7440-22-4	14/18	256	SCSS-061M-0001-SO	NA		4.60E+01	a	277	3,217	No
Thallium	7440-28-0	16/18	3.2 J	SCSS-061M-0001-SO	NA		1.50E+03	a	9001	104,528	No
Semivolatile Organic Compounds											
1,4-Dichlorobenzene	106-46-7	6/18	0.27 J	SCSS-061M-0001-SO	6.2E+02	a	1.60E+00		11	123	Yes
Indeno(1,2,3-cd)pyrene	193-39-5	11/18	0.81	SCSS-060M-0001-SO	3.5E+06	a	9.02E+03		54133	628,641	No
Benzo(b)fluoranthene	205-99-2	15/18	4.8	SCSS-060M-0001-SO	1.2E+06	a	3.20E+03		19189	222,840	No
Benzo(a)pyrene	50-32-8	15/18	2.4	SCSS-060M-0001-SO	1.0E+06	a	2.65E+03		15913	184,796	No
Dibenzo(a,h)anthracene	53-70-3	7/18	0.28	SCSS-060M-0001-SO	3.8E+06	a	9.88E+03		59281	688,425	No
Benzo(a)anthracene	56-55-3	15/18	2.6	SCSS-060M-0001-SO	4.0E+05	a	1.03E+03		6210	72,114	No
Isophorone	78-59-1	6/18	0.2 J	SCSS-063M-0001-SO	4.7E+01	a	1.22E-01		2	20	Yes
Carbazole	86-74-8	9/18	0.61	SCSS-059M-0001-SO	3.4E+03	a	8.81E+00		54	626	Yes
Pentachlorophenol	87-86-5	2/18	0.52 J	SCSS-060M-0001-SO	5.0E+03	c	1.29E+01		78	910	Yes
Pesticides											
Lindane	58-89-9	1/2	0.0013	SCSS-076M-0001-SO	1.1E+03	a	2.78E+00		18	205	Yes

Notes:

a - USEPA, 1996, Soil Screening Guidance: Technical Background Document, EPA Document Number: EPA/540/R-95/128, July

b - Baes, C. F., and R. D. Sharp, 1983, A Proposal for Estimation of Soil Leaching Constants for Use in Assessment Models, Journal of Environmental Quality, 12:17-28.

c - USEPA, 2010, Regional Screening Level (RSL) Chemical-Specific Parameters Supporting Table, EPA Region 9, November

Shaded cells indicate CMCOPCs that are retained for further analysis

Validation Qualifiers:

J = The reported result is an estimated value.

Table E-7
CMCOPCs Based on Arrival Time to Groundwater from Subsurface Soils

Analyte	CAS Number	Frequency of Detection	Maximum Detect (mg/kg)	Sample ID	Sample Bottom Depth (ft bgs)	Leaching Zone Thickness (ft)	Koc L/Kg		Kd L/Kg		R	T year	CMCOPC (T<1000)
Explosives and Propellants													
2,4,6-Trinitrotoluene	118-96-7	1/1	0.1 J	SCSB-049M-0001-SO	5	8	2810	a	3.37E+00		16	151	Yes
2-Amino-4,6-Dinitrotoluene	35572-78-2	1/1	0.26 J	SCSB-049M-0001-SO	5	8	283	d	3.40E-01		3	24	Yes
Inorganics													
Antimony	7440-36-0	37/58	11.2	SCsb-050M-001-SO	5	8	NA		4.50E+01	a	201	1,902	No
Arsenic	7440-38-2	57/58	182	SCSB-037M-0001-SO	5	8	NA		2.00E+02	a	889	8,422	No
Barium	7440-39-3	58/58	932	SCSB-037M-0001-SO	5	8	NA		6.00E+01	a	267	2,533	No
Beryllium	7440-41-7	58/58	3.9	SCSB-037M-0001-SO	5	8	NA		6.50E+02	a	2,888	27,351	No
Cadmium	7440-43-9	38/58	5.5	SCSB-037M-0002-SO	9	4	NA		6.40E+00	a	29	139	Yes
Chromium	7440-47-3	58/58	186	SCSB-037M-0002-SO	9	4	NA		8.50E+02	a	3,776	17,882	No
Copper	7440-50-8	58/58	2,020	SCSB-036M-0003-SO	13	AT WATER TABLE							
Lead	7439-92-1	58/58	907	SCSB-036M-0003-SO	13	AT WATER TABLE							
Mercury	7439-97-6	58/58	2	SCSB-044M-0001-SO	5	8	NA		1.00E+01	a	45	430	Yes
Nickel	7440-02-0	58/58	88.1	SCSB-044M-0001-SO	5	8	NA		1.50E+02	a	667	6,319	No
Selenium	7782-49-2	26/58	5.7	SCSB-037M-0002-SO	9	4	NA		3.00E+02	a	1,333	6,314	No
Silver	7440-22-4	14/58	13.5	SCSB-045M-0001-SO	5	8	NA		4.60E+01	a	205	1,944	No
Thallium	7440-28-0	41/58	17.3	SCSB-037M-0002-SO	9	4	NA		1.50E+03	a	6,663	31,553	No
Zinc	7440-66-6	58/58	1,350	SCSB-036M-0003-SO	13	AT WATER TABLE							
Semivolatile Organic Compounds													
Dibenzofuran	132-64-9	14/58	0.84	SCSB-049M-0001-SO	5	8			0.00E+00		1	9	Yes
Indeno(1,2,3-cd)pyrene	193-39-5	10/58	1.6 Q	SCSB-036M-0003-SO	13	AT WATER TABLE							
Benzo(b)fluoranthene	205-99-2	14/58	13	SCSB-049M-0001-SO	5	8	1.2E+06	a	1.48E+03		6,557	62,097	No
Benzo(k)fluoranthene	207-08-9	11/58	4.4 Q	SCSB-049M-0001-SO	5	8	1.23E+06	a	1.48E+03		6,557	62,097	No
Benzo(a)pyrene	50-32-8	13/58	8.3	SCSB-049M-0001-SO	5	8	1.0E+06	a	1.22E+03		5,437	51,496	No
Dibenzo(a,h)anthracene	53-70-3	6/58	0.55 Q	SCSB-049M-0001-SO	5	8	3.8E+06	a	4.56E+03		20,254	191,824	No
Benzo(a)anthracene	56-55-3	11/58	8.2	SCSB-049M-0001-SO	5	8	4.0E+05	a	4.78E+02		2,122	20,099	No
2,6-Dinitrotoluene	606-20-2	1/58	0.047	SCSB-037M-0004-SO	17	IN GROUNDWATER							
Isophorone	78-59-1	29/58	1.2	SCSB-036M-0003-SO	13	AT WATER TABLE							
Carbazole	86-74-8	8/58	2.2	SCSB-049M-0001-SO	5	8	3.4E+03	a	4.07E+00		19	181	Yes
Pentachlorophenol	87-86-5	1/58	0.38 J	SCSB-050M-0001-SO	5	8	5.0E+03	c	5.95E+00		27	260	Yes

Table E-7
CMCOPCs Based on Arrival Time to Groundwater from Subsurface Soils

Analyte	CAS Number	Frequency of Detection	Maximum Detect (mg/kg)	Sample ID	Sample Bottom Depth (ft bgs)	Leaching Zone Thickness (ft)	Koc L/Kg		Kd L/Kg		R	T year	CMCOPC (T<1000)
Volatile Organic Compounds													
Benzene	71-43-2	1/5	0.06	SCSB-048D-0001-SO	5	8	5.89E+01	a	7.07E-02		1.3	12	Yes
Pesticides													
alpha-BHC	319-84-6	2/5	0.011 JQ	SCSB-037M-0001-SO	5	8	1.23E+03	a	1.48E+00		7.6	72	Yes
beta-BHC	319-85-7	1/5	0.0032 JQ	SCSB-037M-0001-SO	5	8	1.26E+03	a	1.51E+00		7.7	73	Yes
Dieldrin	60-57-1	1/5	0.0034 JQ	SCSB-037M-0001-SO	5	8	2.14E+04	a	2.57E+01		115.1	1,090	No

Notes:

a - USEPA, 1996, Soil Screening Guidance: Technical Background Document, EPA Document Number: EPA/540/R-95/128, July

b - Baes, C. F., and R. D. Sharp, 1983, A Proposal for Estimation of Soil Leaching Constants for Use in Assessment Models, Journal of Environmental Quality, 12:17-28.

c - USEPA, 2010, Regional Screening Level (RSL) Chemical-Specific Parameters Supporting Table, EPA Region 9, November

Shaded cells indicate CMCOPCs that are retained for further analysis.

Validation Qualifiers:

J = The reported result is an estimated value.

Q = One or more quality control criteria failed (e.g., Laboratory Control Sample recovery, surrogate spike recovery or Continuing Calibration Verification)

Table E-8
Physical and Chemical Properties of Initial CMCOPCs Selected for SESOIL Modeling

Analyte	Water Solubility (mg/L)	Coefficient in Air (cm^2/sec)	Henry's Law Constant m3/mole)	K_{oc} (L/Kg)	K_d (L/Kg)	Molecular Weight (g/mole)	Half Life (hour)	Degradation Rate (per hour)
Explosives and Propellants								
2,4,6-Trinitrotoluene	1.15E+02	NF	2.08E-08	2810	--	227.13	8,640	3.3E-06
Dinitrotoluene	3.19E+02	NF	1.62E-10	283	--	197.15	NF	NF
Nitroguanidine	4.40E+03	NF	4.49E-12	20.65	--	104.07	NF	NF
Inorganics								
Cadmium	0.00E+00	0.0E+00	--	--	7.50E+01	112.41	--	0.0E+00
Mercury	6.00E-02	3.07E-02	1.1E-02	--	5.20E+01	200.59	--	0.0E+00
Semi volatile Organic Compounds								
Dibenzofuran	3.1	7.38E-06	2.13E-04	9161	--	168.2	2,688	1.1E-05
1,4 Dichlorobenzene	8.13E+01	5.50E-02	2.41E-03	375.3	--	147	17,280	1.7E-06
Carbazole	7.48E+00	3.90E-02	1.53E-08	3.39E+03	--	167.207	NF	NF
Pentachlorophenol	1.40E+01	5.60E-02	2.45E-08	4959	--	266.34	36,480	7.9E-07
Volatile Organic Compounds								
Benzene	1.79E+03	8.95E-02	5.55E-03	145.8	--	78.11	17,520	1.6E-06
Pesticides								
alpha-BHC	2.00E+00	1.40E-02	1.06E-05	1.23E+03	--	290.83	6,480	4.5E-06
beta-BHC	2.40E-01	1.40E-02	7.43E-07	1.26E+03	--	290.83	5,952	4.9E-06
Lindane	6.80E+00	1.40E-02	1.40E-04	2.14E+04	--	290.83	9,912	2.9E-06

Notes:

NF

NA = Not applicable

Highest half life (lowest degradation rate) obtained from: Handbook of Environmental Degradation Rates,Lewis Publishers.

Howard, P.H., Boethling, R.S., Jarvis, W.F., Meylan, W.M., and Michalenko, E.M., 1991,

Parameters except of half life obtained from the following sources:

USEPA, 1996, Soil Screening Guidance: Technical Background Document, EPA Document Number: EPA/540/R-95/128, July

Baes, C. F., and R. D. Sharp, 1983, A Proposal for Estimation of Soil Leaching Constants for Use in Assessment Models, Journal of Environmental Quality, 12:17-28.

USEPA, 2010, Regional Screening Level (RSL) Chemical-Specific Parameters Supporting Table, EPA Region 9, November

Table E-9
Climatic Data for SESOIL Modeling

Month	Air Temp (^{o}C)	Cloud Cover	Humidity	Albedo	Evapotranspiration[2] (cm/d)	Precipitation (cm)	Duration (days)	Storms per Month	Model Days in Month
October	12	0.6	0.7	0.17	0	6.46	0.42	5.33	30.4
November	5.22	0.7	0.75	0.24	0	7.4	0.53	6.67	30.4
December	-1.06	0.8	0.75	0.31	0	7.06	0.57	6.14	30.4
January	-2.94	0.8	0.8	0.3	0	7.06	0.61	5.69	30.4
February	-2.33	0.7	0.75	0.32	0	5.76	0.53	5.09	30.4
March	2.33	0.7	0.7	0.29	0	8.26	0.55	7.14	30.4
April	9.11	0.7	0.7	0.19	0	8.83	0.48	7.4	30.4
May	14.61	0.6	0.7	0.16	0	8.46	0.45	7.15	30.4
June	19.89	0.6	0.7	0.16	0	9.07	0.36	6.57	30.4
July	21.89	0.5	0.7	0.16	0	9.8	0.3	6.06	30.4
August	21.11	0.55	0.7	0.16	0	8.14	0.3	6.06	30.4
September	17.67	0.55	0.7	0.16	0	7.85	0.4	5.44	30.4

Note:

Data is for 1996, from Youngstown, Ohio Weather Service Office- Airport Station

Table E-10
Source Term Loading Data for SESOIL Model

Analyte	No. of Layers	Layer No.	Layer Thickess (feet)	No. of Sublayers	Sublayer No.	Maximum Soil Concentration (mg/kg)
2,4,6-Trinitrotoluene	4	1	1	1	1	3.9
		2	4	4	1	0.1
					2	0.1
					3	0.1
					4	0.1
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
2-Amino-4,6-Dinitrotoluene	4	1	1	1	1	0.26
		2	4	4	1	0.26
					2	0.26
					3	0.26
					4	0.26
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
Nitroguanidine	4	1	1	1	1	1.2
		2	4	4	1	0
					2	0
					3	0
					4	0
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
Cadmium	4	1	1	1	1	12.9
		2	4	4	1	0
					2	0
					3	0
					4	0
		3	4	4	1	5.5
					2	5.5
					3	5.5
					4	5.5
		4	4	4	1	0
					2	0
					3	0
					4	0

Table E-10
Source Term Loading Data for SESOIL Model

Analyte	No. of Layers	Layer No.	Layer Thickess (feet)	No. of Sublayers	Sublayer No.	Maximum Soil Concentration (mg/kg)
Mercury	4	1	1	1	1	24.6
		2	4	4	1	2
					2	2
					3	2
					4	2
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
Dibenzofuran	4	1	1	1	1	0
		2	4	4	1	0.84
					2	0.84
					3	0.84
					4	0.84
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
1,4 Dichlorobenzene	4	1	1	1	1	0.27
		2	4	4	1	0
					2	0
					3	0
					4	0
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
Carbazole	4	1	1	1	1	0.61
		2	4	4	1	2.2
					2	2.2
					3	2.2
					4	2.2
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0

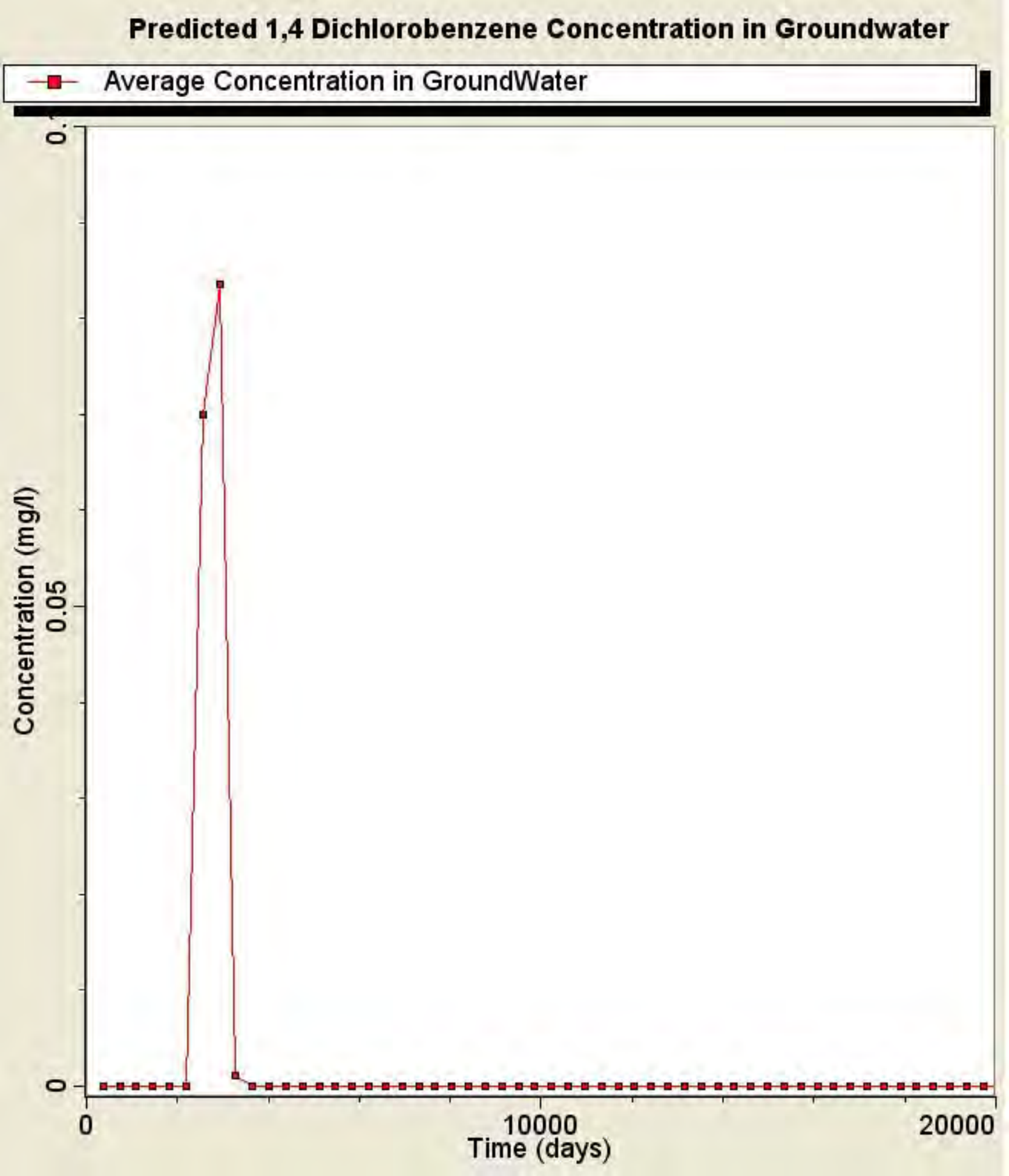
Table E-10
Source Term Loading Data for SESOIL Model

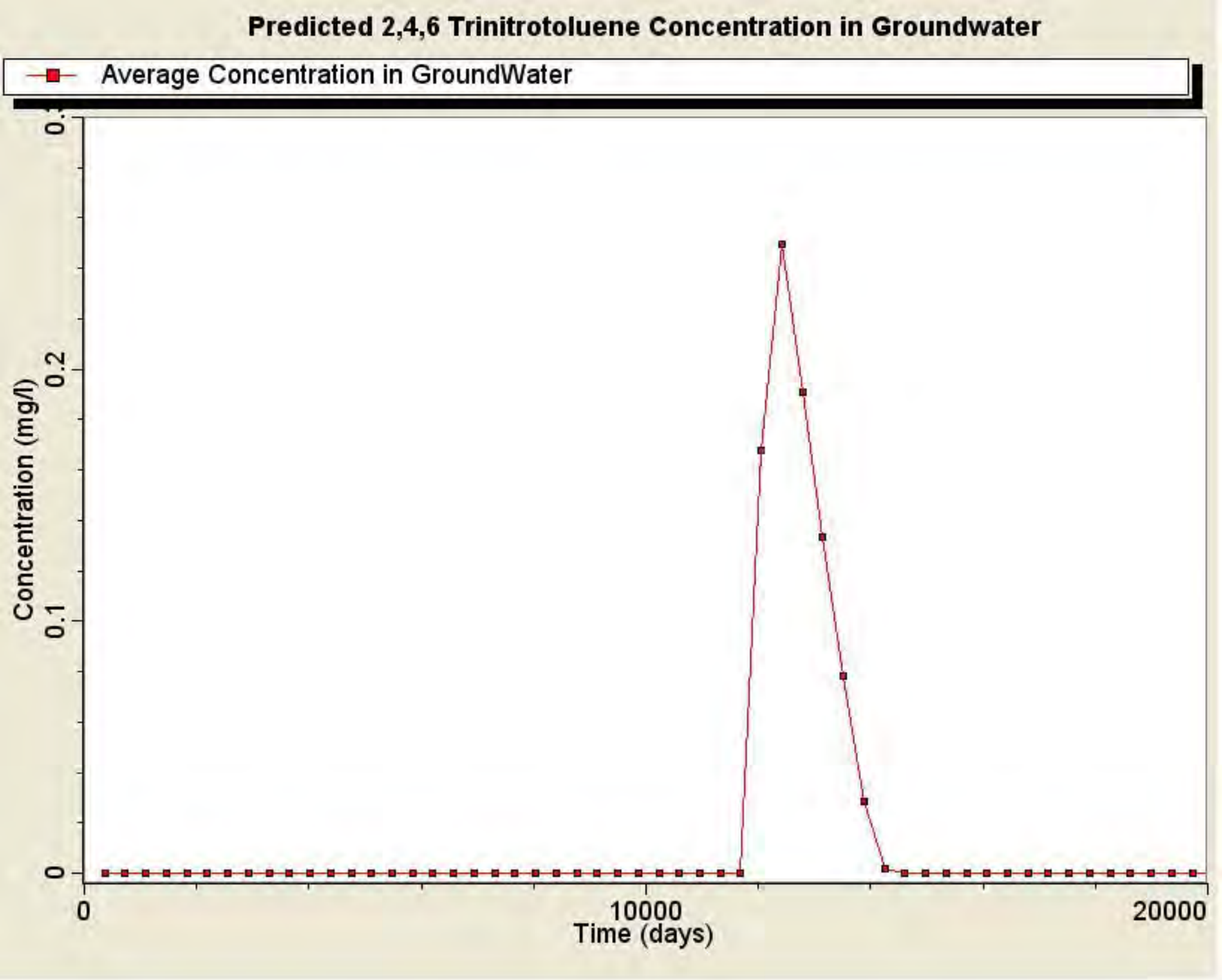
Analyte	No. of Layers	Layer No.	Layer Thickess (feet)	No. of Sublayers	Sublayer No.	Maximum Soil Concentration (mg/kg)
Pentachlorophenol	4	1	1	1	1	0.52
		2	4	4	1	0.38
					2	0.38
					3	0.38
					4	0.38
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
Lindane	4	1	1	1	1	0.0013
		2	4	4	1	0
					2	0
					3	0
					4	0
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
Benzene	4	1	1	1	1	0
		2	4	4	1	0.06
					2	0.06
					3	0.06
					4	0.06
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0
alpha-BHC	4	1	1	1	1	0
		2	4	4	1	0.011
					2	0.011
					3	0.011
					4	0.011
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0

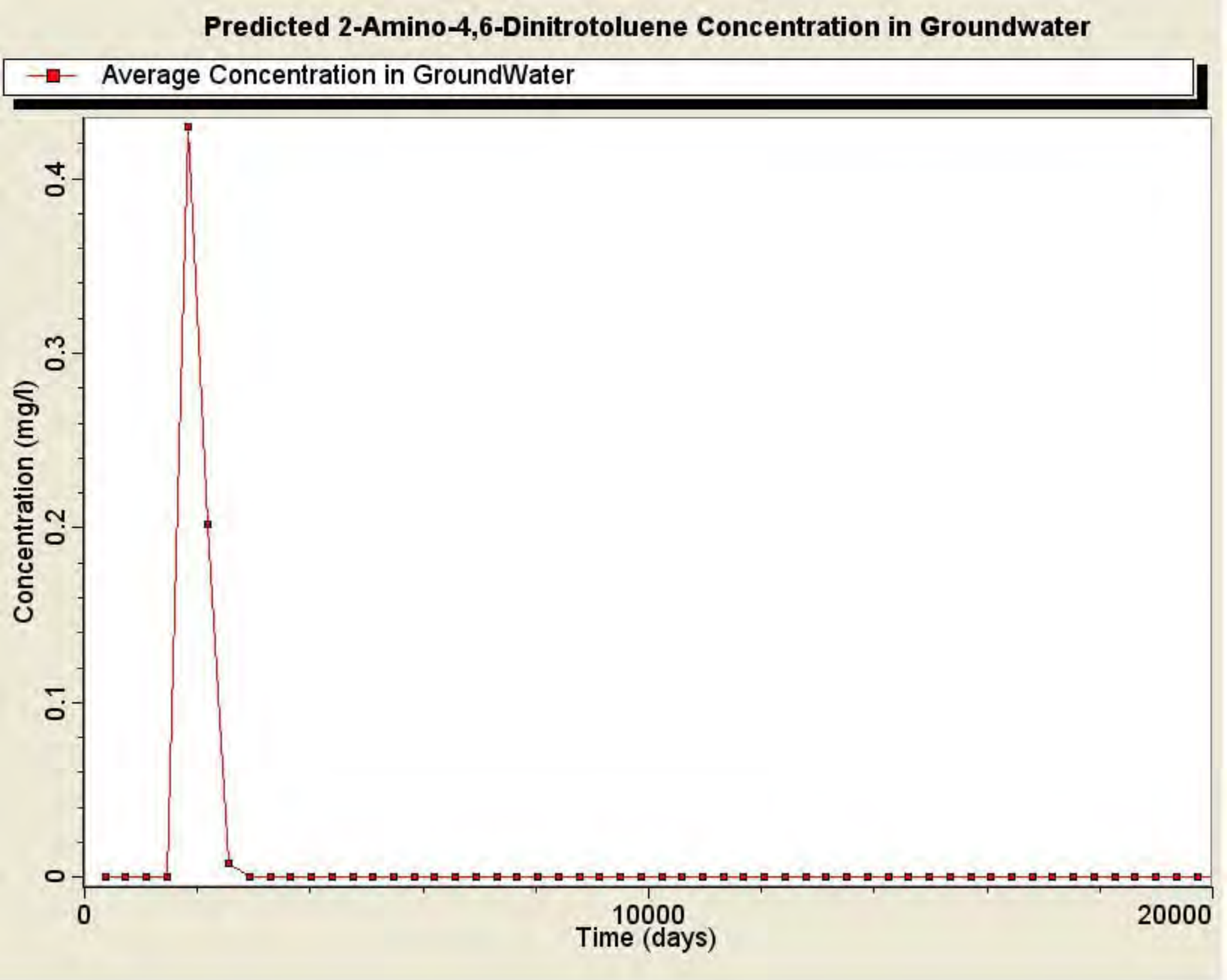
Table E-10
Source Term Loading Data for SESOIL Model

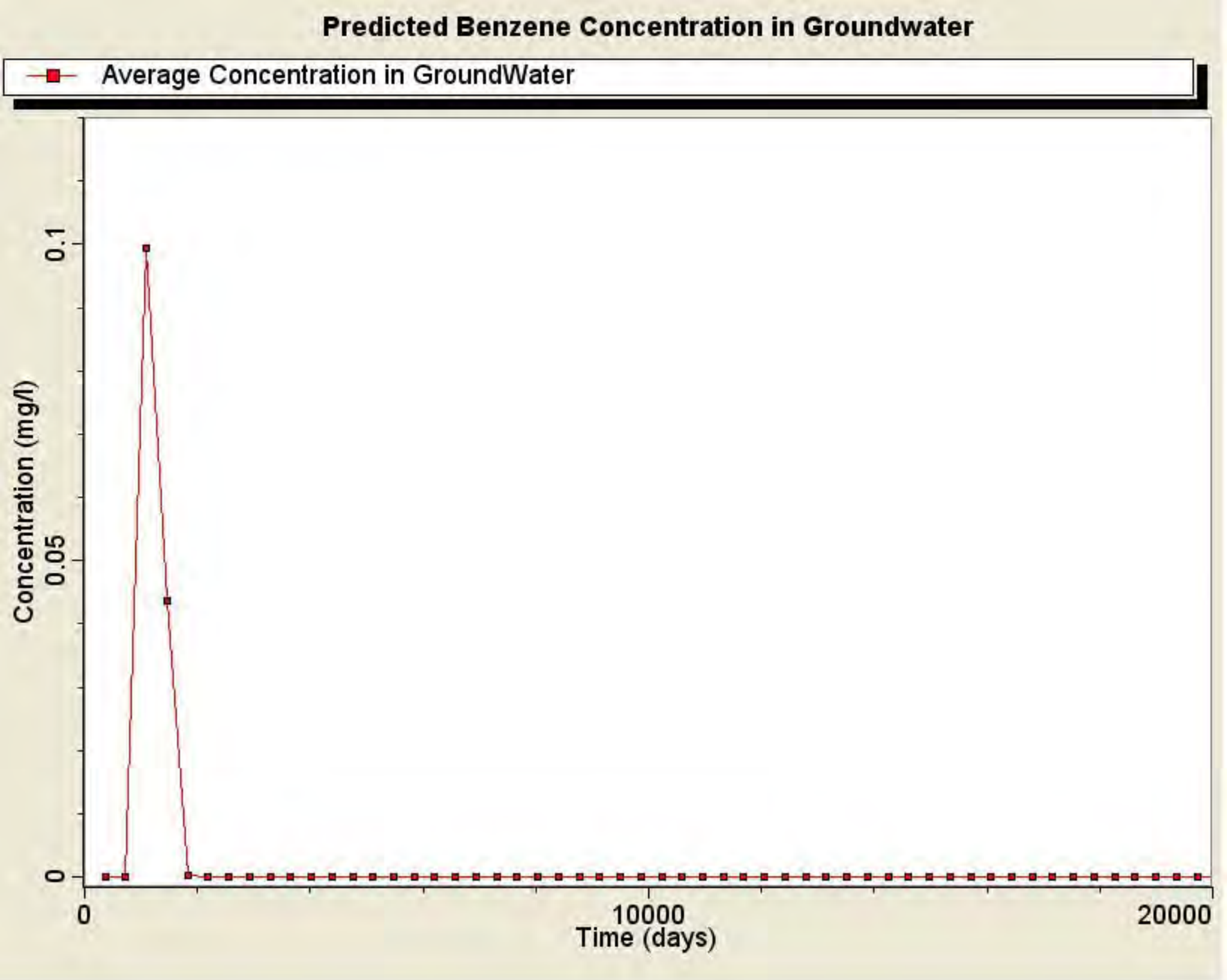
Analyte	No. of Layers	Layer No.	Layer Thickess (feet)	No. of Sublayers	Sublayer No.	Maximum Soil Concentration (mg/kg)
beta-BHC	4	1	1	1	1	0
		2	4	4	1	0.0032
					2	0.0032
					3	0.0032
					4	0.0032
		3	4	4	1	0
					2	0
					3	0
					4	0
		4	4	4	1	0
					2	0
					3	0
					4	0

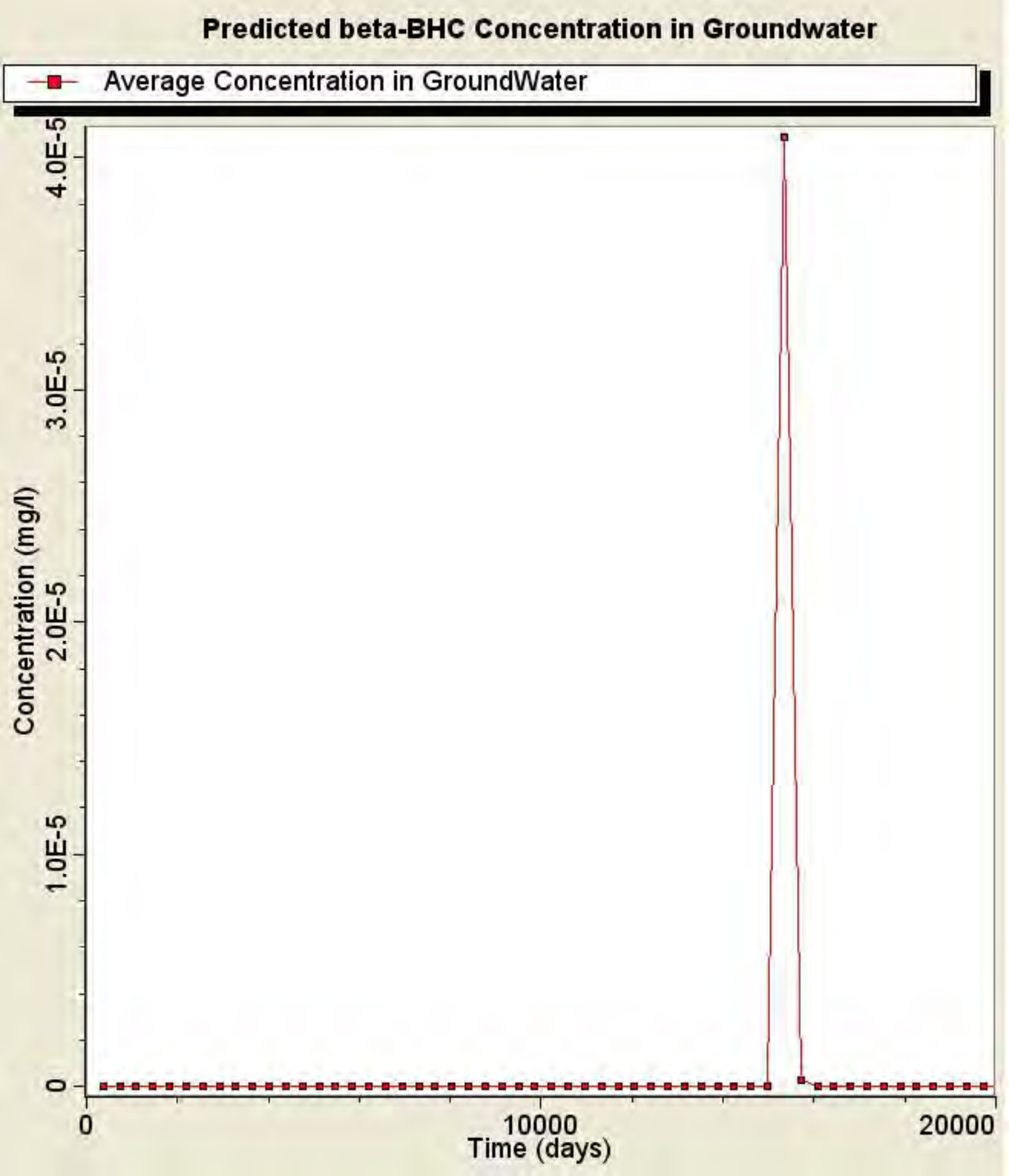
Notes:
mg/kg = milligrams per kilogram

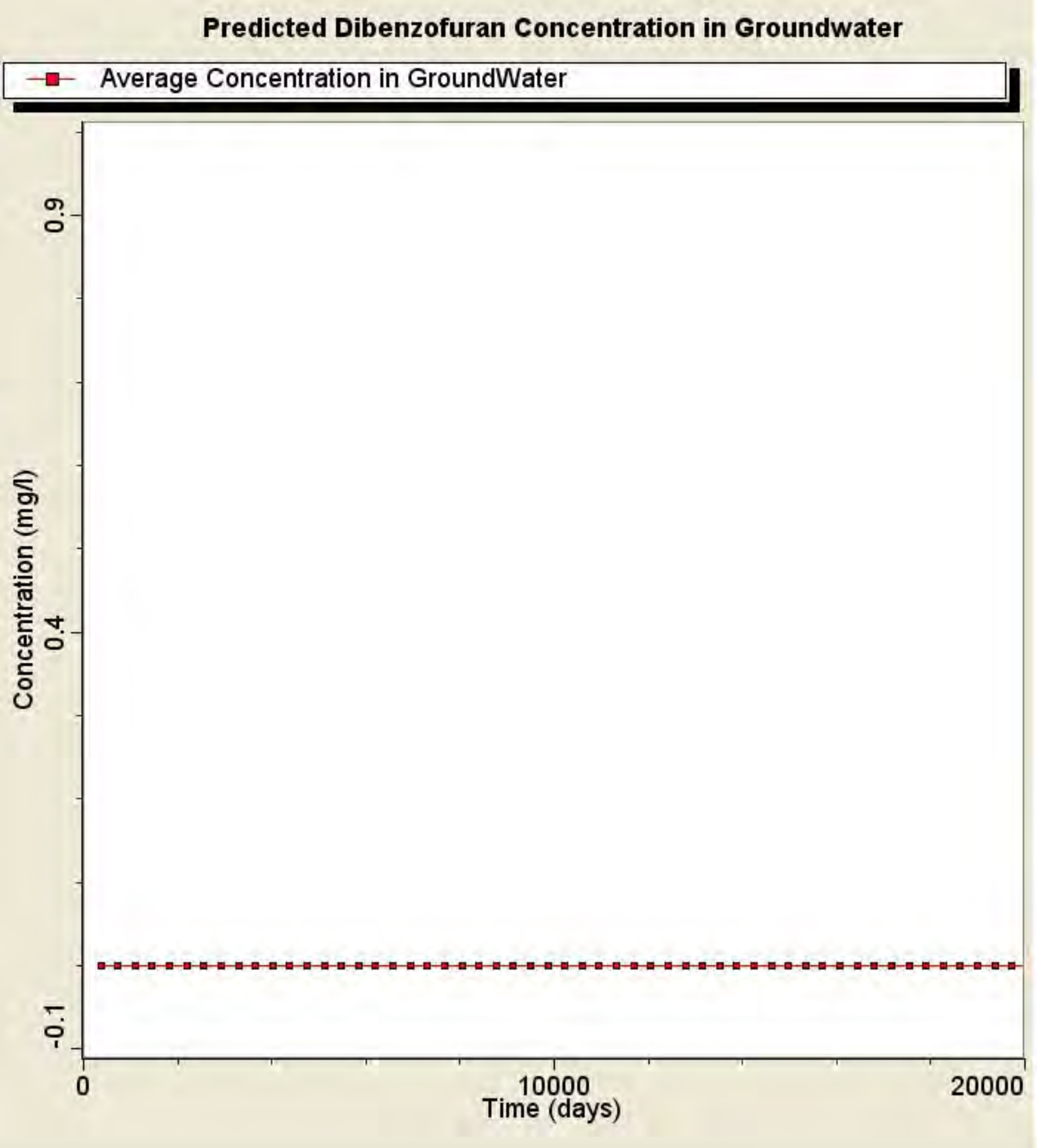

Predicted 1,4 Dichlorobenzene Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0.05
0
0
10000
20000
Time (days)

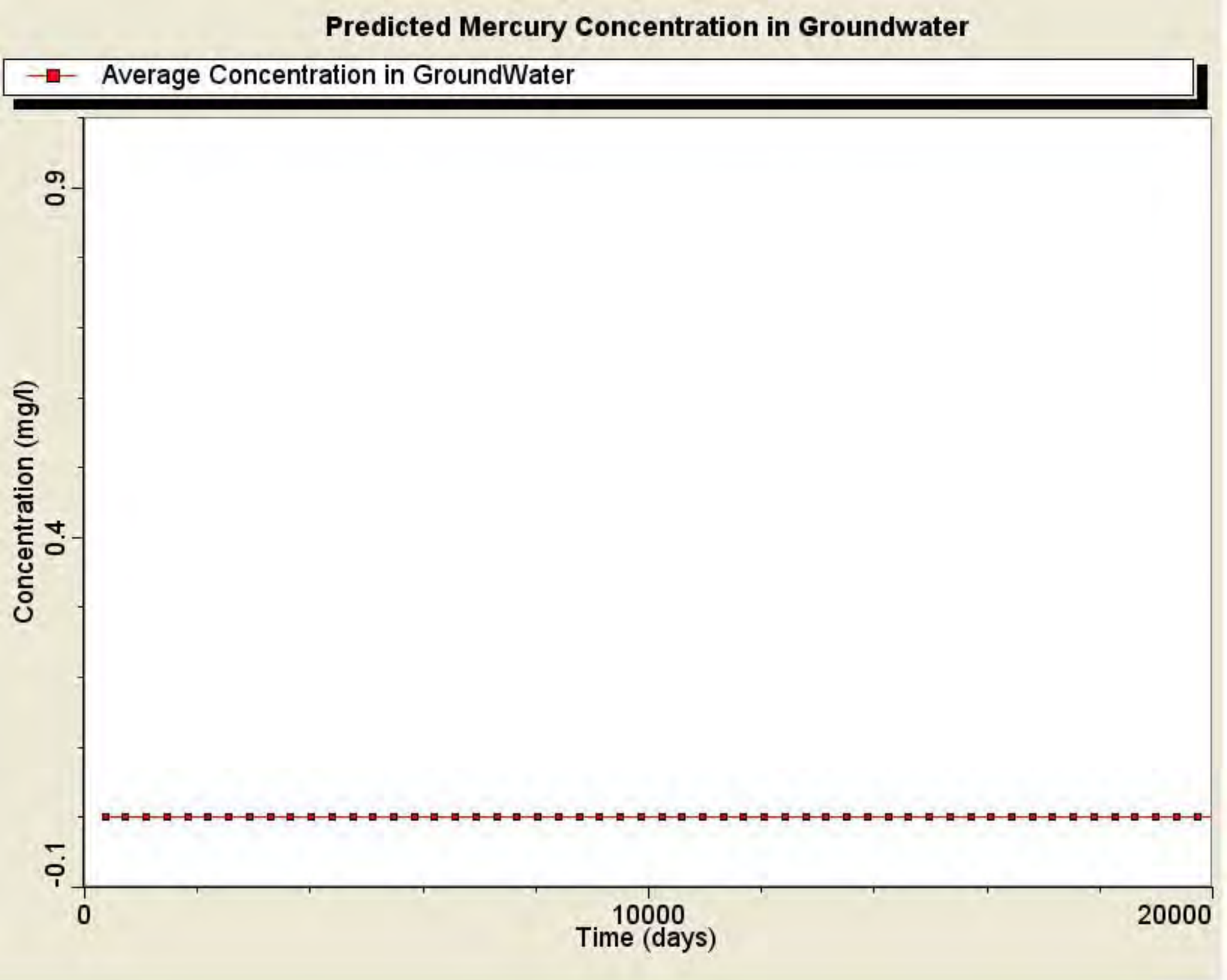

Predicted 2,4,6 Trinitrotoluene Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0.2
0.1
0
0
10000
20000
Time (days)

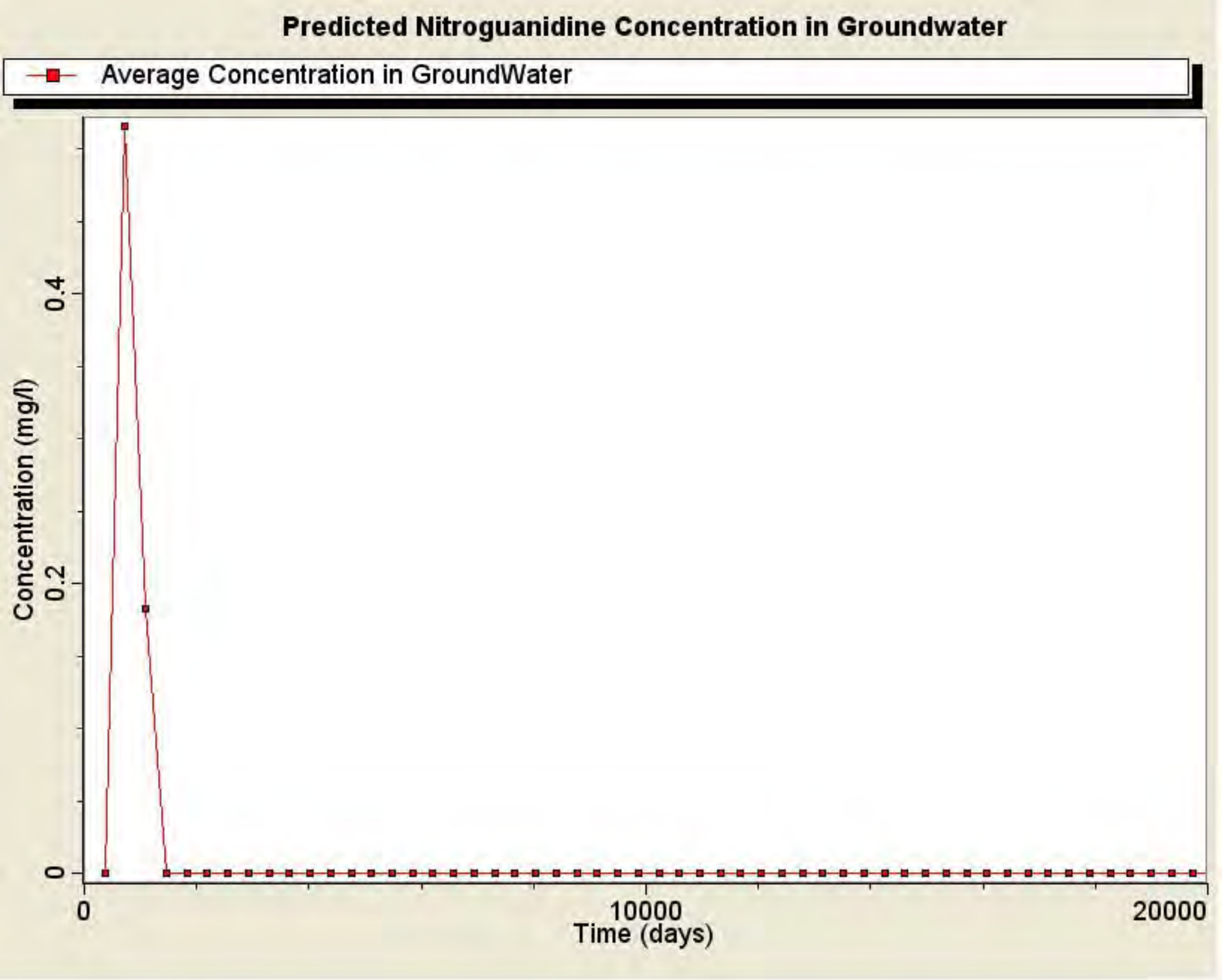

Predicted 2-Amino-4,6-Dinitrotoluene Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0
0.1
0.2
0.3
0.4
0
10000
20000
Time (days)

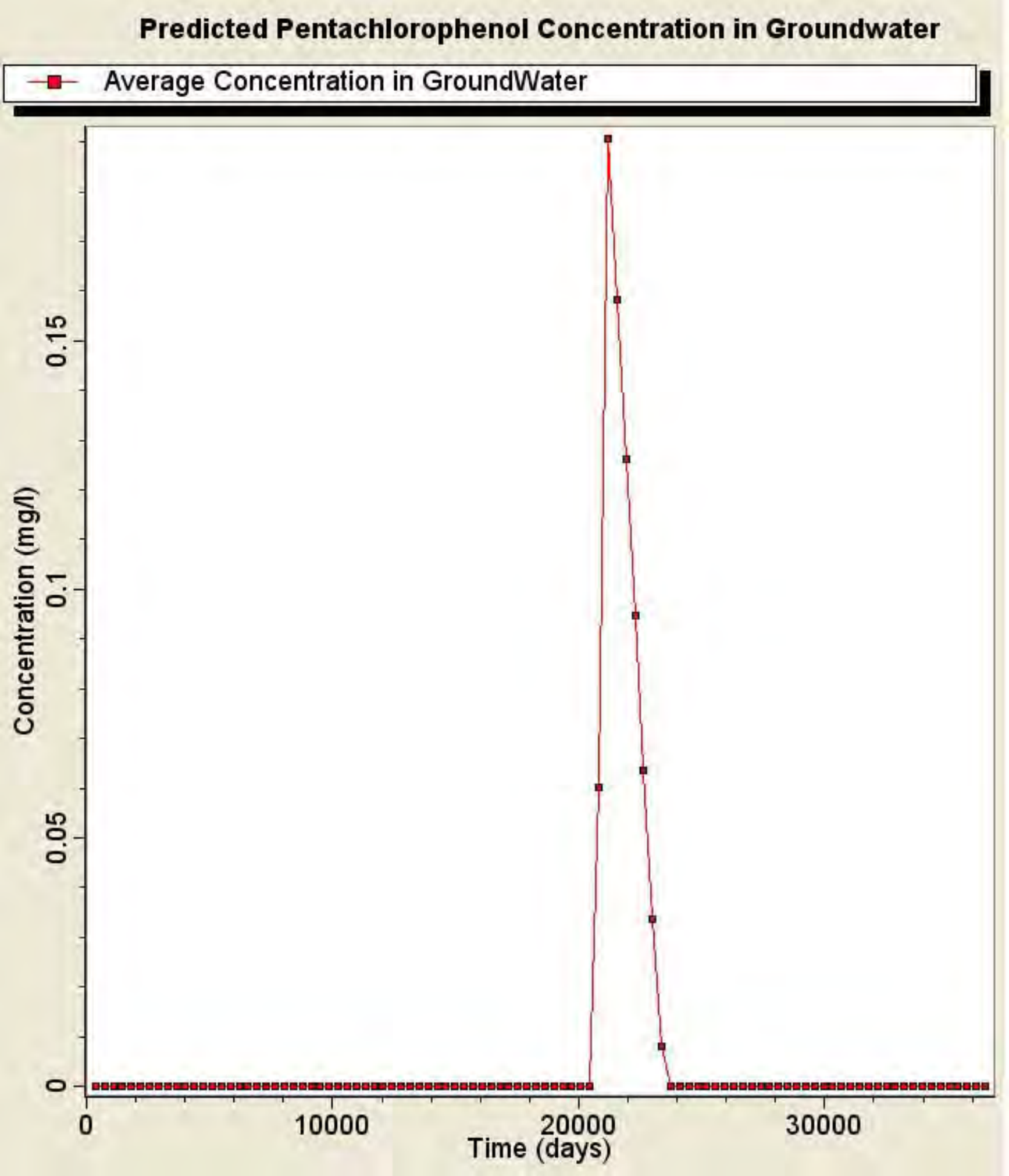

Predicted Benzene Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0.1
0.05
0
0
10000
20000
Time (days)


Predicted beta-BHC Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
4.0E-5
3.0E-5
2.0E-5
1.0E-5
0
0
10000
20000
Time (days)


Predicted Dibenzofuran Concentration in Groundwater
Average Concentration in GroundWater
0.9
0.4
-0.1
Concentration (mg/l)
0
10000
20000
Time (days)


Predicted Mercury Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0.9
0.4
-0.1
0
10000
20000
Time (days)


Predicted Nitroguanidine Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0
0.2
0.4
0
10000
20000
Time (days)


Predicted Pentachlorophenol Concentration in Groundwater
Average Concentration in GroundWater
Concentration (mg/l)
0
0.05
0.1
0.15
0
10000
20000
30000
Time (days)

Appendix F
Human Health Risk Assessment Tables

General UCL Statistics for Full Data Sets - Sand Creek Deep Soils National Guard Trainee

User Selected Options

From File	N:\Shared\Employees Work Folder\Perwak,Jody\Ravenna\Sand Creek\UCLs\NGT DS for UCLs.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9

Raw Statistics

Minimum	6
Maximum	155
Mean	28.9
Median	15.4
SD	47.43
Coefficient of Variation	1.641
Skewness	2.965

Log-transformed Statistics

Minimum of Log Data	1.792
Maximum of Log Data	5.043
Mean of log Data	2.803
SD of log Data	0.909

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.46
Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	58.3

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	71.6
95% Modified-t UCL	60.9

Gamma Distribution Test

k star (bias corrected)	0.759
Theta Star	38.09
MLE of Mean	28.9
MLE of Standard Deviation	33.18
nu star	13.66
Approximate Chi Square Value (.05)	6.336
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	5.322
Anderson-Darling Test Statistic	1.742
Anderson-Darling 5% Critical Value	0.743
Kolmogorov-Smirnov Test Statistic	0.46
Kolmogorov-Smirnov 5% Critical Value	0.287

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	62.28
95% Adjusted Gamma UCL	74.16

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 97.81

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.721
Shapiro Wilk Critical Value	0.829

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	66.26
95% Chebyshev (MVUE) UCL	55.63
97.5% Chebyshev (MVUE) UCL	69.52
99% Chebyshev (MVUE) UCL	96.81

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	54.9
95% Jackknife UCL	58.3
95% Standard Bootstrap UCL	53.43
95% Bootstrap-t UCL	297.5
95% Hall's Bootstrap UCL	349.6
95% Percentile Bootstrap UCL	60.03
95% BCA Bootstrap UCL	61.93
95% Chebyshev(Mean, Sd) UCL	97.81
97.5% Chebyshev(Mean, Sd) UCL	127.6
99% Chebyshev(Mean, Sd) UCL	186.2

Lead

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	6.6	Minimum of Log Data	1.887
Maximum	507	Maximum of Log Data	6.229
Mean	88.42	Mean of log Data	3.776
Median	40.8	SD of log Data	1.098
SD	157.4		
Coefficient of Variation	1.78		
Skewness	2.969		

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.447	Shapiro Wilk Test Statistic	0.719
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
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	186	95% H-UCL	305.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	193.1
95% Adjusted-CLT UCL	230.2	97.5% Chebyshev (MVUE) UCL	245.2
95% Modified-t UCL	194.6	99% Chebyshev (MVUE) UCL	347.5

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.631	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	140.1		
MLE of Mean	88.42		
MLE of Standard Deviation	111.3		
nu star	11.36		
Approximate Chi Square Value (.05)	4.807	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0231	95% CLT UCL	174.7
Adjusted Chi Square Value	3.948	95% Jackknife UCL	186
		95% Standard Bootstrap UCL	168.7
Anderson-Darling Test Statistic	1.847	95% Bootstrap-t UCL	3249
Anderson-Darling 5% Critical Value	0.749	95% Hall's Bootstrap UCL	2199
Kolmogorov-Smirnov Test Statistic	0.473	95% Percentile Bootstrap UCL	191.9
Kolmogorov-Smirnov 5% Critical Value	0.288	95% BCA Bootstrap UCL	237
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	317.1
		97.5% Chebyshev(Mean, Sd) UCL	416
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	610.4
95% Approximate Gamma UCL	208.9		
95% Adjusted Gamma UCL	254.4		

Potential UCL to Use		
	Use 99% Chebyshev (Mean, Sd) UCL	610.4

Recommended UCL exceeds the maximum observation

General UCL Statistics for Data Sets with Non-Detects - Sand Creek Discrete Surface Soils - NGT

User Selected Options

From File	N:\Shared\Employees Work Folder\Perwak,Jody\Ravenna\Sand Creek\UCLs\NGT SS Discrete for UCLs rev.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Observations	22	Number of Distinct Observations	21

Raw Statistics

Minimum	7
Maximum	182
Mean	21.04
Median	13.4
SD	36.12
Coefficient of Variation	1.717
Skewness	4.621

Log-transformed Statistics

Minimum of Log Data	1.946
Maximum of Log Data	5.204
Mean of log Data	2.678
SD of log Data	0.625

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.303
Shapiro Wilk Critical Value	0.911

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.641
Shapiro Wilk Critical Value	0.911

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	34.29

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	41.81
95% Modified-t UCL	35.55

Assuming Lognormal Distribution

95% H-UCL	23.65
95% Chebyshev (MVUE) UCL	28.3
97.5% Chebyshev (MVUE) UCL	32.96
99% Chebyshev (MVUE) UCL	42.12

Gamma Distribution Test

k star (bias corrected)	1.33
Theta Star	15.82
MLE of Mean	21.04
MLE of Standard Deviation	18.24
nu star	58.5
Approximate Chi Square Value (.05)	41.92
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	40.87
Anderson-Darling Test Statistic	4.105
Anderson-Darling 5% Critical Value	0.759
Kolmogorov-Smirnov Test Statistic	0.365
Kolmogorov-Smirnov 5% Critical Value	0.189

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	29.36
95% Adjusted Gamma UCL	30.11

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	33.7
95% Jackknife UCL	34.29
95% Standard Bootstrap UCL	33.75
95% Bootstrap-t UCL	120.3
95% Hall's Bootstrap UCL	98.15
95% Percentile Bootstrap UCL	36.16
95% BCA Bootstrap UCL	44.73
95% Chebyshev(Mean, Sd) UCL	54.6
97.5% Chebyshev(Mean, Sd) UCL	69.12
99% Chebyshev(Mean, Sd) UCL	97.65

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 54.6

Barium

General Statistics

Number of Valid Observations	22	Number of Distinct Observations	22

Raw Statistics		**Log-transformed Statistics**	
Minimum	45	Minimum of Log Data	3.807
Maximum	932	Maximum of Log Data	6.837
Mean	124.5	Mean of log Data	4.488
Median	79.05	SD of log Data	0.653
SD	183.9		
Coefficient of Variation	1.477		
Skewness	4.407		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.382	Shapiro Wilk Test Statistic	0.786
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
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	191.9	95% H-UCL	149.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	179.1
95% Adjusted-CLT UCL	228.3	97.5% Chebyshev (MVUE) UCL	209.5
95% Modified-t UCL	198.1	99% Chebyshev (MVUE) UCL	269.2

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.442	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	86.32		
MLE of Mean	124.5		
MLE of Standard Deviation	103.7		
nu star	63.45		
Approximate Chi Square Value (.05)	46.12	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	189
Adjusted Chi Square Value	45.02	95% Jackknife UCL	191.9
		95% Standard Bootstrap UCL	187.2
Anderson-Darling Test Statistic	2.51	95% Bootstrap-t UCL	415.9
Anderson-Darling 5% Critical Value	0.758	95% Hall's Bootstrap UCL	432.5
Kolmogorov-Smirnov Test Statistic	0.261	95% Percentile Bootstrap UCL	199.7
Kolmogorov-Smirnov 5% Critical Value	0.188	95% BCA Bootstrap UCL	244.8
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	295.4
		97.5% Chebyshev(Mean, Sd) UCL	369.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	514.6
95% Approximate Gamma UCL	171.2		
95% Adjusted Gamma UCL	175.4		

Potential UCL to Use			
		Use 95% Chebyshev (Mean, Sd) UCL	295.4

Cadmium

General Statistics

Number of Valid Data	22	Number of Detected Data	11
Number of Distinct Detected Data	11	Number of Non-Detect Data	11
		Percent Non-Detects	50.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.062	Minimum Detected	-2.781
Maximum Detected	1.6	Maximum Detected	0.47
Mean of Detected	0.417	Mean of Detected	-1.169
SD of Detected	0.411	SD of Detected	0.792
Minimum Non-Detect	0.042	Minimum Non-Detect	-3.17
Maximum Non-Detect	0.11	Maximum Non-Detect	-2.207

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	12
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	10
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	54.55%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.637	Shapiro Wilk Test Statistic	0.919
5% Shapiro Wilk Critical Value	0.85	5% 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**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.223	Mean	-2.42
SD	0.347	SD	1.417
95% DL/2 (t) UCL	0.35	95% H-Stat (DL/2) UCL	0.458
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0007067	Mean in Log Scale	-2.211
SD	0.557	SD in Log Scale	1.269
95% MLE (t) UCL	0.205	Mean in Original Scale	0.231
95% MLE (Tiku) UCL	0.269	SD in Original Scale	0.342
		95% Percentile Bootstrap UCL	0.358
		95% BCA Bootstrap UCL	0.421

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.398	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	0.299		
nu star	30.76		
A-D Test Statistic	0.691	**Nonparametric Statistics**	
5% A-D Critical Value	0.74	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.74	Mean	0.24
5% K-S Critical Value	0.259	SD	0.329
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0735
		95% KM (t) UCL	0.366
Assuming Gamma Distribution		95% KM (z) UCL	0.361
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.348
Minimum	0.062	95% KM (bootstrap t) UCL	0.479
Maximum	1.6	95% KM (BCA) UCL	0.454

Mean	0.417	95% KM (Percentile Bootstrap) UCL	0.406
Median	0.404	95% KM (Chebyshev) UCL	0.56
SD	0.284	97.5% KM (Chebyshev) UCL	0.699
k star	3.076	99% KM (Chebyshev) UCL	0.972
Theta star	0.135		
Nu star	135.4	**Potential UCLs to Use**	
AppChi2	109.5	95% KM (t) UCL	0.366
95% Gamma Approximate UCL	0.515		
95% Adjusted Gamma UCL	0.523		

Note: DL/2 is not a recommended method.

Cobalt

General Statistics

Number of Valid Observations	22	Number of Distinct Observations	17

Raw Statistics		**Log-transformed Statistics**	
Minimum	4.8	Minimum of Log Data	1.569
Maximum	22.3	Maximum of Log Data	3.105
Mean	9.786	Mean of log Data	2.229
Median	9.3	SD of log Data	0.323
SD	3.534		
Coefficient of Variation	0.361		
Skewness	2.029		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.801	Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
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	11.08	95% H-UCL	11.15
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	12.74
95% Adjusted-CLT UCL	11.37	97.5% Chebyshev (MVUE) UCL	14.02
95% Modified-t UCL	11.14	99% Chebyshev (MVUE) UCL	16.55

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	8.463	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	1.156		
MLE of Mean	9.786		
MLE of Standard Deviation	3.364		
nu star	372.4		
Approximate Chi Square Value (.05)	328.6	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	11.03
Adjusted Chi Square Value	325.6	95% Jackknife UCL	11.08
		95% Standard Bootstrap UCL	10.99
Anderson-Darling Test Statistic	0.667	95% Bootstrap-t UCL	11.55
Anderson-Darling 5% Critical Value	0.744	95% Hall's Bootstrap UCL	17.04
Kolmogorov-Smirnov Test Statistic	0.185	95% Percentile Bootstrap UCL	11.02
Kolmogorov-Smirnov 5% Critical Value	0.185	95% BCA Bootstrap UCL	11.35
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	13.07
		97.5% Chebyshev(Mean, Sd) UCL	14.49
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	17.28
95% Approximate Gamma UCL	11.09		
95% Adjusted Gamma UCL	11.19		

Potential UCL to Use	
Use 95% Approximate Gamma UCL	11.09

Lead

General Statistics

Number of Valid Observations	22	Number of Distinct Observations	21

Raw Statistics		**Log-transformed Statistics**	
Minimum	8.7	Minimum of Log Data	2.163
Maximum	325	Maximum of Log Data	5.784
Mean	47.23	Mean of log Data	3.418
Median	35.3	SD of log Data	0.847
SD	67.25		
Coefficient of Variation	1.424		
Skewness	3.747		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.491	Shapiro Wilk Test Statistic	0.898
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
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	71.9	95% H-UCL	67.76
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	79.65
95% Adjusted-CLT UCL	83.05	97.5% Chebyshev (MVUE) UCL	95.62
95% Modified-t UCL	73.81	99% Chebyshev (MVUE) UCL	127
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.14	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	41.43		
MLE of Mean	47.23		
MLE of Standard Deviation	44.23		
nu star	50.16		
Approximate Chi Square Value (.05)	34.9	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	70.81
Adjusted Chi Square Value	33.95	95% Jackknife UCL	71.9
		95% Standard Bootstrap UCL	69.48
Anderson-Darling Test Statistic	1.553	95% Bootstrap-t UCL	141.4
Anderson-Darling 5% Critical Value	0.764	95% Hall's Bootstrap UCL	191.8
Kolmogorov-Smirnov Test Statistic	0.259	95% Percentile Bootstrap UCL	74.6
Kolmogorov-Smirnov 5% Critical Value	0.189	95% BCA Bootstrap UCL	88.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	109.7
		97.5% Chebyshev(Mean, Sd) UCL	136.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	189.9
95% Approximate Gamma UCL	67.88		
95% Adjusted Gamma UCL	69.78		

Potential UCL to Use			
		Use 95% Chebyshev (Mean, Sd) UCL	109.7

Manganese

General Statistics

Number of Valid Observations	22	Number of Distinct Observations	21

Raw Statistics		**Log-transformed Statistics**	
Minimum	244	Minimum of Log Data	5.497
Maximum	1640	Maximum of Log Data	7.402
Mean	596.3	Mean of log Data	6.284
Median	480	SD of log Data	0.451
SD	319.6		
Coefficient of Variation	0.536		
Skewness	1.962		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.807	Shapiro Wilk Test Statistic	0.958
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
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	713.6	95% H-UCL	719.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	846
95% Adjusted-CLT UCL	738.9	97.5% Chebyshev (MVUE) UCL	956.5
95% Modified-t UCL	718.3	99% Chebyshev (MVUE) UCL	1174

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.229	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	141		
MLE of Mean	596.3		
MLE of Standard Deviation	290		
nu star	186.1		
Approximate Chi Square Value (.05)	155.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	708.4
Adjusted Chi Square Value	153.5	95% Jackknife UCL	713.6
		95% Standard Bootstrap UCL	702.9
Anderson-Darling Test Statistic	0.635	95% Bootstrap-t UCL	774
Anderson-Darling 5% Critical Value	0.746	95% Hall's Bootstrap UCL	873.2
Kolmogorov-Smirnov Test Statistic	0.161	95% Percentile Bootstrap UCL	713.5
Kolmogorov-Smirnov 5% Critical Value	0.186	95% BCA Bootstrap UCL	750.9
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	893.3
		97.5% Chebyshev(Mean, Sd) UCL	1022
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1274
95% Approximate Gamma UCL	713.5		
95% Adjusted Gamma UCL	723.2		

Potential UCL to Use	
Use 95% Approximate Gamma UCL	713.5

Benzo(a)anthracene

General Statistics

Number of Valid Data	22	Number of Detected Data	9
Number of Distinct Detected Data	8	Number of Non-Detect Data	13
		Percent Non-Detects	59.09%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.046	Minimum Detected	-3.079
Maximum Detected	8.2	Maximum Detected	2.104
Mean of Detected	1.182	Mean of Detected	-1.18
SD of Detected	2.651	SD of Detected	1.511
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	20
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	2
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	90.91%

Warning: There are only 9 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.476	Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.604	Mean	-1.421
SD	1.708	SD	0.955
95% DL/2 (t) UCL	1.231	95% H-Stat (DL/2) UCL	0.736
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.519
		SD in Log Scale	1.218
		Mean in Original Scale	0.634
		SD in Original Scale	1.71
		95% Percentile Bootstrap UCL	1.345
		95% BCA Bootstrap UCL	1.789

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.391	**Data appear Lognormal at 5% Significance Level**	
Theta Star	3.022		
nu star	7.038		
A-D Test Statistic	1.169	**Nonparametric Statistics**	
5% A-D Critical Value	0.775	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.775	Mean	0.596
5% K-S Critical Value	0.295	SD	1.673
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.379
		95% KM (t) UCL	1.249
Assuming Gamma Distribution		95% KM (z) UCL	1.22
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.227
Minimum	0.046	95% KM (bootstrap t) UCL	4.963
Maximum	8.2	95% KM (BCA) UCL	1.329
Mean	1.194	95% KM (Percentile Bootstrap) UCL	1.305
Median	0.828	95% KM (Chebyshev) UCL	2.25
SD	1.678	97.5% KM (Chebyshev) UCL	2.965
k star	0.873	99% KM (Chebyshev) UCL	4.371
Theta star	1.368		
Nu star	38.42	**Potential UCLs to Use**	
AppChi2	25.22	97.5% KM (Chebyshev) UCL	2.965
95% Gamma Approximate UCL	1.819		
95% Adjusted Gamma UCL	1.878		

Note: DL/2 is not a recommended method.

Benzo(a)pyrene

General Statistics

Number of Valid Data	22	Number of Detected Data	10
Number of Distinct Detected Data	10	Number of Non-Detect Data	12
		Percent Non-Detects	54.55%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.035	Minimum Detected	-3.352
Maximum Detected	8.3	Maximum Detected	2.116
Mean of Detected	1.118	Mean of Detected	-1.302
SD of Detected	2.55	SD of Detected	1.603
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	19
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	86.36%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.47	Shapiro Wilk Test Statistic	0.925
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.619	Mean	-1.458
SD	1.733	SD	1.06
95% DL/2 (t) UCL	1.255	95% H-Stat (DL/2) UCL	0.874
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.724
		SD in Log Scale	1.322
		Mean in Original Scale	0.608
		SD in Original Scale	1.74
		95% Percentile Bootstrap UCL	1.305
		95% BCA Bootstrap UCL	1.749

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.386	**Data appear Lognormal at 5% Significance Level**	
Theta Star	2.897		
nu star	7.717		
A-D Test Statistic	1.05	**Nonparametric Statistics**	
5% A-D Critical Value	0.785	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.785	Mean	0.599
5% K-S Critical Value	0.282	SD	1.7
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.383
		95% KM (t) UCL	1.259
Assuming Gamma Distribution		95% KM (z) UCL	1.229
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.24
Minimum	1E-09	95% KM (bootstrap t) UCL	5.024
Maximum	8.3	95% KM (BCA) UCL	1.326
Mean	1.089	95% KM (Percentile Bootstrap) UCL	1.314
Median	0.607	95% KM (Chebyshev) UCL	2.27
SD	1.732	97.5% KM (Chebyshev) UCL	2.993
k star	0.366	99% KM (Chebyshev) UCL	4.413
Theta star	2.98		
Nu star	16.09	**Potential UCLs to Use**	
AppChi2	8.022	97.5% KM (Chebyshev) UCL	2.993
95% Gamma Approximate UCL	2.184		
95% Adjusted Gamma UCL	2.306		

Note: DL/2 is not a recommended method.

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	22	Number of Detected Data	11
Number of Distinct Detected Data	11	Number of Non-Detect Data	11
		Percent Non-Detects	50.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.039	Minimum Detected	-3.244
Maximum Detected	13	Maximum Detected	2.565
Mean of Detected	1.714	Mean of Detected	-0.937
SD of Detected	3.819	SD of Detected	1.741
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	16
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	6
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	72.73%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.486	Shapiro Wilk Test Statistic	0.952
5% Shapiro Wilk Critical Value	0.85	5% 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**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.959	Mean	-1.263
SD	2.746	SD	1.247
95% DL/2 (t) UCL	1.967	95% H-Stat (DL/2) UCL	1.355
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.703
		SD in Log Scale	1.593
		Mean in Original Scale	0.919
		SD in Original Scale	2.759
		95% Percentile Bootstrap UCL	2.034
		95% BCA Bootstrap UCL	2.799

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.38	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
Theta Star	4.511		
nu star	8.36		
A-D Test Statistic	0.811	**Nonparametric Statistics**	
5% A-D Critical Value	0.793	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.793	Mean	0.92
5% K-S Critical Value	0.271	SD	2.695
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.603
		95% KM (t) UCL	1.958
Assuming Gamma Distribution		95% KM (z) UCL	1.913
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.934
Minimum	1E-09	95% KM (bootstrap t) UCL	9.014
Maximum	13	95% KM (BCA) UCL	2.055
Mean	1.587	95% KM (Percentile Bootstrap) UCL	2.048
Median	0.967	95% KM (Chebyshev) UCL	3.55
SD	2.688	97.5% KM (Chebyshev) UCL	4.688
k star	0.366	99% KM (Chebyshev) UCL	6.923
Theta star	4.333		
Nu star	16.12	**Potential UCLs to Use**	
AppChi2	8.045	95% KM (t) UCL	1.958
95% Gamma Approximate UCL	3.18		
95% Adjusted Gamma UCL	3.357		

Note: DL/2 is not a recommended method.

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Data	22	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	17
		Percent Non-Detects	77.27%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.032	Minimum Detected	-3.442
Maximum Detected	0.55	Maximum Detected	-0.598
Mean of Detected	0.156	Mean of Detected	-2.496
SD of Detected	0.222	SD of Detected	1.153
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	21
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	95.45%

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.656	Shapiro Wilk Test Statistic	0.858
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.193	Mean	-1.794
SD	0.0992	SD	0.637
95% DL/2 (t) UCL	0.23	95% H-Stat (DL/2) UCL	0.397
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.832
		SD in Log Scale	0.847
		Mean in Original Scale	0.0883
		SD in Original Scale	0.113
		95% Percentile Bootstrap UCL	0.133
		95% BCA Bootstrap UCL	0.16

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.5	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	0.311		
nu star	5.004		
A-D Test Statistic	0.629	**Nonparametric Statistics**	
5% A-D Critical Value	0.694	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.694	Mean	0.0794
5% K-S Critical Value	0.365	SD	0.106
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0284
		95% KM (t) UCL	0.128
Assuming Gamma Distribution		95% KM (z) UCL	0.126
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.128
Minimum	1E-09	95% KM (bootstrap t) UCL	0.232
Maximum	0.55	95% KM (BCA) UCL	0.136
Mean	0.143	95% KM (Percentile Bootstrap) UCL	0.129
Median	0.146	95% KM (Chebyshev) UCL	0.203
SD	0.115	97.5% KM (Chebyshev) UCL	0.257
k star	0.538	99% KM (Chebyshev) UCL	0.362
Theta star	0.267		
Nu star	23.65	**Potential UCLs to Use**	
AppChi2	13.59	95% KM (t) UCL	0.128
95% Gamma Approximate UCL	0.25		
95% Adjusted Gamma UCL	0.261		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets - Sand Creek Deep Soils - RF

User Selected Options

From File	N:\Shared\Employees Work Folder\Perwak,Jody\Ravenna\Sand Creek\UCLs\RF DS for UCLs all detects.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	32

Raw Statistics

Minimum	11.5
Maximum	2020
Mean	78.96
Median	17.7
SD	317.1
Coefficient of Variation	4.016
Skewness	6.187

Log-transformed Statistics

Minimum of Log Data	2.442
Maximum of Log Data	7.611
Mean of log Data	3.182
SD of log Data	0.936

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.212
Shapiro Wilk Critical Value	0.94

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.543
Shapiro Wilk Critical Value	0.94

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	163.4

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	213.8
95% Modified-t UCL	171.6

Assuming Lognormal Distribution

95% H-UCL	52.97
95% Chebyshev (MVUE) UCL	64
97.5% Chebyshev (MVUE) UCL	75.79
99% Chebyshev (MVUE) UCL	98.93

Gamma Distribution Test

k star (bias corrected)	0.507
Theta Star	155.7
MLE of Mean	78.96
MLE of Standard Deviation	110.9
nu star	40.58
Approximate Chi Square Value (.05)	26.98
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	26.56
Anderson-Darling Test Statistic	10.51
Anderson-Darling 5% Critical Value	0.81
Kolmogorov-Smirnov Test Statistic	0.445
Kolmogorov-Smirnov 5% Critical Value	0.147

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	118.7
95% Adjusted Gamma UCL	120.6

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	161.4
95% Jackknife UCL	163.4
95% Standard Bootstrap UCL	161.9
95% Bootstrap-t UCL	893.9
95% Hall's Bootstrap UCL	809
95% Percentile Bootstrap UCL	178
95% BCA Bootstrap UCL	236.6
95% Chebyshev(Mean, Sd) UCL	297.5
97.5% Chebyshev(Mean, Sd) UCL	392.1
99% Chebyshev(Mean, Sd) UCL	577.8

Potential UCL to Use

Use 95% Chebyshev (Mean, Sd) UCL 297.5

Lead

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	38

Raw Statistics

Minimum	6.6
Maximum	907
Mean	75.11
Median	37.95
SD	161.7
Coefficient of Variation	2.153
Skewness	4.265

Log-transformed Statistics

Minimum of Log Data	1.887
Maximum of Log Data	6.81
Mean of log Data	3.562
SD of log Data	1.018

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.389
Shapiro Wilk Critical Value	0.94

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.838
Shapiro Wilk Critical Value	0.94

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	118.2

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	135.6
95% Modified-t UCL	121.1

Assuming Lognormal Distribution

95% H-UCL	87.98
95% Chebyshev (MVUE) UCL	105.8
97.5% Chebyshev (MVUE) UCL	126.5
99% Chebyshev (MVUE) UCL	167

Gamma Distribution Test

k star (bias corrected)	0.744
Theta Star	101
MLE of Mean	75.11
MLE of Standard Deviation	87.08
nu star	59.51
Approximate Chi Square Value (.05)	42.77
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	42.24
Anderson-Darling Test Statistic	5.177
Anderson-Darling 5% Critical Value	0.788
Kolmogorov-Smirnov Test Statistic	0.37
Kolmogorov-Smirnov 5% Critical Value	0.145

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	104.5
95% Adjusted Gamma UCL	105.8

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	117.2
95% Jackknife UCL	118.2
95% Standard Bootstrap UCL	115.8
95% Bootstrap-t UCL	192.1
95% Hall's Bootstrap UCL	217.9
95% Percentile Bootstrap UCL	120.3
95% BCA Bootstrap UCL	139
95% Chebyshev(Mean, Sd) UCL	186.6
97.5% Chebyshev(Mean, Sd) UCL	234.8
99% Chebyshev(Mean, Sd) UCL	329.5

Potential UCL to Use

Use 99% Chebyshev (Mean, Sd) UCL 329.5

Vanadium

General Statistics

Number of Valid Observations	40	Number of Distinct Observations	28

Raw Statistics

Minimum	12.6
Maximum	173
Mean	20.96
Median	16.6
SD	25.05
Coefficient of Variation	1.195
Skewness	6.039

Log-transformed Statistics

Minimum of Log Data	2.534
Maximum of Log Data	5.153
Mean of log Data	2.873
SD of log Data	0.418

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.261
Shapiro Wilk Critical Value	0.94

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.515
Shapiro Wilk Critical Value	0.94

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	27.64

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	31.52
95% Modified-t UCL	28.27

Assuming Lognormal Distribution

95% H-UCL	21.86
95% Chebyshev (MVUE) UCL	24.99
97.5% Chebyshev (MVUE) UCL	27.47
99% Chebyshev (MVUE) UCL	32.34

Gamma Distribution Test

k star (bias corrected)	2.888
Theta Star	7.26
MLE of Mean	20.96
MLE of Standard Deviation	12.34
nu star	231
Approximate Chi Square Value (.05)	196.8
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	195.6
Anderson-Darling Test Statistic	8.23
Anderson-Darling 5% Critical Value	0.754
Kolmogorov-Smirnov Test Statistic	0.367
Kolmogorov-Smirnov 5% Critical Value	0.14

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	24.6
95% Adjusted Gamma UCL	24.75

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	27.48
95% Jackknife UCL	27.64
95% Standard Bootstrap UCL	27.43
95% Bootstrap-t UCL	76.66
95% Hall's Bootstrap UCL	59.54
95% Percentile Bootstrap UCL	28.54
95% BCA Bootstrap UCL	36.41
95% Chebyshev(Mean, Sd) UCL	38.23
97.5% Chebyshev(Mean, Sd) UCL	45.7
99% Chebyshev(Mean, Sd) UCL	60.37

Potential UCL to Use

Use 95% Student's-t UCL	27.64
or 95% Modified-t UCL	28.27

General UCL Statistics for Data Sets with Non-Detects - Sand Creek Deep Soils - RF (some NDs)

User Selected Options

From File	N:\Shared\Employees Work Folder\Perwak,Jody\Ravenna\Sand Creek\UCLs\RF DS for UCLs some nds.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Number of Valid Data	40	Number of Detected Data	27
Number of Distinct Detected Data	24	Number of Non-Detect Data	13
		Percent Non-Detects	32.50%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.11	Minimum Detected	-2.207
Maximum Detected	11.2	Maximum Detected	2.416
Mean of Detected	1.375	Mean of Detected	-0.134
SD of Detected	2.086	SD of Detected	0.878
Minimum Non-Detect	0.27	Minimum Non-Detect	-1.309
Maximum Non-Detect	1.4	Maximum Non-Detect	0.336

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	33
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	82.50%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.464	Shapiro Wilk Test Statistic	0.953
5% Shapiro Wilk Critical Value	0.923	5% 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	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.029	Mean	-0.533
SD	1.78	SD	0.985
95% DL/2 (t) UCL	1.503	95% H-Stat (DL/2) UCL	1.255
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.534
		SD in Log Scale	0.962
		Mean in Original Scale	1.021
		SD in Original Scale	1.782
		95% Percentile Bootstrap UCL	1.522
		95% BCA Bootstrap UCL	1.82

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.131	**Data appear Lognormal at 5% Significance Level**	
Theta Star	1.216		
nu star	61.08		

A-D Test Statistic	1.398
5% A-D Critical Value	0.768
K-S Test Statistic	0.768
5% K-S Critical Value	0.172

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	11.2
Mean	1.159
Median	0.77
SD	1.776
k star	0.346
Theta star	3.348
Nu star	27.68
AppChi2	16.68
95% Gamma Approximate UCL	1.923
95% Adjusted Gamma UCL	1.96

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.028
SD	1.759
SE of Mean	0.284
95% KM (t) UCL	1.507
95% KM (z) UCL	1.496
95% KM (jackknife) UCL	1.505
95% KM (bootstrap t) UCL	2.322
95% KM (BCA) UCL	1.601
95% KM (Percentile Bootstrap) UCL	1.547
95% KM (Chebyshev) UCL	2.267
97.5% KM (Chebyshev) UCL	2.803
99% KM (Chebyshev) UCL	3.856

Potential UCLs to Use

95% KM (BCA) UCL	1.601

Arsenic

General Statistics

Number of Valid Data	40	Number of Detected Data	39
Number of Distinct Detected Data	35	Number of Non-Detect Data	1
		Percent Non-Detects	2.50%

Raw Statistics

Minimum Detected	6
Maximum Detected	182
Mean of Detected	21.6
SD of Detected	34.93
Minimum Non-Detect	1.8
Maximum Non-Detect	1.8

Log-transformed Statistics

Minimum Detected	1.792
Maximum Detected	5.204
Mean of Detected	2.703
SD of Detected	0.644
Minimum Non-Detect	0.588
Maximum Non-Detect	0.588

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.339
5% Shapiro Wilk Critical Value	0.939

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	21.08
SD	34.64
95% DL/2 (t) UCL	30.31
Maximum Likelihood Estimate(MLE) Method	
Mean	20.55
SD	34.78
95% MLE (t) UCL	29.82
95% MLE (Tiku) UCL	28.94

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.686
5% Shapiro Wilk Critical Value	0.939

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	2.633
SD	0.775
95% H-Stat (DL/2) UCL	23.54
Log ROS Method	
Mean in Log Scale	2.669
SD in Log Scale	0.67
Mean in Original Scale	21.15
SD in Original Scale	34.6
95% Percentile Bootstrap UCL	31.88
95% BCA Bootstrap UCL	36.28

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.399
Theta Star	15.43
nu star	109.1
A-D Test Statistic	6.718
5% A-D Critical Value	0.766
K-S Test Statistic	0.766
5% K-S Critical Value	0.144
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	182
Mean	21.06
Median	14.85
SD	34.65
k star	0.623
Theta star	33.78
Nu star	49.86
AppChi2	34.65
95% Gamma Approximate UCL	30.3
95% Adjusted Gamma UCL	30.72

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only	
Data do not follow a Discernable Distribution (0.05)	
Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	21.21
SD	34.14
SE of Mean	5.468
95% KM (t) UCL	30.42
95% KM (z) UCL	30.2
95% KM (jackknife) UCL	30.4
95% KM (bootstrap t) UCL	93.56
95% KM (BCA) UCL	31.18
95% KM (Percentile Bootstrap) UCL	30.61
95% KM (Chebyshev) UCL	45.04
97.5% KM (Chebyshev) UCL	55.35
99% KM (Chebyshev) UCL	75.61
Potential UCLs to Use	
95% KM (Chebyshev) UCL	45.04

Thallium

General Statistics

Number of Valid Data	40	Number of Detected Data	30
Number of Distinct Detected Data	21	Number of Non-Detect Data	10
		Percent Non-Detects	25.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.34	Minimum Detected	-1.079
Maximum Detected	17.3	Maximum Detected	2.851
Mean of Detected	2.132	Mean of Detected	0.398
SD of Detected	3.023	SD of Detected	0.749
Minimum Non-Detect	0.28	Minimum Non-Detect	-1.273
Maximum Non-Detect	0.29	Maximum Non-Detect	-1.238

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	10
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	30
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	25.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.431	Shapiro Wilk Test Statistic	0.91
5% Shapiro Wilk Critical Value	0.927	5% Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	1.635
SD	2.749
95% DL/2 (t) UCL	2.367
Maximum Likelihood Estimate(MLE) Method	
Mean	1.085
SD	3.281
95% MLE (t) UCL	1.958
95% MLE (Tiku) UCL	1.966

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-0.191
SD	1.219
95% H-Stat (DL/2) UCL	2.008
Log ROS Method	
Mean in Log Scale	-0.0156
SD in Log Scale	0.987
Mean in Original Scale	1.675
SD in Original Scale	2.728
95% Percentile Bootstrap UCL	2.482
95% BCA Bootstrap UCL	2.982

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.406
Theta Star	1.517
nu star	84.35
A-D Test Statistic	1.971
5% A-D Critical Value	0.763
K-S Test Statistic	0.763
5% K-S Critical Value	0.163
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	17.3
Mean	1.699
Median	1.25
SD	2.723
k star	0.285
Theta star	5.957
Nu star	22.82
AppChi2	12.95
95% Gamma Approximate UCL	2.993
95% Adjusted Gamma UCL	3.059

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	1.684
SD	2.688
SE of Mean	0.432
95% KM (t) UCL	2.413
95% KM (z) UCL	2.395
95% KM (jackknife) UCL	2.399
95% KM (bootstrap t) UCL	3.766
95% KM (BCA) UCL	2.619
95% KM (Percentile Bootstrap) UCL	2.479
95% KM (Chebyshev) UCL	3.569
97.5% KM (Chebyshev) UCL	4.384
99% KM (Chebyshev) UCL	5.986
Potential UCLs to Use	
95% KM (BCA) UCL	2.619

Note: DL/2 is not a recommended method.

Benzo(a)anthracene

General Statistics

Number of Valid Data	40	Number of Detected Data	11
Number of Distinct Detected Data	10	Number of Non-Detect Data	29
		Percent Non-Detects	72.50%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.046	Minimum Detected	-3.079
Maximum Detected	8.2	Maximum Detected	2.104
Mean of Detected	1.09	Mean of Detected	-1.208
SD of Detected	2.396	SD of Detected	1.53
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	37
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	92.50%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.479	Shapiro Wilk Test Statistic	0.925
5% Shapiro Wilk Critical Value	0.85	5% 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**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.446	Mean	-1.49
SD	1.278	SD	0.795
95% DL/2 (t) UCL	0.787	95% H-Stat (DL/2) UCL	0.435
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	5.185	Mean in Log Scale	-1.727
SD	3.301	SD in Log Scale	1.203
95% MLE (t) UCL	6.065	Mean in Original Scale	0.465
95% MLE (Tiku) UCL	8.295	SD in Original Scale	1.287
		95% Percentile Bootstrap UCL	0.853
		95% BCA Bootstrap UCL	1.109
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.418	**Data appear Lognormal at 5% Significance Level**	
Theta Star	2.605		
nu star	9.204		
A-D Test Statistic	1.022	**Nonparametric Statistics**	
5% A-D Critical Value	0.783	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.783	Mean	0.426
5% K-S Critical Value	0.269	SD	1.269
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.213
		95% KM (t) UCL	0.784
Assuming Gamma Distribution		95% KM (z) UCL	0.776
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.773
Minimum	1E-09	95% KM (bootstrap t) UCL	1.767
Maximum	8.2	95% KM (BCA) UCL	0.831
Mean	0.98	95% KM (Percentile Bootstrap) UCL	0.841
Median	0.905	95% KM (Chebyshev) UCL	1.353
SD	1.315	97.5% KM (Chebyshev) UCL	1.754
k star	0.278	99% KM (Chebyshev) UCL	2.542
Theta star	3.52		
Nu star	22.27	**Potential UCLs to Use**	
AppChi2	12.54	95% KM (Chebyshev) UCL	1.353
95% Gamma Approximate UCL	1.74		
95% Adjusted Gamma UCL	1.779		

Note: DL/2 is not a recommended method.

Benzo(a)pyrene

General Statistics

Number of Valid Data	40	Number of Detected Data	13
Number of Distinct Detected Data	13	Number of Non-Detect Data	27
		Percent Non-Detects	67.50%

Raw Statistics	
Minimum Detected	0.035
Maximum Detected	8.3
Mean of Detected	0.997
SD of Detected	2.255
Minimum Non-Detect	0.4
Maximum Non-Detect	0.41

Log-transformed Statistics	
Minimum Detected	-3.352
Maximum Detected	2.116
Mean of Detected	-1.45
SD of Detected	1.666
Minimum Non-Detect	-0.916
Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	36
Number treated as Detected	4
Single DL Non-Detect Percentage	90.00%

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.474
5% Shapiro Wilk Critical Value	0.866

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.922
5% Shapiro Wilk Critical Value	0.866

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.461
SD	1.306
95% DL/2 (t) UCL	0.809
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-1.55
SD	0.927
95% H-Stat (DL/2) UCL	0.478
Log ROS Method	
Mean in Log Scale	-2.024
SD in Log Scale	1.342
Mean in Original Scale	0.435
SD in Original Scale	1.318
95% Percentile Bootstrap UCL	0.842
95% BCA Bootstrap UCL	1.029

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.395
Theta Star	2.524
nu star	10.27
A-D Test Statistic	1.026
5% A-D Critical Value	0.801
K-S Test Statistic	0.801
5% K-S Critical Value	0.252

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	8.3
Mean	0.901
Median	0.765
SD	1.317
k star	0.315
Theta star	2.856
Nu star	25.24
AppChi2	14.79
95% Gamma Approximate UCL	1.537
95% Adjusted Gamma UCL	1.569

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.418
SD	1.302
SE of Mean	0.216
95% KM (t) UCL	0.782
95% KM (z) UCL	0.774
95% KM (jackknife) UCL	0.773
95% KM (bootstrap t) UCL	1.901
95% KM (BCA) UCL	0.832
95% KM (Percentile Bootstrap) UCL	0.825
95% KM (Chebyshev) UCL	1.36
97.5% KM (Chebyshev) UCL	1.768
99% KM (Chebyshev) UCL	2.569

Potential UCLs to Use	
95% KM (Chebyshev) UCL	1.36

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	40	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	26
		Percent Non-Detects	65.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.039	Minimum Detected	-3.244
Maximum Detected	13	Maximum Detected	2.565
Mean of Detected	1.645	Mean of Detected	-0.988
SD of Detected	3.467	SD of Detected	1.764
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	33
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	82.50%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.52	Shapiro Wilk Test Statistic	0.945
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.707	Mean	-1.384
SD	2.12	SD	1.061
95% DL/2 (t) UCL	1.272	95% H-Stat (DL/2) UCL	0.631
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.912
		SD in Log Scale	1.521
		Mean in Original Scale	0.673
		SD in Original Scale	2.131
		95% Percentile Bootstrap UCL	1.307
		95% BCA Bootstrap UCL	1.663

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.391	**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
Theta Star	4.211		
nu star	10.94		
A-D Test Statistic	0.868	**Nonparametric Statistics**	
5% A-D Critical Value	0.806	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.806	Mean	0.652
5% K-S Critical Value	0.244	SD	2.108
Data follow Appr. Gamma Distribution at 5% Significance Level		SE of Mean	0.347
		95% KM (t) UCL	1.236
Assuming Gamma Distribution		95% KM (z) UCL	1.222
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.222
Minimum	0.039	95% KM (bootstrap t) UCL	3.804
Maximum	13	95% KM (BCA) UCL	1.299
Mean	1.553	95% KM (Percentile Bootstrap) UCL	1.267
Median	1.432	95% KM (Chebyshev) UCL	2.163
SD	2.021	97.5% KM (Chebyshev) UCL	2.817

k star	0.998	99% KM (Chebyshev) UCL	4.101
Theta star	1.555		
Nu star	79.88	**Potential UCLs to Use**	
AppChi2	60.28	95% KM (t) UCL	1.236
95% Gamma Approximate UCL	2.057		
95% Adjusted Gamma UCL	2.079		

Note: DL/2 is not a recommended method.

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Data	40	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	34
		Percent Non-Detects	85.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.032	Minimum Detected	-3.442
Maximum Detected	0.55	Maximum Detected	-0.598
Mean of Detected	0.183	Mean of Detected	-2.27
SD of Detected	0.21	SD of Detected	1.171
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.42	Maximum Non-Detect	-0.868

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	39
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	97.50%

Warning: There are only 6 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.788	Shapiro Wilk Test Statistic	0.902
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.2	Mean	-1.697
SD	0.0755	SD	0.485
95% DL/2 (t) UCL	0.22	95% H-Stat (DL/2) UCL	0.296
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.596
		SD in Log Scale	0.865
		Mean in Original Scale	0.108
		SD in Original Scale	0.107
		95% Percentile Bootstrap UCL	0.137
		95% BCA Bootstrap UCL	0.142

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.615	**Data appear Normal at 5% Significance Level**
Theta Star	0.297	
nu star	7.386	

A-D Test Statistic	0.452	**Nonparametric Statistics**	
5% A-D Critical Value	0.715	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.715	Mean	0.121
5% K-S Critical Value	0.341	SD	0.127
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0529
		95% KM (t) UCL	0.21
Assuming Gamma Distribution		95% KM (z) UCL	0.208
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.22
Minimum	0.032	95% KM (bootstrap t) UCL	0.408
Maximum	0.55	95% KM (BCA) UCL	0.22
Mean	0.182	95% KM (Percentile Bootstrap) UCL	0.223
Median	0.182	95% KM (Chebyshev) UCL	0.351
SD	0.0754	97.5% KM (Chebyshev) UCL	0.451
k star	5.52	99% KM (Chebyshev) UCL	0.647
Theta star	0.0329		
Nu star	441.6	**Potential UCLs to Use**	
AppChi2	393.9	95% KM (t) UCL	0.21
95% Gamma Approximate UCL	0.204	95% KM (Percentile Bootstrap) UCL	0.223
95% Adjusted Gamma UCL	0.204		

Note: DL/2 is not a recommended method.

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	40	Number of Detected Data	10
Number of Distinct Detected Data	9	Number of Non-Detect Data	30
		Percent Non-Detects	75.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.024	Minimum Detected	-3.73
Maximum Detected	1.6	Maximum Detected	0.47
Mean of Detected	0.411	Mean of Detected	-1.934
SD of Detected	0.634	SD of Detected	1.506
Minimum Non-Detect	0.4	Minimum Non-Detect	-0.916
Maximum Non-Detect	0.41	Maximum Non-Detect	-0.892

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	38
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	95.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.621	Shapiro Wilk Test Statistic	0.902
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.255	Mean	-1.681
SD	0.318	SD	0.739
95% DL/2 (t) UCL	0.339	95% H-Stat (DL/2) UCL	0.365

Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Log ROS Method	
Mean in Log Scale	-2.36
SD in Log Scale	1.199
Mean in Original Scale	0.203
SD in Original Scale	0.347
95% Percentile Bootstrap UCL	0.299
95% BCA Bootstrap UCL	0.326

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.481
Theta Star	0.854
nu star	9.628
A-D Test Statistic	0.836
5% A-D Critical Value	0.77
K-S Test Statistic	0.77
5% K-S Critical Value	0.279

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.6
Mean	0.376
Median	0.354
SD	0.352
k star	0.453
Theta star	0.829
Nu star	36.23
AppChi2	23.46
95% Gamma Approximate UCL	0.58
95% Adjusted Gamma UCL	0.59

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.188
SD	0.338
SE of Mean	0.0644
95% KM (t) UCL	0.296
95% KM (z) UCL	0.294
95% KM (jackknife) UCL	0.296
95% KM (bootstrap t) UCL	0.394
95% KM (BCA) UCL	0.309
95% KM (Percentile Bootstrap) UCL	0.293
95% KM (Chebyshev) UCL	0.469
97.5% KM (Chebyshev) UCL	0.59
99% KM (Chebyshev) UCL	0.828

Potential UCLs to Use

95% KM (t) UCL	0.296

Appendix G
Ecological Screening Values

Table G-1
Proposed Soil Ecological Screening Levels for Ravenna Army Ammunition Plant

COPEC	Log Kow	CAS Number	Ecological Screening Values for Soil: USEPA Eco SSL 2010 [a] (mg/kg)	ORNL PRGs 1997 [b] (mg/kg)	Region 5 ESLs 2003 [c] (mg/kg)	LANL ESLs 2010 [d] (mg/kg)	Talmage et al. 1999 [e] (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Soil Ecological Screening Value [g] (mg/kg)	Is the ESV Protective of Food Chain Effects?
Explosives (USEPA SW-846 8330B)										
1,3,5-Trinitrobenzene	1.45	99-35-4	NA	NA	0.376	6.6	9.7	No (Log Kow < 3.0)	0.376	Yes
1,3-Dinitrobenzene	1.63	99-65-0	NA	NA	0.655	0.073	0.41	No (Log Kow < 3.0)	0.655	Yes
2,4,6-Trinitrotoluene	1.99	118-96-7	NA	NA	NA	6.4	5.6	No (Log Kow < 3.0)	6.4	Yes
2,4-Dinitrotoluene	2.18	121-14-2	NA	NA	1.28	0.52	NA	No (Log Kow < 3.0)	1.28	Yes
2,6-Dinitrotoluene	2.18	606-20-2	NA	NA	0.0328	0.37	NA	No (Log Kow < 3.0)	0.0328	Yes
Dinitrotoluene (2,4/2,6-) Mixture (ca)	2.18	25321-14-6	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	Yes
2-Amino-4,6-dinitrotoluene	1.84	35572-78-2	NA	NA	NA	2.1	80	No (Log Kow < 3.0)	2.1	Yes
2-Nitrotoluene	2.36	88-72-2	NA	NA	NA	2	NA	No (Log Kow < 3.0)	2	Yes
3-Nitrotoluene	2.36	99-08-1	NA	NA	NA	2.4	NA	No (Log Kow < 3.0)	2.4	Yes
3,5-Dinitroaniline	1.29	618-87-1	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
4-Amino-2,6-dinitrotoluene	1.84	19406-51-0	NA	NA	NA	0.73	NA	No (Log Kow < 3.0)	0.73	Yes
4-Nitrotoluene	2.36	99-99-0	NA	NA	NA	4.4	NA	No (Log Kow < 3.0)	4.4	Yes
HMX	0.82	2691-41-0	NA	NA	NA	27	5.6	No (Log Kow < 3.0)	27	Yes
Nitrobenzene	1.81	98-95-3	NA	NA	1.31	2.2	NA	No (Log Kow < 3.0)	1.31	Yes
Nitroglycerin	1.51	55-63-0	NA	NA	NA	71	NA	No (Log Kow < 3.0)	71	Yes
Nitroguanidine	-1.72	556-88-7	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
PETN	2.38	78-11-5	NA	NA	NA	8600	NA	No (Log Kow < 3.0)	8600	Yes
RDX	0.68	121-82-4	NA	NA	NA	7.5	15	No (Log Kow < 3.0)	7.5	Yes
Tetryl	1.64	479-45-8	NA	NA	NA	0.99	4.4	No (Log Kow < 3.0)	0.99	Yes
Metals (USEPA SW-846 6010B)										
Aluminum	NA	7429-90-5	Narrative	NA	NA	Narrative	NA	No (not USEPA IBC)	NA	NA
Antimony	NA	7440-36-0	0.27	5	0.142	0.05	NA	No (not USEPA IBC)	0.27	Yes
Arsenic	NA	7440-38-2	18	9.9	5.7	6.8	NA	**Yes (USEPA IBC)**	18	Yes
Barium	NA	7440-39-3	330	283	1.04	110	NA	No (not USEPA IBC)	330	Yes
Beryllium	NA	7440-41-7	21	10	1.06	2.5	NA	No (not USEPA IBC)	21	Yes
Cadmium	NA	7440-43-9	0.36	4	0.00222	0.27	NA	**Yes (USEPA IBC)**	0.36	Yes
Calcium	NA	7440-70-2	NA	NA	NA	NA	NA	No (not USEPA IBC)	Nutrient	NA
Cobalt	NA	7440-48-4	13	20	0.14	13	NA	No (not USEPA IBC)	13	Yes
Copper	NA	7440-50-8	28	60	5.4	15	NA	**Yes (USEPA IBC)**	28	Yes
Chromium (as Cr^{3+})	NA	7440-47-3	26	0.4	0.4	2.3	NA	No (not USEPA IBC)	26	Yes
Chromium (as Cr^{6+})	NA	18540-29-9	130	NA	NA	0.34	NA	**Yes (USEPA IBC)**	130	Yes
Iron	NA	4739-89-6	Narrative	NA	NA	NA	NA	No (not USEPA IBC)	NA	NA
Lead	NA	7439-92-1	11	40.5	0.0537	14	NA	**Yes (USEPA IBC)**	11	Yes
Magnesium	NA	7439-95-4	NA	NA	NA	NA	NA	No (not USEPA IBC)	Nutrient	NA
Manganese	NA	7439-96-5	220	NA	NA	220	NA	No (not USEPA IBC)	220	Yes
Mercury	NA	7439-97-6	NA	0.00051	0.1	0.013	NA	**Yes (OEPA PBT)**	0.00051	Yes
Nickel	NA	7440-02-0	38	30	13.6	9.7	NA	**Yes (USEPA IBC)**	38	Yes
Selenium	NA	7782-49-2	0.52	0.21	0.0276	0.52	NA	**Yes (USEPA IBC)**	0.52	Yes
Silver	NA	7440-22-4	4.2	2	4.04	2.6	NA	**Yes (USEPA IBC)**	4.2	Yes
Sodium	NA		NSV	NSV	NSV	NSV	NA	No (not USEPA IBC)	Nutrient	NA
Strontium	NA	7440-24-6	NA	NA	NA	96	NA	No (not USEPA IBC)	96	Yes
Thallium	NA	7440-28-0	NSV	1	0.0569	0.032	NA	No (not USEPA IBC)	1	Yes
Vanadium	NA	7440-62-2	7.8	2	1.59	0.025	NA	No (not USEPA IBC)	7.8	Yes
Zinc	NA	7440-66-0	46	8.5	6.62	48	NA	**Yes (USEPA IBC)**	46	Yes
Volatile Organic Compounds										
Chloroethane	1.58	75-00-3	NSV	NSV	NSV	NSV	NA	No (Log Kow < 3.0)	NA	NA

Table G-1
Proposed Soil Ecological Screening Levels for Ravenna Army Ammunition Plant

COPEC	Log Kow	CAS Number	Ecological Screening Values for Soil							
			USEPA Eco SSL 2010 [a] (mg/kg)	ORNL PRGs 1997 [b] (mg/kg)	Region 5 ESLs 2003 [c] (mg/kg)	LANL ESLs 2010 [d] (mg/kg)	Talmage et al. 1999 [e] (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Soil Ecological Screening Value [g] (mg/kg)	Is the ESV Protective of Food Chain Effects?
SVOCs (USEPA SW-846 8270C)										
1,2,4-Trichlorobenzene	3.93	120-82-1	NA	20	11.1	0.27	NA	**Yes (Log Kow ≥ 3.0)**	20	No
1,2-Dichlorobenzene	3.28	95-50-1	NA	NA	2.96	0.92	NA	**Yes (Log Kow ≥ 3.0)**	2.96	Yes
1,3-Dichlorobenzene	3.28	541-73-1	NA	NA	37.7	0.73	NA	**Yes (Log Kow ≥ 3.0)**	37.7	Yes
1,4-Dichlorobenzene	3.28	106-46-7	NA	20	0.546	0.88	NA	**Yes (Log Kow ≥ 3.0)**	20	No
2,4,5-Trichlorophenol	3.45	95-95-4	NA	9	14.1	NA	NA	**Yes (Log Kow ≥ 3.0)**	9	No
2,4,6-Trichlorophenol	3.45	88-06-2	NA	4	9.94	NA	NA	**Yes (Log Kow ≥ 3.0)**	4	No
2,4-Dichlorophenol	2.8	120-83-2	NA	NA	87.5	NA	NA	No (Log Kow < 3.0)	87.5	Yes
2,4-Dimethylphenol	2.61	105-67-9	NA	NA	0.01	NA	NA	No (Log Kow < 3.0)	0.01	No
2,4-Dinitrophenol	1.73	51-28-5	NA	20	0.0609	NA	NA	No (Log Kow < 3.0)	20	No
2,4-Dinitrotoluene	2.18	121-14-2	NA	NA	1.28	0.52	NA	No (Log Kow < 3.0)	1.28	No
2,6-Dinitrotoluene	2.18	606-20-2	NA	NA	0.0328	0.37	NA	No (Log Kow < 3.0)	0.0328	No
2-Chloronaphthalene	3.81	91-58-7	NA	NA	0.0122	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.0122	Yes
2-Chlorophenol	2.16	95-57-8	NA	NA	0.243	0.39	NA	No (Log Kow < 3.0)	0.243	Yes
2-Methylnaphthalene	3.72	91-57-6	NA	NA	3.24	2.5	NA	**Yes (Log Kow ≥ 3.0)**	3.24	Yes
2-Methylphenol	2.06	95-48-7	NA	NA	40.4	0.67	NA	No (Log Kow < 3.0)	40.4	Yes
2-Nitroaniline	2.02	88-74-4	NA	NA	74.1	5.4	NA	No (Log Kow < 3.0)	74.1	Yes
2-Nitrophenol	1.91	88-75-5	NA	NA	1.6	NA	NA	No (Log Kow < 3.0)	1.6	Yes
3 & 4-Methylphenol	2.06	CASID30030	NA	NA	3.49	0.69	NA	No (Log Kow < 3.0)	3.49	Yes
3,3'-Dichlorobenzidine	3.21	91-94-1	NA	NA	0.646	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.646	Yes
3-Nitroaniline	1.47	99-09-2	NA	NA	3.16	NA	NA	No (Log Kow < 3.0)	3.16	Yes
4,6-Dinitro-2-methylphenol	2.27	534-52-1	NA	NA	0.144	NA	NA	No (Log Kow < 3.0)	0.144	Yes
4-Bromophenyl-phenyl ether	4.94	101-55-3	NA	NA	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	NA	NA
4-Chloro-3-methylphenol	2.7	59-50-7	NA	NA	7.95	NA	NA	No (Log Kow < 3.0)	7.95	Yes
4-Chloroaniline	1.72	106-47-8	NA	NA	1.1	1	NA	No (Log Kow < 3.0)	1.1	Yes
4-Chlorophenyl-phenyl ether	4.69	7005-72-3	NA	NA	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	NA	NA
4-Nitroaniline	1.47	100-01-6	NA	NA	21.9	NA	NA	No (Log Kow < 3.0)	21.9	Yes
4-Nitrophenol	1.91	100-02-7	NA	7	5.12	NA	NA	No (Log Kow < 3.0)	7	No
Acenaphthene	4.15	83-32-9	29	20	682	0.25	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Acenaphthylene	3.94	208-96-8	29	NA	682	120	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Anthracene	4.35	120-12-7	29	NA	1480	6.8	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Benzo(a)anthracene	5.52	56-55-3	1.1	NA	5.21	3	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Benzo(a)pyrene	6.11	50-32-8	1.1	NA	1.52	53	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Benzo(b)fluoranthene	6.11	205-99-2	1.1	NA	59.8	18	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Benzo(g,h,i)perylene	6.7	191-24-2	1.1	NA	119	24	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Benzo(k)fluoranthene	6.11	207-08-9	1.1	NA	148	62	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Benzoic acid	1.87	65-85-0	NA	NA	NA	1	NA	No (Log Kow < 3.0)	1	Yes
Benzyl alcohol	1.08	100-51-6	NA	NA	65.8	120	NA	No (Log Kow < 3.0)	65.8	Yes
Bis(2-chloroethoxy)methane	1.3	111-91-1	NA	NA	0.302	NA	NA	No (Log Kow < 3.0)	0.302	Yes
Bis(2-chloroethyl)ether	1.56	111-44-4	NA	NA	23.7	NA	NA	No (Log Kow < 3.0)	23.7	Yes
Bis(2-chloroisopropyl)ether	2.39	108-60-1	NA	NA	19.9	NA	NA	No (Log Kow < 3.0)	19.9	Yes
Bis(2-ethylhexyl)phthalate	8.39	117-81-7	NA	NA	0.925	0.02	NA	**Yes (Log Kow ≥ 3.0)**	0.925	Yes
Butylbenzylphthalate	4.84	85-68-7	NA	NA	0.239	90	NA	**Yes (Log Kow ≥ 3.0)**	0.239	Yes
Carbazole	3.23	86-74-8	NA	NA	NA	0.00008	NA	**Yes (Log Kow ≥ 3.0)**	0.00008	Yes
Chrysene	5.52	218-01-9	1.1	NA	4.73	2.4	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Di-n-butylphthalate	4.61	84-74-2	NA	200	0.15	0.011	NA	**Yes (Log Kow ≥ 3.0)**	200	No
Di-n-octylphthalate	8.54	117-84-0	NA	NA	709	1.1	NA	**Yes (Log Kow ≥ 3.0)**	709	Yes

Table G-1
Proposed Soil Ecological Screening Levels for Ravenna Army Ammunition Plant

COPEC	Log Kow	CAS Number	Ecological Screening Values for Soil							
			USEPA Eco SSL 2010 [a] (mg/kg)	ORNL PRGs 1997 [b] (mg/kg)	Region 5 ESLs 2003 [c] (mg/kg)	LANL ESLs 2010 [d] (mg/kg)	Talmage et al. 1999 [e] (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Soil Ecological Screening Value [g] (mg/kg)	Is the ESV Protective of Food Chain Effects?
Dibenzo(a,h)anthracene	6.7	53-70-3	1.1	NA	18.4	12	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Dibenzofuran	3.71	132-64-9	NA	NA	NA	6.1	NA	**Yes (Log Kow ≥ 3.0)**	6.1	Yes
Diethylphthalate	2.65	84-66-2	NA	100	24.8	100	NA	No (Log Kow < 3.0)	100	No
Dimethylphthalate	1.66	131-11-3	NA	NA	734	10	NA	No (Log Kow < 3.0)	734	Yes
Fluoranthene	4.93	206-44-0	29	NA	122	10	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Fluorene	4.02	86-73-7	29	NA	122	3.7	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Hexachlorobenzene	5.86	118-74-1	NA	NA	0.199	0.079	NA	**Yes (Log Kow ≥ 3.0)**	0.199	Yes
Hexachlorobutadiene	4.72	87-68-3	NA	NA	0.0398	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.0398	Yes
Hexachlorocyclopentadiene	4.63	77-47-4	NA	10	0.755	NA	NA	**Yes (Log Kow ≥ 3.0)**	10	No
Hexachloroethane	4.03	67-72-1	NA	NA	0.596	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.596	Yes
Indeno(1,2,3-cd)pyrene	6.7	193-39-5	1.1	NA	109	62	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Isophorone	2.62	78-59-1	NA	NA	139	NA	NA	No (Log Kow < 3.0)	139	Yes
N-Nitroso-di-n-propylamine	1.33	621-64-7	NA	NA	0.544	NA	NA	No (Log Kow < 3.0)	0.544	Yes
N-Nitrosodiphenylamine & Diphn	3.16	86-30-6	NA	NA	0.545	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.545	Yes
Naphthalene	3.17	91-20-3	29	NA	0.0994	1	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Nitrobenzene	1.81	98-95-3	NA	NA	1.31	2.2	NA	No (Log Kow < 3.0)	1.31	Yes
Pentachlorophenol	4.74	87-86-5	2.1	3	0.119	0.36	NA	**Yes (Log Kow ≥ 3.0)**	2.1	Yes
Phenanthrene	4.35	85-01-8	29	NA	45.7	5.5	NA	**Yes (Log Kow ≥ 3.0)**	29	Yes
Phenol	1.51	108-95-2	NA	30	120	0.79	NA	No (Log Kow < 3.0)	30	No
Pyrene	4.93	129-00-0	1.1	NA	78.5	10	NA	**Yes (Log Kow ≥ 3.0)**	1.1	Yes
Pesticides										
4,4'-DDD	5.87	72-54-8	0.021	NSV	0.758	0.0063	NA	**Yes (Log Kow ≥ 3.0)**	0.021	Yes
4,4'-DDT	6.79	50-29-3	0.021	NSV	0.0035	0.044	NA	**Yes (Log Kow ≥ 3.0)**	0.021	Yes
Heptachlor	5.86	76-44-8	NSV	NSV	0.00598	0.059	NA	**Yes (Log Kow ≥ 3.0)**	0.00598	Yes
PCBs (Method SW-846 8082A)										
Aroclor 1016	5.69	12674-11-2	NA	0.371	0.000332	1	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
Aroclor 1221	4.4	11104-28-2	NA	0.371	0.000332	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
Aroclor 1232	4.4	11141-16-5	NA	0.371	0.000332	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
Aroclor 1242	6.34	53469-21-9	NA	0.371	0.000332	0.041	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
Aroclor 1248	6.34	12672-29-6	NA	0.371	0.000332	0.0072	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
Aroclor 1254	6.98	11097-69-1	NA	0.371	0.000332	0.041	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
Aroclor 1260	8.27	11096-82-5	NA	0.371	0.000332	0.14	NA	**Yes (Log Kow ≥ 3.0)**	0.371	No
General Chemistry										
Cyanide, Total	NA	57-12-5	NSV	NSV	1.33	0.1	NA	NA	1.33	Yes
Modified)										
Nitrocellulose	NA	9004-70-0	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
Total Organic Carbon										
Total Organic Carbon	NA	TOC (mg/kg)	NA	NA	NA	NA	NA	NA	NA	NA
pH	NA	pH (Units)	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
[a] Ecological Soil Screening Levels (EcoSSLs), (EPA, 2008) online updates from http://www.epa.gov/ecotox/ecossl/.
[b] ORNL: Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. *Preliminary Remediation Goals for Ecological Endpoints* , ES/ER/TM-162/R2.
[c] Ecological Screening Levels (ESLs), US EPA Region V, August 2003.
[d] Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.5, October 2010.
[e] From *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values* , Talmage et al., 1999, Rev. Environ. Contamin. Toxicol., 161: 1-156.

Table G-1
Proposed Soil Ecological Screening Levels for Ravenna Army Ammunition Plant

COPEC	Log Kow	CAS Number	Ecological Screening Values for Soil							
			USEPA Eco SSL 2010 [a] (mg/kg)	ORNL PRGs 1997 [b] (mg/kg)	Region 5 ESLs 2003 [c] (mg/kg)	LANL ESLs 2010 [d] (mg/kg)	Talmage et al. 1999 [e] (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Soil Ecological Screening Value [g] (mg/kg)	Is the ESV Protective of Food Chain Effects?

[f] Analyte identified as a persistent, bioaccumulative, and toxic (PBT) compound (OEPA DERR ERA Guidance, April 2008).

[g] The following hierarchy (based on OEPA DERR ERA Guidance, April 2008) was used to select the soil screening values:

1. USEPA EcoSSL (plants, invertebrates, wildlife)
2. ORNL (1997) [plants, invertebrates, wildlife]
3. USEPA Region 5 ESLs (2003)
4. LANL (2010) [various endpoints]
5. Talmage et al. (1999)

CAS = Chemical Abstract Service.
mg/kg = milligrams per kilogram.
NA = RVAAP-specific screening level not available.
RVAAP = Ravenna Army Ammunition Plant.
RL = reporting limit.
SVOC = semivolatile organic compound

Table G-2
Proposed Surface Water Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Surface Water						
				Ecological Screening Values					
			Surface Water Background Values	Ohio WQC (2009) [a]	Region 5 ESLs (2003) [b]	ORNL PRGs (1997) [c]	LANL ESLs (2010) [d]	Talmage et al. (1999) [e]	Recommended Surface Water Ecological Screening Value [f]
Explosives (USEPA SW-846 8330B)			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1,3,5-Trinitrobenzene	1.45	99-35-4	NA	11	NA	NA	60000	11	11
1,3-Dinitrobenzene	1.63	99-65-0	NA	22	22	NA	26	20	22
2,4,6-Trinitrotoluene	1.99	118-96-7	NA	13	NA	NA	40000	90	13
2,4-Dinitrotoluene	2.18	121-14-2	NA	44	44	NA	310	NA	44
2,6-Dinitrotoluene	2.18	606-20-2	NA	81	81	NA	60	NA	81
Dinitrotoluene (2,4/2,6-) Mixture (ca)	2.18	25321-14-6	NA	NA	NA	NA	NA	NA	NA
2-Amino-4,6-dinitrotoluene	1.84	35572-78-2	NA	18	NA	NA	12000	20	18
2-Nitrotoluene	2.36	88-72-2	NA	71	NA	NA	8000	NA	71
3-Nitrotoluene	2.36	99-08-1	NA	42	NA	NA	9600	NA	42
3,5-Dinitroaniline	1.29	618-87-1	NA	70	NA	NA	NA	NA	70
4-Amino-2,6-dinitrotoluene	1.84	19406-51-0	NA	11	NA	NA	8600	na	11
4-Nitrotoluene	2.36	99-99-0	NA	46	NA	NA	17000	NA	46
HMX	0.82	2691-41-0	NA	220	NA	NA	330000	330	220
Nitrobenzene	1.81	98-95-3	NA	380	220	NA	270	NA	380
Nitroglycerin	1.51	55-63-0	NA	18	NA	NA	430000	NA	18
Nitroguanidine	-1.72	556-88-7	NA	NA	NA	NA	NA	NA	NA
PETN	2.38	78-11-5	NA	NA	NA	NA	26000000	NA	26000000
RDX	0.68	121-82-4	NA	79	NA	NA	44000	190	79
Tetryl	1.64	479-45-8	NA	NA	NA	NA	5800	NA	5800
Metals (USEPA SW-846 6010B)			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Aluminum	NA	7429-90-5	3,370	NA	NA	87	87	NA	87
Antimony	NA	7440-36-0	NA	190	80	30	100	NA	190
Arsenic	NA		3.2	150	148	3.1	150	NA	150
Barium	NA	7440-39-3	47.5	220	220	4	3.8	NA	220
Cadmium	NA	7440-43-9	NA	2.5	0.15	1.1	0.15	NA	2.5
Calcium	NA	7440-70-2	41,400	NA	NA	NA	NA	NA	NA
Copper	NA	7440-50-8	7.9	9.3	1.58	12	5	NA	9.3
Chromium (as Cr^{3+})	NA	7440-47-3	NA	86	42	210	77	NA	86
Chromium (as Cr^{6+})	NA	18540-29-9	NA	11	42	11	11	NA	11
Iron	NA	4739-89-6	2,560	NA	NA	1000	1000	NA	1000
Lead	NA	7439-92-1	NA	6.4	1.17	3.2	1.2	NA	6.4
Magnesium	NA	7439-95-4	10,800	NA	NA	NA	NA	NA	NA
Manganese	NA	7439-96-5	391	NA	NA	120	80	NA	120
Mercury	NA	7439-97-6	NA	0.91	0.0013	0.0026	0.0028	NA	0.91
Strontium	NA	7440-24-6	NA	21000	NA	1500	620	NA	21000
Zinc	NA	7440-66-0	42	120	65.7	110	66	NA	120
SVOCs (USEPA SW-846 8270C)			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1,2,4-Trichlorobenzene	3.93	120-82-1	NA	NA	30	110	110	NA	30
1,2-Dichlorobenzene	3.28	95-50-1	NA	23	14	14	NA	NA	23
1,3-Dichlorobenzene	3.28	541-73-1	NA	22	38	71	NA	NA	22
1,4-Dichlorobenzene	3.28	106-46-7	NA	9.4	9.4	15	15	NA	9.4
2,4,5-Trichlorophenol	3.45	95-95-4	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol	3.45	88-06-2	NA	4.9	4.9	NA	NA	NA	4.9
2,4-Dichlorophenol	2.8	120-83-2	NA	11	11	NA	NA	NA	11
2,4-Dimethylphenol	2.61	105-67-9	NA	15	0.1	NA	NA	NA	15
2,4-Dinitrophenol	1.73	51-28-5	NA	NA	19	NA	NA	NA	19
2,4-Dinitrotoluene	2.18	121-14-2	NA	44	44	NA	310	NA	44
2,6-Dinitrotoluene	2.18	606-20-2	NA	81	81	NA	60	NA	81

Table G-2
Proposed Surface Water Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Surface Water						
				Ecological Screening Values					
			Surface Water Background Values	Ohio WQC (2009) [a]	Region 5 ESLs (2003) [b]	ORNL PRGs (1997) [c]	LANL ESLs (2010) [d]	Talmage et al. (1999) [e]	Recommended Surface Water Ecological Screening Value [f]
2-Chloronaphthalene	3.81	91-58-7	NA	NA	0.396	NA	NA	NA	0.396
2-Chlorophenol	2.16	95-57-8	NA	32	24	NA	43	NA	32
2-Methylnaphthalene	3.72	91-57-6	NA	NA	330	NA	2	NA	330
2-Methylphenol	2.06	95-48-7	NA	67	67	13	NA	NA	67
2-Nitroaniline	2.02	88-74-4	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol	1.91	88-75-5	NA	73	NA	NA	NA	NA	73
3 & 4-Methylphenol	2.06	CASID30030	NA	53	25	NA	NA	NA	53
3,3'-Dichlorobenzidine	3.21	91-94-1	NA	NA	4.5	NA	NA	NA	4.5
3-Nitroaniline	1.47	99-09-2	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol	2.27	534-52-1	NA	NA	23	NA	NA	NA	23
4-Bromophenyl-phenyl ether	4.94	101-55-3	NA	NA	1.5	NA	NA	NA	1.5
4-Chloro-3-methylphenol	2.7	59-50-7	NA	NA	34.8	NA	NA	NA	34.8
4-Chloroaniline	1.72	106-47-8	NA	NA	232	NA	NA	NA	232
4-Chlorophenyl-phenyl ether	4.69	7005-72-3	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline	1.47	100-01-6	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol	1.91	100-02-7	NA	NA	60	300	NA	NA	60
Acenaphthene	4.15	83-32-9	NA	15	38	23	23	NA	15
Acenaphthylene	3.94	208-96-8	NA	NA	4840	NA	30	NA	4840
Anthracene	4.35	120-12-7	NA	0.02	0.035	0.73	0.0013	NA	0.02
Benzo(a)anthracene	5.52	56-55-3	NA	NA	0.025	0.027	0.027	NA	0.025
Benzo(a)pyrene	6.11	50-32-8	NA	NA	0.014	0.014	0.014	NA	0.014
Benzo(b)fluoranthene	6.11	205-99-2	NA	NA	9.07	NA	30	NA	9.07
Benzo(g,h,i)perylene	6.7	191-24-2	NA	NA	7.64	NA	30	NA	7.64
Benzo(k)fluoranthene	6.11	207-08-9	NA	NA	NA	NA	30	NA	30
Benzoic acid	1.87	65-85-0	NA	NA	NA	42	41	NA	42
Benzyl alcohol	1.08	100-51-6	NA	NA	8.6	8.6	NA	NA	8.6
Bis(2-chloroethoxy)methane	1.3	111-91-1	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether	1.56	111-44-4	NA	NA	19000	NA	NA	NA	19000
Bis(2-chloroisopropyl)ether	2.39	108-60-1	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	8.39	117-81-7	NA	8.4	0.3	0.12	32	NA	8.4
Butylbenzylphthalate	4.84	85-68-7	NA	23	23	19	22	NA	23
Carbazole	3.23	86-74-8	NA	NA	NA	NA	NA	NA	NA
Chrysene	5.52	218-01-9	NA	NA	NA	NA	30	NA	30
Di-n-butylphthalate	4.61	84-74-2	NA	NA	9.7	1	32	NA	9.7
Di-n-octylphthalate	8.54	117-84-0	NA	NA	30	NA	320	NA	30
Dibenzo(a,h)anthracene	6.7	53-70-3	NA	NA	NA	NA	30	NA	30
Dibenzofuran	3.71	132-64-9	NA	4	4	3.7	20	NA	4
Diethylphthalate	2.65	84-66-2	NA	220	110	210	NA	NA	220
Dimethylphthalate	1.66	131-11-3	NA	1100	NA	NA	330	NA	1100
Fluoranthene	4.93	206-44-0	NA	0.8	1.9	6.2	6.1	NA	0.8
Fluorene	4.02	86-73-7	NA	19	19	3.9	3.9	NA	19
Hexachlorobenzene	5.86	118-74-1	NA	NA	0.0003	NA	NA	NA	0.0003
Hexachlorobutadiene	4.72	87-68-3	NA	NA	0.053	NA	NA	NA	0.053
Hexachlorocyclopentadiene	4.63	77-47-4	NA	NA	77	NA	NA	NA	77
Hexachloroethane	4.03	67-72-1	NA	NA	8	12	NA	NA	8
Indeno(1,2,3-cd)pyrene	6.7	193-39-5	NA	NA	4.31	NA	30	NA	4.31
Isophorone	2.62	78-59-1	NA	920	920	NA	NA	NA	920
N-Nitroso-di-n-propylamine	1.33	621-64-7	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine & Diphn	3.16	86-30-6	NA	NA	NA	210	NA	NA	210

Table G-2
Proposed Surface Water Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Surface Water						
				Ecological Screening Values					
			Surface Water Background Values	Ohio WQC (2009) [a]	Region 5 ESLs (2003) [b]	ORNL PRGs (1997) [c]	LANL ESLs (2010) [d]	Talmage et al. (1999) [e]	Recommended Surface Water Ecological Screening Value [f]
Naphthalene	3.17	91-20-3	NA	21	13	12	23	NA	21
Nitrobenzene	1.81	98-95-3	NA	380	220	NA	270	NA	380
Pentachlorophenol	4.74	87-86-5	NA	6.7	4	NA	2.4	NA	6.7
Phenanthrene	4.35	85-01-8	NA	2.3	3.6	6.3	6.3	NA	2.3
Phenol	1.51	108-95-2	NA	160	180	110	110	NA	160
Pyrene	4.93	129-00-0	NA	4.6	0.3	NA	30	NA	4.6
PCBs (Method SW-846 8082A)			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Aroclor 1016	5.69	12674-11-2	NA	0.001	0.00012	0.23	0.014	NA	0.001
Aroclor 1221	4.4	11104-28-2	NA	0.001	0.00012	0.28	NA	NA	0.001
Aroclor 1232	4.4	11141-16-5	NA	0.001	0.00012	0.58	NA	NA	0.001
Aroclor 1242	6.34	53469-21-9	NA	0.001	0.00012	0.047	0.06	NA	0.001
Aroclor 1248	6.34	12672-29-6	NA	0.001	0.00012	0.0019	0.01	NA	0.001
Aroclor 1254	6.98	11097-69-1	NA	0.001	0.00012	0.0019	0.02	NA	0.001
Aroclor 1260	8.27	11096-82-5	NA	0.001	0.00012	94	10	NA	0.001
Nitrocellulose			(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Nitrocellulose	-4.56	9004-70-0	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon									
Total Organic Carbon	NA	TOC (mg/kg)	NA	NA	NA	NA	NA	NA	NA
pH	NA	pH (Units)	NA	6.5 - 9	NA	NA	NA	NA	pH =6.5 - 9

Notes:

[a] Ohio Administrative Code 3745-1, *Ohio River Basin Aquatic Life Criteria, OMZA, October 20, 2009* . Based on total recoverable metals, assuming a hardness of 100 mg/L for hardness-dependent criteria, and a pH of 7.0 for pH-dependent criteria. Iron criterion is based on protection of agricultural use. PCBs criteria are based on wildlife protection.

[b] Ecological Screening Levels (ESLs), US EPA Region V, August 2003.

[c] ORNL: Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. *Preliminary Remediation Goals for Ecological Endpoints* , ES/ER/TM-162/R2.

[d] Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.5, October 2010.

[e] From *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values* , Talmage et al., 1999, Rev. Environ. Contamin. Toxicol., 161: 1-156.

[f] The following hierarchy (based on OEPA DERR ERA Guidance, April 2008) was used to select the surface water screening values:

1. Ohio water quality criteria (2009) [aquatic life, OMZA]
2. USEPA Region 5 ESLs (2003)
3. ORNL (1997) [plants, invertebrates, wildlife]
4. LANL (2010) [various endpoints]
5. Talmage et al. (1999)

CAS = Chemical Abstract Service.
µg/L = micrograms per liter
NA = RVAAP-specific screening level not available.
RVAAP = Ravenna Army Ammunition Plant.
SVOC = semivolatile organic compound

Table G-3
Proposed Sediment Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Sediment								
				Ecological Screening Values							
			Sediment Background Value (mg/kg)	MacDonald et al. 2000[a] (mg/kg)	Region 5 ESLs 2003[a] (mg/kg)	ORNL PRGs 1997[c] (mg/kg)	LANL ESLs 2010[c] (mg/kg)	Talmage et al. 1999a (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Sediment Ecological Screening Value [g]	Is the ESV Protective of Food Chain Effects?
Explosives (USEPA SW-846 8330B)											
1,3,5-Trinitrobenzene	1.45	99-35-4	NA	NA	NA	NA	1300	0.024	No (Log Kow < 3.0)	1300	Yes
1,3-Dinitrobenzene	1.63	99-65-0	NA	NA	0.00861	NA	0.92	0.067	No (Log Kow < 3.0)	0.00861	No
2,4,6-Trinitrotoluene	1.99	118-96-7	NA	NA	NA	NA	420	0.92	No (Log Kow < 3.0)	420	Yes
2,4-Dinitrotoluene	2.18	121-14-2	NA	NA	0.0144	NA	0.29	NA	No (Log Kow < 3.0)	0.0144	No
2,6-Dinitrotoluene	2.18	606-20-2	NA	NA	0.0398	NA	1.9	NA	No (Log Kow < 3.0)	0.0398	No
Dinitrotoluene (2,4/2,6-) Mixture (ca)	2.18	25321-14-6	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	No
2-Amino-4,6-dinitrotoluene	1.84	35572-78-2	NA	NA	NA	NA	7	NA	No (Log Kow < 3.0)	7	Yes
2-Nitrotoluene	2.36	88-72-2	NA	NA	NA	NA	5.6	NA	No (Log Kow < 3.0)	5.6	Yes
3-Nitrotoluene	2.36	99-08-1	NA	NA	NA	NA	4.9	NA	No (Log Kow < 3.0)	4.9	Yes
3,5-Dinitroaniline	1.29	618-87-1	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
4-Amino-2,6-dinitrotoluene	1.84	19406-51-0	NA	NA	NA	NA	1.9	NA	No (Log Kow < 3.0)	1.9	Yes
4-Nitrotoluene	2.36	99-99-0	NA	NA	NA	NA	10	NA	No (Log Kow < 3.0)	10	Yes
HMX	0.82	2691-41-0	NA	NA	NA	NA	27000	0.047	No (Log Kow < 3.0)	27000	Yes
Nitrobenzene	1.81	98-95-3	NA	NA	0.145	NA	32	NA	No (Log Kow < 3.0)	0.145	No
Nitroglycerin	1.51	55-63-0	NA	NA	NA	NA	1700	NA	No (Log Kow < 3.0)	1700	Yes
Nitroguanidine	-1.72	556-88-7	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
PETN	2.38	78-11-5	NA	NA	NA	NA	120000	NA	No (Log Kow < 3.0)	120000	Yes
RDX	0.68	121-82-4	NA	NA	NA	NA	45	0.13	No (Log Kow < 3.0)	45	Yes
Tetryl	1.64	479-45-8	NA	NA	NA	NA	100	NA	No (Log Kow < 3.0)	100	Yes
Metals (USEPA SW-846 6010B)											
Aluminum	NA	7429-90-5	13900	NA	NA	NA	280	NA	No (not USEPA IBC)	280	Yes
Antimony	NA	7440-36-0	NA	NA	NA	NA	0.36	NA	No (not USEPA IBC)	0.36	Yes
Arsenic	NA	7440-38-2	19.5	9.79	9.79	42	12	NA	Yes (USEPA IBC)	9.79	No
Barium	NA	7440-39-3	123	NA	NA	NA	48	NA	No (not USEPA IBC)	48	No
Beryllium	NA	7440-41-7	0.38	NA	NA	NA	73	NA	No (not USEPA IBC)	73	Yes
Cadmium	NA	7440-43-9	NA	0.99	0.99	4.2	0.33	NA	Yes (USEPA IBC)	0.99	No
Calcium	NA	7440-70-2	5510	NA	NA	NA	NA	NA	No (not USEPA IBC)	NA	NA
Cobalt	NA	7440-48-4	9.1	NA	50	NA	230	NA	No (not USEPA IBC)	50	No
Copper	NA	7440-50-8	27.6	31.6	31.6	77.7	23	NA	Yes (USEPA IBC)	31.6	No
Chromium (as Cr^{3+})	NA	7440-47-3	18.1	43.4	43.4	159	56	NA	No (not USEPA IBC)	43.4	No
Chromium (as Cr^{6+})	NA	18540-29-9	NA	NA	NA	NA	8	NA	Yes (USEPA IBC)	8	No
Iron	NA	4739-89-6	28200	NA	NA	NA	20	NA	No (not USEPA IBC)	20	No
Lead	NA	7439-92-1	27.4	35.8	35.8	110	27	NA	Yes (USEPA IBC)	35.8	No
Magnesium	NA	7439-95-4	2760	NA	NA	NA	NA	NA	No (not USEPA IBC)	NA	NA
Manganese	NA	7439-96-5	1950	NA	NA	NA	720	NA	No (not USEPA IBC)	720	No
Mercury	NA	7439-97-6	0.059	0.18	0.174	0.7	0.00046	NA	Yes (OEPA PBT)	0.18	No
Nickel	NA	7440-02-0	17.7	22.7	22.7	38.5	13	NA	Yes (USEPA IBC)	22.7	No
Selenium	NA	7782-49-2	1.7	NA	NA	NA	0.9	NA	Yes (USEPA IBC)	0.9	Yes
Silver	NA	7440-22-4	ND	NA	0.5	1.8	1	NA	Yes (USEPA IBC)	0.5	No
Sodium	NA		112	NA	NA	NA	NA	NA	No (not USEPA IBC)	Nutrient	NA
Strontium	NA	7440-24-6	NA	NA	NA	NA	1700	NA	No (not USEPA IBC)	1700	Yes
Thallium	NA	7440-28-0	0.89	NA	NA	NA	0.044	NA	No (not USEPA IBC)	0.044	Yes
Vanadium	NA	7440-62-2	26.1	NA	NA	NA	30	NA	No (not USEPA IBC)	30	Yes
Zinc	NA	7440-66-0	532	121	121	270	65	NA	Yes (USEPA IBC)	121	No
General Chemistry											

Table G-3
Proposed Sediment Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Sediment								
				Ecological Screening Values							
			Sediment Background Value	MacDonald et al. 2000[a]	Region 5 ESLs 2003[a]	ORNL PRGs 1997[c]	LANL ESLs 2010[c]	Talmage et al. 1999a	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Sediment Ecological Screening Value [g]	Is the ESV Protective of Food Chain Effects?
			(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)			
Cyanide, Total		57-12-5	NA	NA	0.0001	NA	0.1	NA	No (not USEPA IBC)	0.0001	No
Volatile Organic Compounds											
Acetone	-0.24	67-64-1	NA	NA	0.0099	0.0091	0.065	NA	No (not USEPA IBC)	0.0099	No
SVOCs (USEPA SW-846 8270C)											
1,2,4-Trichlorobenzene	3.93	120-82-1	NA	NA	5.062	9.7	0.33	NA	**Yes (Log Kow ≥ 3.0)**	5.062	No
1,2-Dichlorobenzene	3.28	95-50-1	NA	NA	0.294	0.33	1.1	NA	**Yes (Log Kow ≥ 3.0)**	0.294	No
1,3-Dichlorobenzene	3.28	541-73-1	NA	NA	1.315	1.7	0.92	NA	**Yes (Log Kow ≥ 3.0)**	1.315	No
1,4-Dichlorobenzene	3.28	106-46-7	NA	NA	0.318	0.35	0.35	NA	**Yes (Log Kow ≥ 3.0)**	0.318	No
2,4,5-Trichlorophenol	3.45	95-95-4	NA	NA	NA	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	NA	NA
2,4,6-Trichlorophenol	3.45	88-06-2	NA	NA	0.208	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.208	No
2,4-Dichlorophenol	2.8	120-83-2	NA	NA	0.0817	NA	NA	NA	No (Log Kow < 3.0)	0.0817	No
2,4-Dimethylphenol	2.61	105-67-9	NA	NA	0.304	NA	NA	NA	No (Log Kow < 3.0)	0.304	No
2,4-Dinitrophenol	1.73	51-28-5	NA	NA	0.00621	NA	NA	NA	No (Log Kow < 3.0)	0.00621	No
2,4-Dinitrotoluene	2.18	121-14-2	NA	NA	0.014	NA	0.29	NA	No (Log Kow < 3.0)	0.014	No
2,6-Dinitrotoluene	2.18	606-20-2	NA	NA	0.0398	NA	1.9	NA	No (Log Kow < 3.0)	0.0398	No
2-Chloronaphthalene	3.81	91-58-7	NA	NA	0.417	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.417	No
2-Chlorophenol	2.16	95-57-8	NA	NA	0.0319	NA	0.057	NA	No (Log Kow < 3.0)	0.0319	No
2-Methylnaphthalene	3.72	91-57-6	NA	NA	0.0202	NA	0.18	NA	**Yes (Log Kow ≥ 3.0)**	0.0202	No
2-Methylphenol	2.06	95-48-7	NA	NA	0.0554	0.012	1900	NA	No (Log Kow < 3.0)	0.0554	No
2-Nitroaniline	2.02	88-74-4	NA	NA	NA	NA	8.1	NA	No (Log Kow < 3.0)	8.1	Yes
2-Nitrophenol	1.91	88-75-5	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
3 & 4-Methylphenol	2.06	CASID30030	NA	NA	0.0202	NA	NA	NA	No (Log Kow < 3.0)	0.0202	No
3,3'-Dichlorobenzidine	3.21	91-94-1	NA	NA	0.127	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.127	No
3-Nitroaniline	1.47	99-09-2	NA	NA	NA	NA	8.1 [L]	NA	No (Log Kow < 3.0)	8.1	Yes
4,6-Dinitro-2-methylphenol	2.27	534-52-1	NA	NA	0.104	NA	NA	NA	No (Log Kow < 3.0)	0.104	No
4-Bromophenyl-phenyl ether	4.94	101-55-3	NA	NA	1.55	1.2	NA	NA	**Yes (Log Kow ≥ 3.0)**	1.55	No
4-Chloro-3-methylphenol	2.7	59-50-7	NA	NA	0.388	NA	NA	NA	No (Log Kow < 3.0)	0.388	No
4-Chloroaniline	1.72	106-47-8	NA	NA	0.146	NA	NA	NA	No (Log Kow < 3.0)	0.146	No
4-Chlorophenyl-phenyl ether	4.69	7005-72-3	NA	NA	NA	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	NA	NA
4-Nitroaniline	1.47	100-01-6	NA	NA	NA	NA	8.1 [L]	NA	No (Log Kow < 3.0)	8.1	Yes
4-Nitrophenol	1.91	100-02-7	NA	NA	0.0133	NA	NA	NA	No (Log Kow < 3.0)	0.0133	No
Acenaphthene	4.15	83-32-9	NA	NA	0.00671	0.089	0.62	NA	**Yes (Log Kow ≥ 3.0)**	0.00671	No
Acenaphthylene	3.94	208-96-8	NA	NA	0.00587	0.13	0.044	NA	**Yes (Log Kow ≥ 3.0)**	0.00587	No
Anthracene	4.35	120-12-7	NA	0.0572	0.0572	0.25	0.00039	NA	**Yes (Log Kow ≥ 3.0)**	0.0572	No
Benzo(a)anthracene	5.52	56-55-3	NA	0.108	0.108	0.69	0.11	NA	**Yes (Log Kow ≥ 3.0)**	0.108	No
Benzo(a)pyrene	6.11	50-32-8	NA	0.15	0.15	0.394	0.35	NA	**Yes (Log Kow ≥ 3.0)**	0.15	No
Benzo(b)fluoranthene	6.11	205-99-2	NA	NA	10.4	4	0.24	NA	**Yes (Log Kow ≥ 3.0)**	10.4	No
Benzo(g,h,i)perylene	6.7	191-24-2	NA	NA	0.17	6.3	0.29	NA	**Yes (Log Kow ≥ 3.0)**	0.17	No
Benzo(k)fluoranthene	6.11	207-08-9	NA	NA	0.24	4	0.24	NA	**Yes (Log Kow ≥ 3.0)**	0.24	No
Benzoic acid	1.87	65-85-0	NA	NA	NA	NA	0.065	NA	No (Log Kow < 3.0)	0.065	No
Benzyl alcohol	1.08	100-51-6	NA	NA	0.00104	0.0011	330	NA	No (Log Kow < 3.0)	0.00104	No
Bis(2-chloroethoxy)methane	1.3	111-91-1	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
Bis(2-chloroethyl)ether	1.56	111-44-4	NA	NA	3.52	NA	NA	NA	No (Log Kow < 3.0)	3.52	No
Bis(2-chloroisopropyl)ether	2.39	108-60-1	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
Bis(2-ethylhexyl)phthalate	8.39	117-81-7	NA	NA	0.182	2.7	0.026	NA	**Yes (Log Kow ≥ 3.0)**	0.182	No
Butylbenzylphthalate	4.84	85-68-7	NA	NA	1.97	NA	13	NA	**Yes (Log Kow ≥ 3.0)**	1.97	No

Table G-3
Proposed Sediment Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Sediment								
				Ecological Screening Values							
			Sediment Background Value (mg/kg)	MacDonald et al. 2000[a] (mg/kg)	Region 5 ESLs 2003[a] (mg/kg)	ORNL PRGs 1997[c] (mg/kg)	LANL ESLs 2010[c] (mg/kg)	Talmage et al. 1999a (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Sediment Ecological Screening Value [g]	Is the ESV Protective of Food Chain Effects?
Carbazole	3.23	86-74-8	NA	NA	NA	NA	0.00014	NA	**Yes (Log Kow ≥ 3.0)**	0.00014	Yes
Chrysene	5.52	218-01-9	NA	0.166	0.166	0.85	0.5	NA	**Yes (Log Kow ≥ 3.0)**	0.166	No
Di-n-butylphthalate	4.61	84-74-2	NA	NA	1.114	240	0.014	NA	**Yes (Log Kow ≥ 3.0)**	1.114	No
Di-n-octylphthalate	8.54	117-84-0	NA	NA	40.6	NA	1.3	NA	**Yes (Log Kow ≥ 3.0)**	40.6	No
Dibenzo(a,h)anthracene	6.7	53-70-3	NA	0.033	0.033	0.0282	0.015	NA	**Yes (Log Kow ≥ 3.0)**	0.033	No
Dibenzofuran	3.71	132-64-9	NA	NA	0.449	0.42	2.3	NA	**Yes (Log Kow ≥ 3.0)**	0.449	No
Diethylphthalate	2.65	84-66-2	NA	NA	0.295	0.61	4500	NA	No (Log Kow < 3.0)	0.295	No
Dimethylphthalate	1.66	131-11-3	NA	NA	NA	NA	120	NA	No (Log Kow < 3.0)	120	Yes
Fluoranthene	4.93	206-44-0	NA	0.423	0.423	0.834	2.9	NA	**Yes (Log Kow ≥ 3.0)**	0.423	No
Fluorene	4.02	86-73-7	NA	0.0774	0.0774	0.14	0.54	NA	**Yes (Log Kow ≥ 3.0)**	0.0774	No
Hexachlorobenzene	5.86	118-74-1	NA	NA	0.02	NA	0.1	NA	**Yes (Log Kow ≥ 3.0)**	0.02	No
Hexachlorobutadiene	4.72	87-68-3	NA	NA	0.0265	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.0265	No
Hexachlorocyclopentadiene	4.63	77-47-4	NA	NA	0.901	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.901	No
Hexachloroethane	4.03	67-72-1	NA	NA	0.584	1	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.584	No
Indeno(1,2,3-cd)pyrene	6.7	193-39-5	NA	NA	0.2	0.837	0.078	NA	**Yes (Log Kow ≥ 3.0)**	0.2	No
Isophorone	2.62	78-59-1	NA	NA	0.432	NA	NA	NA	No (Log Kow < 3.0)	0.432	No
N-Nitroso-di-n-propylamine	1.33	621-64-7	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
N-Nitrosodiphenylamine & Diphn	3.16	86-30-6	NA	NA	NA	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	NA	NA
Naphthalene	3.17	91-20-3	NA	0.176	0.176	0.39	0.47	NA	**Yes (Log Kow ≥ 3.0)**	0.176	No
Nitrobenzene	1.81	98-95-3	NA	NA	0.145	NA	32	NA	No (Log Kow < 3.0)	0.145	No
Pentachlorophenol	4.74	87-86-5	NA	NA	23	NA	0.48	NA	**Yes (Log Kow ≥ 3.0)**	23	No
Phenanthrene	4.35	85-01-8	NA	0.204	0.204	0.54	0.85	NA	**Yes (Log Kow ≥ 3.0)**	0.204	No
Phenol	1.51	108-95-2	NA	NA	0.0491	0.032	840	NA	No (Log Kow < 3.0)	0.0491	No
Pyrene	4.93	129-00-0	NA	0.195	0.195	1.4	0.57	NA	**Yes (Log Kow ≥ 3.0)**	0.195	No
Pesticides											
4,4'-DDD	5.87	72-54-8	NA	0.00488	0.00488	0.0078	0.0084	NA	**Yes (Log Kow ≥ 3.0)**	0.00488	No
4,4'-DDE	6	72-55-9	NA	0.00316	0.00316	0.027	0.0022	NA	**Yes (Log Kow ≥ 3.0)**	0.00316	No
4,4'-DDT	6.79	50-29-3	NA	0.00416	0.00416	0.052	0.0015	NA	**Yes (Log Kow ≥ 3.0)**	0.00416	No
alpha-Chlordane	6.26	5103-71-9	NA	0.00324	0.00324	0.0048	0.0005	NA	**Yes (Log Kow ≥ 3.0)**	0.00324	No
beta-BHC	4.26	319-84-6	NA	NA	0.006	120	0.14	NA	**Yes (Log Kow ≥ 3.0)**	0.006	No
delta-BHC	4.26	319-86-8	NA	NA	7.15	120	NA	NA	**Yes (Log Kow ≥ 3.0)**	7.15	No
Dieldrin	5.45	60-57-1	NA	0.0019	0.0019	0.0043	0.0056	NA	**Yes (Log Kow ≥ 3.0)**	0.0019	No
Endosulfan Sulfate	3.64	1031-7-8	NA	NA	34.6	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	34.6	No
Endrin Aldehyde	4.8	7421-93-4	NA	NA	0.48	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.48	No
gamma-Chlordane	6.26	5103-74-2	NA	0.00324	0.00324	0.0048	0.0005	NA	**Yes (Log Kow ≥ 3.0)**	0.00324	No
Heptachlor	5.86	76-44-8	NA	NA	0.6	13	0.01	NA	**Yes (Log Kow ≥ 3.0)**	0.6	No
Methoxychlor	5.67	72-43-5	NA	NA	0.0136	0.019	0.03	NA	**Yes (Log Kow ≥ 3.0)**	0.0136	No
PCBs (Method SW-846 8082A)											
Aroclor 1016	5.69	12674-11-2	NA	0.0598	0.0598	0.53	0.01	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1221	4.4	11104-28-2	NA	0.0598	0.0598	0.12	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1232	4.4	11141-16-5	NA	0.0598	0.0598	0.6	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1242	6.34	53469-21-9	NA	0.0598	0.0598	29	0.031	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1248	6.34	12672-29-6	NA	0.0598	0.0598	1	0.009	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1254	6.98	11097-69-1	NA	0.0598	0.0598	72	0.031	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1260	8.27	11096-82-5	NA	0.0598	0.0598	63	0.031	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Aroclor 1262			NA	NA	0.0598	NA	NA	NA	**Yes (Log Kow ≥ 3.0)**	0.0598	No
Nitrocellulose											

Table G-3
Proposed Sediment Ecological Screening Levels for Ravenna Army Ammunition Plant

Analyte	Log Kow	CAS Number	Sediment Background Value (mg/kg)	MacDonald et al. 2000[a] (mg/kg)	Region 5 ESLs 2003[a] (mg/kg)	ORNL PRGs 1997[c] (mg/kg)	LANL ESLs 2010[c] (mg/kg)	Talmage et al. 1999a (mg/kg)	Persistent, Bioaccumulative, and Toxic Pollutant [f]	Recommended Sediment Ecological Screening Value [g]	Is the ESV Protective of Food Chain Effects?
			Sediment								
				Ecological Screening Values							
Nitrocellulose	-4.56	9004-70-0	NA	NA	NA	NA	NA	NA	No (Log Kow < 3.0)	NA	NA
Total Organic Carbon									---		
Total Organic Carbon	NA	TOC	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH	NA	pH (Units)	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

[a] *MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000, Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems, Arch. Environ. Contam. Toxicol. 39:20-31.*

TEC = threshold effect concentration.

[b] *Ecological Screening Levels (ESLs), US EPA Region V, August 2003.*

[c] *ORNL: Efroymson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints, ES/ER/TM-162/R2.*

[d] *Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.5, October 2010.*

[e] *From Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, Talmage et al., 1999, Rev. Environ. Contamin. Toxicol., 161: 1-156. Sediment benchmarks originally reported as mg compound per kg total organic carbon (TOC) in sediment, and 10% TOC assumed.*

[f] *Analyte identified as a persistent, bioaccumulative, and toxic (PBT) compound (OEPA DERR ERA Guidance, April 2008).*

[g] *The following hierarchy (based on OEPA DERR ERA Guidance, April 2008) was used to select the sediment screening values:*

1. MacDonald et al. (2000)
2. USEPA Region 5 ESLs (2003)
3. ORNL (1997) [plants, invertebrates, wildlife]
4. LANL (2010) [various endpoints]
5. Talmage et al. (1999)

CAS = Chemical Abstract Service.
mg/kg = milligrams per kilogram.
NA = RVAAP-specific screening level not available
RVAAP = Ravenna Army Ammunition Plant.
SVOC = semivolatile organic compound

Appendix H
Ecological Risk Assessment Tables

Table H-1
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Short-tailed Shrew
Sand Creek Dump
Ravenna Army Ammunition Plant, Ravenna, Ohio

Chemical		Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$	HQ $_{NOAEL}$	TRV $_{LOAEL}$	HQ $_{LOAEL}$
								----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals																														
Mercury	MAX	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.74E+00	0.00E+00	0.00E+00	1.52E+00	0.00E+00	1.51E-01	0.00E+00	0.00E+00	3.40E+00	1.30E+01	2.62E-01	1.32E+02	2.58E-02
Mercury	AVG	0.00E+00	mg/L	0.00E+00	mg/kg	3.60E+00	mg/kg	1.00E+00			4.58E-01		2.04E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.54E-01	0.00E+00	0.00E+00	8.04E-01	0.00E+00	5.35E-02	0.00E+00	0.00E+00	1.11E+00	1.30E+01	8.55E-02	1.32E+02	8.42E-03
Mercury	SCSS-057	0.00E+00	mg/L	0.00E+00	mg/kg	1.51E+01	mg/kg	1.00E+00			1.75E-01		1.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.07E+00	0.00E+00	0.00E+00	1.29E+00	0.00E+00	1.16E-01	0.00E+00	0.00E+00	2.47E+00	1.30E+01	1.90E-01	1.32E+02	1.87E-02
Mercury	SCSS-058	0.00E+00	mg/L	0.00E+00	mg/kg	1.11E+01	mg/kg	1.00E+00			2.16E-01		1.22E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	7.84E-01	0.00E+00	0.00E+00	1.17E+00	0.00E+00	9.82E-02	0.00E+00	0.00E+00	2.05E+00	1.30E+01	1.57E-01	1.32E+02	1.55E-02
Mercury	SCSS-059	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.74E+00	0.00E+00	0.00E+00	1.52E+00	0.00E+00	1.51E-01	0.00E+00	0.00E+00	3.40E+00	1.30E+01	2.62E-01	1.32E+02	2.58E-02
Mercury	SCSS-060	0.00E+00	mg/L	0.00E+00	mg/kg	8.80E+00	mg/kg	1.00E+00			2.52E-01		1.35E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	6.21E-01	0.00E+00	0.00E+00	1.08E+00	0.00E+00	8.67E-02	0.00E+00	0.00E+00	1.79E+00	1.30E+01	1.37E-01	1.32E+02	1.35E-02
Mercury	SCSS-061	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E+00	mg/kg	1.00E+00			5.56E-01		2.33E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.91E-01	0.00E+00	0.00E+00	7.31E-01	0.00E+00	4.58E-02	0.00E+00	0.00E+00	9.67E-01	1.30E+01	7.44E-02	1.32E+02	7.33E-03
Mercury	SCSS-062	0.00E+00	mg/L	0.00E+00	mg/kg	5.00E-01	mg/kg	1.00E+00			1.72E+00		5.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.53E-02	0.00E+00	0.00E+00	4.19E-01	0.00E+00	1.84E-02	0.00E+00	0.00E+00	4.73E-01	1.30E+01	3.64E-02	1.32E+02	3.58E-03
Mercury	SCSS-063	0.00E+00	mg/L	0.00E+00	mg/kg	5.50E-01	mg/kg	1.00E+00			1.61E+00		4.84E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.88E-02	0.00E+00	0.00E+00	4.32E-01	0.00E+00	1.94E-02	0.00E+00	0.00E+00	4.91E-01	1.30E+01	3.77E-02	1.32E+02	3.72E-03
Mercury	SCSS-064	0.00E+00	mg/L	0.00E+00	mg/kg	7.80E-02	mg/kg	1.00E+00			5.97E+00		1.19E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.51E-03	0.00E+00	0.00E+00	2.27E-01	0.00E+00	6.75E-03	0.00E+00	0.00E+00	2.39E-01	1.30E+01	1.84E-02	1.32E+02	1.81E-03
Mercury	SCSS-065	0.00E+00	mg/L	0.00E+00	mg/kg	2.90E-02	mg/kg	1.00E+00			1.16E+01		1.88E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.05E-03	0.00E+00	0.00E+00	1.64E-01	0.00E+00	3.96E-03	0.00E+00	0.00E+00	1.70E-01	1.30E+01	1.31E-02	1.32E+02	1.29E-03
Mercury	SCSS-066	0.00E+00	mg/L	0.00E+00	mg/kg	7.00E-02	mg/kg	1.00E+00			6.42E+00		1.25E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.94E-03	0.00E+00	0.00E+00	2.19E-01	0.00E+00	6.37E-03	0.00E+00	0.00E+00	2.30E-01	1.30E+01	1.77E-02	1.32E+02	1.74E-03
Mercury	SCSS-067	0.00E+00	mg/L	0.00E+00	mg/kg	2.60E-02	mg/kg	1.00E+00			1.25E+01		1.97E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.84E-03	0.00E+00	0.00E+00	1.58E-01	0.00E+00	3.73E-03	0.00E+00	0.00E+00	1.64E-01	1.30E+01	1.26E-02	1.32E+02	1.24E-03
Mercury	SCSS-068	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-02	mg/kg	1.00E+00			1.11E+01		1.82E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.19E-03	0.00E+00	0.00E+00	1.67E-01	0.00E+00	4.10E-03	0.00E+00	0.00E+00	1.74E-01	1.30E+01	1.34E-02	1.32E+02	1.32E-03
Mercury	SCSS-069	0.00E+00	mg/L	0.00E+00	mg/kg	6.10E-02	mg/kg	1.00E+00			7.04E+00		1.33E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.31E-03	0.00E+00	0.00E+00	2.09E-01	0.00E+00	5.91E-03	0.00E+00	0.00E+00	2.20E-01	1.30E+01	1.69E-02	1.32E+02	1.66E-03
Mercury	SCSS-072	0.00E+00	mg/L	0.00E+00	mg/kg	6.30E-02	mg/kg	1.00E+00			6.89E+00		1.31E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.45E-03	0.00E+00	0.00E+00	2.12E-01	0.00E+00	6.02E-03	0.00E+00	0.00E+00	2.22E-01	1.30E+01	1.71E-02	1.32E+02	1.68E-03
Mercury	SCSS-073	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			2.60E+00		6.72E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.91E-02	0.00E+00	0.00E+00	3.42E-01	0.00E+00	1.32E-02	0.00E+00	0.00E+00	3.74E-01	1.30E+01	2.88E-02	1.32E+02	2.83E-03
Mercury	SCSS-074	0.00E+00	mg/L	0.00E+00	mg/kg	1.30E-01	mg/kg	1.00E+00			4.24E+00		9.40E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	9.18E-03	0.00E+00	0.00E+00	2.69E-01	0.00E+00	8.90E-03	0.00E+00	0.00E+00	2.87E-01	1.30E+01	2.21E-02	1.32E+02	2.17E-03
Mercury	SCSS-075	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-02	mg/kg	1.00E+00			7.64E+00		1.41E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.81E-03	0.00E+00	0.00E+00	2.01E-01	0.00E+00	5.54E-03	0.00E+00	0.00E+00	2.10E-01	1.30E+01	1.62E-02	1.32E+02	1.59E-03
Mercury	SCSS-076	0.00E+00	mg/L	0.00E+00	mg/kg	4.90E-02	mg/kg	1.00E+00			8.16E+00		1.47E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.46E-03	0.00E+00	0.00E+00	1.95E-01	0.00E+00	5.25E-03	0.00E+00	0.00E+00	2.03E-01	1.30E+01	1.56E-02	1.32E+02	1.54E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0.13	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0.87	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.0012	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.00952	kg/d
Body weight =	0.017	kg
Home range =	0.96	acres
Water intake rate =	0.0038	L/d
Site Area =	2	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table H-2
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the American Robin
Sand Creek Dump
Ravenna Army Ammunition Plant, Ravenna, Ohio

Chemical		Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV NOAEL	HQ NOAEL	TRV LOAEL	HQ LOAEL	
								----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d		
Metals																															
Mercury	MAX	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.48E+00	0.00E+00	0.00E+00	1.87E+00	0.00E+00	1.24E+00	0.00E+00	0.00E+00	4.59E+00	4.50E-01	1.02E+01	9.00E-01	5.10E+00	MAX
Mercury	AVG	0.00E+00	mg/L	0.00E+00	mg/kg	3.60E+00	mg/kg	1.00E+00			4.58E-01		2.04E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.16E-01	0.00E+00	0.00E+00	9.90E-01	0.00E+00	4.41E-01	0.00E+00	0.00E+00	1.65E+00	4.50E-01	3.66E+00	9.00E-01	1.83E+00	AVG
Mercury	SCSS-057	0.00E+00	mg/L	0.00E+00	mg/kg	1.51E+01	mg/kg	1.00E+00			1.75E-01		1.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	9.06E-01	0.00E+00	0.00E+00	1.59E+00	0.00E+00	9.56E-01	0.00E+00	0.00E+00	3.45E+00	4.50E-01	7.67E+00	9.00E-01	3.83E+00	SCSS-057
Mercury	SCSS-058	0.00E+00	mg/L	0.00E+00	mg/kg	1.11E+01	mg/kg	1.00E+00			2.16E-01		1.22E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	6.66E-01	0.00E+00	0.00E+00	1.44E+00	0.00E+00	8.10E-01	0.00E+00	0.00E+00	2.91E+00	4.50E-01	6.47E+00	9.00E-01	3.23E+00	SCSS-058
Mercury	SCSS-059	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.48E+00	0.00E+00	0.00E+00	1.87E+00	0.00E+00	1.24E+00	0.00E+00	0.00E+00	4.59E+00	4.50E-01	1.02E+01	9.00E-01	5.10E+00	SCSS-059
Mercury	SCSS-060	0.00E+00	mg/L	0.00E+00	mg/kg	8.80E+00	mg/kg	1.00E+00			2.52E-01		1.35E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.28E-01	0.00E+00	0.00E+00	1.33E+00	0.00E+00	7.14E-01	0.00E+00	0.00E+00	2.57E+00	4.50E-01	5.72E+00	9.00E-01	2.86E+00	SCSS-060
Mercury	SCSS-061	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E+00	mg/kg	1.00E+00			5.56E-01		2.33E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.62E-01	0.00E+00	0.00E+00	9.00E-01	0.00E+00	3.77E-01	0.00E+00	0.00E+00	1.44E+00	4.50E-01	3.20E+00	9.00E-01	1.60E+00	SCSS-061
Mercury	SCSS-062	0.00E+00	mg/L	0.00E+00	mg/kg	5.00E-01	mg/kg	1.00E+00			1.72E+00		5.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.00E-02	0.00E+00	0.00E+00	5.16E-01	0.00E+00	1.52E-01	0.00E+00	0.00E+00	6.98E-01	4.50E-01	1.55E+00	9.00E-01	7.75E-01	SCSS-062
Mercury	SCSS-063	0.00E+00	mg/L	0.00E+00	mg/kg	5.50E-01	mg/kg	1.00E+00			1.61E+00		4.84E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.30E-02	0.00E+00	0.00E+00	5.33E-01	0.00E+00	1.60E-01	0.00E+00	0.00E+00	7.25E-01	4.50E-01	1.61E+00	9.00E-01	8.06E-01	SCSS-063
Mercury	SCSS-064	0.00E+00	mg/L	0.00E+00	mg/kg	7.80E-02	mg/kg	1.00E+00			5.97E+00		1.19E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.68E-03	0.00E+00	0.00E+00	2.80E-01	0.00E+00	5.57E-02	0.00E+00	0.00E+00	3.40E-01	4.50E-01	7.55E-01	9.00E-01	3.78E-01	SCSS-064
Mercury	SCSS-065	0.00E+00	mg/L	0.00E+00	mg/kg	2.90E-02	mg/kg	1.00E+00			1.16E+01		1.88E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.74E-03	0.00E+00	0.00E+00	2.02E-01	0.00E+00	3.26E-02	0.00E+00	0.00E+00	2.36E-01	4.50E-01	5.24E-01	9.00E-01	2.62E-01	SCSS-065
Mercury	SCSS-066	0.00E+00	mg/L	0.00E+00	mg/kg	7.00E-02	mg/kg	1.00E+00			6.42E+00		1.25E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.20E-03	0.00E+00	0.00E+00	2.70E-01	0.00E+00	5.25E-02	0.00E+00	0.00E+00	3.26E-01	4.50E-01	7.25E-01	9.00E-01	3.63E-01	SCSS-066
Mercury	SCSS-067	0.00E+00	mg/L	0.00E+00	mg/kg	2.60E-02	mg/kg	1.00E+00			1.25E+01		1.97E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.56E-03	0.00E+00	0.00E+00	1.95E-01	0.00E+00	3.08E-02	0.00E+00	0.00E+00	2.27E-01	4.50E-01	5.04E-01	9.00E-01	2.52E-01	SCSS-067
Mercury	SCSS-068	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-02	mg/kg	1.00E+00			1.11E+01		1.82E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.86E-03	0.00E+00	0.00E+00	2.06E-01	0.00E+00	3.38E-02	0.00E+00	0.00E+00	2.42E-01	4.50E-01	5.37E-01	9.00E-01	2.69E-01	SCSS-068
Mercury	SCSS-069	0.00E+00	mg/L	0.00E+00	mg/kg	6.10E-02	mg/kg	1.00E+00			7.04E+00		1.33E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.66E-03	0.00E+00	0.00E+00	2.58E-01	0.00E+00	4.87E-02	0.00E+00	0.00E+00	3.10E-01	4.50E-01	6.89E-01	9.00E-01	3.45E-01	SCSS-069
Mercury	SCSS-072	0.00E+00	mg/L	0.00E+00	mg/kg	6.30E-02	mg/kg	1.00E+00			6.89E+00		1.31E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.78E-03	0.00E+00	0.00E+00	2.61E-01	0.00E+00	4.96E-02	0.00E+00	0.00E+00	3.14E-01	4.50E-01	6.98E-01	9.00E-01	3.49E-01	SCSS-072
Mercury	SCSS-073	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			2.60E+00		6.72E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.62E-02	0.00E+00	0.00E+00	4.21E-01	0.00E+00	1.09E-01	0.00E+00	0.00E+00	5.46E-01	4.50E-01	1.21E+00	9.00E-01	6.07E-01	SCSS-073
Mercury	SCSS-074	0.00E+00	mg/L	0.00E+00	mg/kg	1.30E-01	mg/kg	1.00E+00			4.24E+00		9.40E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	7.80E-03	0.00E+00	0.00E+00	3.31E-01	0.00E+00	7.33E-02	0.00E+00	0.00E+00	4.12E-01	4.50E-01	9.16E-01	9.00E-01	4.58E-01	SCSS-074
Mercury	SCSS-075	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-02	mg/kg	1.00E+00			7.64E+00		1.41E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.24E-03	0.00E+00	0.00E+00	2.48E-01	0.00E+00	4.56E-02	0.00E+00	0.00E+00	2.96E-01	4.50E-01	6.59E-01	9.00E-01	3.29E-01	SCSS-075
Mercury	SCSS-076	0.00E+00	mg/L	0.00E+00	mg/kg	4.90E-02	mg/kg	1.00E+00			8.16E+00		1.47E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.94E-03	0.00E+00	0.00E+00	2.40E-01	0.00E+00	4.33E-02	0.00E+00	0.00E+00	2.86E-01	4.50E-01	6.36E-01	9.00E-01	3.18E-01	SCSS-076

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \times Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0.5	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0.5	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.00486	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.0972	kg/d
Body weight =	0.081	kg
Home range =	0.618	acres
Water intake rate =	0.011	L/d
Site Area =	2	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table H-3
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Meadow Vole
Sand Creek Dump
Ravenna Army Ammunition Plant, Ravenna, Ohio

Chemical		Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$		TRV $_{LOAEL}$	
								----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	HQ $_{NOAEL}$	mg/kg-d	HQ $_{LOAEL}$
Metals																														
Mercury	MAX	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.84E-01	0.00E+00	0.00E+00	8.48E-01	1.30E+01	6.53E-02	1.32E+02	6.43E-03
Mercury	AVG	0.00E+00	mg/L	0.00E+00	mg/kg	3.60E+00	mg/kg	1.00E+00			4.58E-01		2.04E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-01	0.00E+00	0.00E+00	2.66E-01	1.30E+01	2.05E-02	1.32E+02	2.02E-03
Mercury	SCSS-057	0.00E+00	mg/L	0.00E+00	mg/kg	1.51E+01	mg/kg	1.00E+00			1.75E-01		1.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E-01	0.00E+00	0.00E+00	6.27E-01	1.30E+01	4.82E-02	1.32E+02	4.75E-03
Mercury	SCSS-058	0.00E+00	mg/L	0.00E+00	mg/kg	1.11E+01	mg/kg	1.00E+00			2.16E-01		1.22E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	7.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.45E-01	0.00E+00	0.00E+00	5.19E-01	1.30E+01	3.99E-02	1.32E+02	3.93E-03
Mercury	SCSS-059	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.84E-01	0.00E+00	0.00E+00	8.48E-01	1.30E+01	6.53E-02	1.32E+02	6.43E-03
Mercury	SCSS-060	0.00E+00	mg/L	0.00E+00	mg/kg	8.80E+00	mg/kg	1.00E+00			2.52E-01		1.35E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.87E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.93E-01	0.00E+00	0.00E+00	4.52E-01	1.30E+01	3.47E-02	1.32E+02	3.42E-03
Mercury	SCSS-061	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E+00	mg/kg	1.00E+00			5.56E-01		2.33E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.80E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-01	0.00E+00	0.00E+00	2.26E-01	1.30E+01	1.74E-02	1.32E+02	1.71E-03
Mercury	SCSS-062	0.00E+00	mg/L	0.00E+00	mg/kg	5.00E-01	mg/kg	1.00E+00			1.72E+00		5.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.33E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.35E-02	0.00E+00	0.00E+00	8.68E-02	1.30E+01	6.68E-03	1.32E+02	6.58E-04
Mercury	SCSS-063	0.00E+00	mg/L	0.00E+00	mg/kg	5.50E-01	mg/kg	1.00E+00			1.61E+00		4.84E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.67E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.79E-02	0.00E+00	0.00E+00	9.16E-02	1.30E+01	7.04E-03	1.32E+02	6.94E-04
Mercury	SCSS-064	0.00E+00	mg/L	0.00E+00	mg/kg	7.80E-02	mg/kg	1.00E+00			5.97E+00		1.19E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-02	0.00E+00	0.00E+00	3.11E-02	1.30E+01	2.40E-03	1.32E+02	2.36E-04
Mercury	SCSS-065	0.00E+00	mg/L	0.00E+00	mg/kg	2.90E-02	mg/kg	1.00E+00			1.16E+01		1.88E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.93E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-02	0.00E+00	0.00E+00	1.81E-02	1.30E+01	1.40E-03	1.32E+02	1.37E-04
Mercury	SCSS-066	0.00E+00	mg/L	0.00E+00	mg/kg	7.00E-02	mg/kg	1.00E+00			6.42E+00		1.25E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.67E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.89E-02	0.00E+00	0.00E+00	2.93E-02	1.30E+01	2.26E-03	1.32E+02	2.22E-04
Mercury	SCSS-067	0.00E+00	mg/L	0.00E+00	mg/kg	2.60E-02	mg/kg	1.00E+00			1.25E+01		1.97E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.73E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-02	0.00E+00	0.00E+00	1.71E-02	1.30E+01	1.31E-03	1.32E+02	1.29E-04
Mercury	SCSS-068	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-02	mg/kg	1.00E+00			1.11E+01		1.82E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.86E-02	0.00E+00	0.00E+00	1.88E-02	1.30E+01	1.45E-03	1.32E+02	1.42E-04
Mercury	SCSS-069	0.00E+00	mg/L	0.00E+00	mg/kg	6.10E-02	mg/kg	1.00E+00			7.04E+00		1.33E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.07E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.68E-02	0.00E+00	0.00E+00	2.72E-02	1.30E+01	2.09E-03	1.32E+02	2.06E-04
Mercury	SCSS-072	0.00E+00	mg/L	0.00E+00	mg/kg	6.30E-02	mg/kg	1.00E+00			6.89E+00		1.31E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.73E-02	0.00E+00	0.00E+00	2.77E-02	1.30E+01	2.13E-03	1.32E+02	2.10E-04
Mercury	SCSS-073	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			2.60E+00		6.72E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.80E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.99E-02	0.00E+00	0.00E+00	6.17E-02	1.30E+01	4.74E-03	1.32E+02	4.67E-04
Mercury	SCSS-074	0.00E+00	mg/L	0.00E+00	mg/kg	1.30E-01	mg/kg	1.00E+00			4.24E+00		9.40E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	8.67E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.03E-02	0.00E+00	0.00E+00	4.12E-02	1.30E+01	3.17E-03	1.32E+02	3.12E-04
Mercury	SCSS-075	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-02	mg/kg	1.00E+00			7.64E+00		1.41E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.60E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.51E-02	0.00E+00	0.00E+00	2.55E-02	1.30E+01	1.96E-03	1.32E+02	1.93E-04
Mercury	SCSS-076	0.00E+00	mg/L	0.00E+00	mg/kg	4.90E-02	mg/kg	1.00E+00			8.16E+00		1.47E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	3.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.38E-02	0.00E+00	0.00E+00	2.41E-02	1.30E+01	1.86E-03	1.32E+02	1.83E-04

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \times Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (l) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	1	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.00022	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.01089	kg/d
Body weight =	0.033	kg
Home range =	0.07	acres
Water intake rate =	0.00594	L/d
Site Area =	2	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table H-4
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Red-tailed Hawk
Sand Creek Dump
Ravenna Army Ammunition Plant, Ravenna, Ohio

Chemical		Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$		TRV $_{LOAEL}$	
								----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	HQ $_{NOAEL}$	mg/kg-d	HQ $_{LOAEL}$
Metals																														
Mercury	MAX	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.20E-01	0.00E+00	5.20E-01	4.50E-01	1.15E+00	9.00E-01	5.77E-01
Mercury	AVG	0.00E+00	mg/L	0.00E+00	mg/kg	3.60E+00	mg/kg	1.00E+00			4.58E-01		2.04E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.60E-02	0.00E+00	7.60E-02	4.50E-01	1.69E-01	9.00E-01	8.45E-02
Mercury	SCSS-057	0.00E+00	mg/L	0.00E+00	mg/kg	1.51E+01	mg/kg	1.00E+00			1.75E-01		1.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.19E-01	0.00E+00	3.19E-01	4.50E-01	7.09E-01	9.00E-01	3.54E-01
Mercury	SCSS-058	0.00E+00	mg/L	0.00E+00	mg/kg	1.11E+01	mg/kg	1.00E+00			2.16E-01		1.22E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-01	0.00E+00	2.34E-01	4.50E-01	5.21E-01	9.00E-01	2.60E-01
Mercury	SCSS-059	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.20E-01	0.00E+00	5.20E-01	4.50E-01	1.15E+00	9.00E-01	5.77E-01
Mercury	SCSS-060	0.00E+00	mg/L	0.00E+00	mg/kg	8.80E+00	mg/kg	1.00E+00			2.52E-01		1.35E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.86E-01	0.00E+00	1.86E-01	4.50E-01	4.13E-01	9.00E-01	2.07E-01
Mercury	SCSS-061	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E+00	mg/kg	1.00E+00			5.56E-01		2.33E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.70E-02	0.00E+00	5.70E-02	4.50E-01	1.27E-01	9.00E-01	6.34E-02
Mercury	SCSS-062	0.00E+00	mg/L	0.00E+00	mg/kg	5.00E-01	mg/kg	1.00E+00			1.72E+00		5.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-02	0.00E+00	1.06E-02	4.50E-01	2.35E-02	9.00E-01	1.17E-02
Mercury	SCSS-063	0.00E+00	mg/L	0.00E+00	mg/kg	5.50E-01	mg/kg	1.00E+00			1.61E+00		4.84E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-02	0.00E+00	1.16E-02	4.50E-01	2.58E-02	9.00E-01	1.29E-02
Mercury	SCSS-064	0.00E+00	mg/L	0.00E+00	mg/kg	7.80E-02	mg/kg	1.00E+00			5.97E+00		1.19E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-03	0.00E+00	1.65E-03	4.50E-01	3.66E-03	9.00E-01	1.83E-03
Mercury	SCSS-065	0.00E+00	mg/L	0.00E+00	mg/kg	2.90E-02	mg/kg	1.00E+00			1.16E+01		1.88E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.12E-04	0.00E+00	6.12E-04	4.50E-01	1.36E-03	9.00E-01	6.81E-04
Mercury	SCSS-066	0.00E+00	mg/L	0.00E+00	mg/kg	7.00E-02	mg/kg	1.00E+00			6.42E+00		1.25E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-03	0.00E+00	1.48E-03	4.50E-01	3.29E-03	9.00E-01	1.64E-03
Mercury	SCSS-067	0.00E+00	mg/L	0.00E+00	mg/kg	2.60E-02	mg/kg	1.00E+00			1.25E+01		1.97E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.49E-04	0.00E+00	5.49E-04	4.50E-01	1.22E-03	9.00E-01	6.10E-04
Mercury	SCSS-068	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-02	mg/kg	1.00E+00			1.11E+01		1.82E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.55E-04	0.00E+00	6.55E-04	4.50E-01	1.45E-03	9.00E-01	7.27E-04
Mercury	SCSS-069	0.00E+00	mg/L	0.00E+00	mg/kg	6.10E-02	mg/kg	1.00E+00			7.04E+00		1.33E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.29E-03	0.00E+00	1.29E-03	4.50E-01	2.86E-03	9.00E-01	1.43E-03
Mercury	SCSS-072	0.00E+00	mg/L	0.00E+00	mg/kg	6.30E-02	mg/kg	1.00E+00			6.89E+00		1.31E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.33E-03	0.00E+00	1.33E-03	4.50E-01	2.96E-03	9.00E-01	1.48E-03
Mercury	SCSS-073	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			2.60E+00		6.72E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.70E-03	0.00E+00	5.70E-03	4.50E-01	1.27E-02	9.00E-01	6.34E-03
Mercury	SCSS-074	0.00E+00	mg/L	0.00E+00	mg/kg	1.30E-01	mg/kg	1.00E+00			4.24E+00		9.40E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E-03	0.00E+00	2.75E-03	4.50E-01	6.10E-03	9.00E-01	3.05E-03
Mercury	SCSS-075	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-02	mg/kg	1.00E+00			7.64E+00		1.41E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-03	0.00E+00	1.14E-03	4.50E-01	2.53E-03	9.00E-01	1.27E-03
Mercury	SCSS-076	0.00E+00	mg/L	0.00E+00	mg/kg	4.90E-02	mg/kg	1.00E+00			8.16E+00		1.47E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-03	0.00E+00	1.03E-03	4.50E-01	2.30E-03	9.00E-01	1.15E-03

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x \, Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (l) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	1	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.1243	kg/d
Body weight =	1.13	kg
Home range =	1722	acres
Water intake rate =	0.06441	L/d
Site Area =	2	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table H-5
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Barn Owl
Sand Creek Dump
Ravenna Army Ammunition Plant, Ravenna, Ohio

Chemical		Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$		TRV $_{LOAEL}$	
								----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	HQ $_{NOAEL}$	mg/kg-d	HQ $_{LOAEL}$
Metals																														
Mercury	MAX	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.90E-01	0.00E+00	5.90E-01	4.50E-01	1.31E+00	NA	NA
Mercury	AVG	0.00E+00	mg/L	0.00E+00	mg/kg	3.60E+00	mg/kg	1.00E+00			4.58E-01		2.04E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.64E-02	0.00E+00	8.64E-02	4.50E-01	1.92E-01	NA	NA
Mercury	SCSS-057	0.00E+00	mg/L	0.00E+00	mg/kg	1.51E+01	mg/kg	1.00E+00			1.75E-01		1.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.62E-01	0.00E+00	3.62E-01	4.50E-01	8.05E-01	NA	NA
Mercury	SCSS-058	0.00E+00	mg/L	0.00E+00	mg/kg	1.11E+01	mg/kg	1.00E+00			2.16E-01		1.22E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-01	0.00E+00	2.66E-01	4.50E-01	5.92E-01	NA	NA
Mercury	SCSS-059	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.90E-01	0.00E+00	5.90E-01	4.50E-01	1.31E+00	NA	NA
Mercury	SCSS-060	0.00E+00	mg/L	0.00E+00	mg/kg	8.80E+00	mg/kg	1.00E+00			2.52E-01		1.35E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E-01	0.00E+00	2.11E-01	4.50E-01	4.69E-01	NA	NA
Mercury	SCSS-061	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E+00	mg/kg	1.00E+00			5.56E-01		2.33E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.48E-02	0.00E+00	6.48E-02	4.50E-01	1.44E-01	NA	NA
Mercury	SCSS-062	0.00E+00	mg/L	0.00E+00	mg/kg	5.00E-01	mg/kg	1.00E+00			1.72E+00		5.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-02	0.00E+00	1.20E-02	4.50E-01	2.67E-02	NA	NA
Mercury	SCSS-063	0.00E+00	mg/L	0.00E+00	mg/kg	5.50E-01	mg/kg	1.00E+00			1.61E+00		4.84E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.32E-02	0.00E+00	1.32E-02	4.50E-01	2.93E-02	NA	NA
Mercury	SCSS-064	0.00E+00	mg/L	0.00E+00	mg/kg	7.80E-02	mg/kg	1.00E+00			5.97E+00		1.19E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.87E-03	0.00E+00	1.87E-03	4.50E-01	4.16E-03	NA	NA
Mercury	SCSS-065	0.00E+00	mg/L	0.00E+00	mg/kg	2.90E-02	mg/kg	1.00E+00			1.16E+01		1.88E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.96E-04	0.00E+00	6.96E-04	4.50E-01	1.55E-03	NA	NA
Mercury	SCSS-066	0.00E+00	mg/L	0.00E+00	mg/kg	7.00E-02	mg/kg	1.00E+00			6.42E+00		1.25E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-03	0.00E+00	1.68E-03	4.50E-01	3.73E-03	NA	NA
Mercury	SCSS-067	0.00E+00	mg/L	0.00E+00	mg/kg	2.60E-02	mg/kg	1.00E+00			1.25E+01		1.97E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.24E-04	0.00E+00	6.24E-04	4.50E-01	1.39E-03	NA	NA
Mercury	SCSS-068	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-02	mg/kg	1.00E+00			1.11E+01		1.82E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.44E-04	0.00E+00	7.44E-04	4.50E-01	1.65E-03	NA	NA
Mercury	SCSS-069	0.00E+00	mg/L	0.00E+00	mg/kg	6.10E-02	mg/kg	1.00E+00			7.04E+00		1.33E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-03	0.00E+00	1.46E-03	4.50E-01	3.25E-03	NA	NA
Mercury	SCSS-072	0.00E+00	mg/L	0.00E+00	mg/kg	6.30E-02	mg/kg	1.00E+00			6.89E+00		1.31E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-03	0.00E+00	1.51E-03	4.50E-01	3.36E-03	NA	NA
Mercury	SCSS-073	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			2.60E+00		6.72E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.48E-03	0.00E+00	6.48E-03	4.50E-01	1.44E-02	NA	NA
Mercury	SCSS-074	0.00E+00	mg/L	0.00E+00	mg/kg	1.30E-01	mg/kg	1.00E+00			4.24E+00		9.40E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.12E-03	0.00E+00	3.12E-03	4.50E-01	6.93E-03	NA	NA
Mercury	SCSS-075	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-02	mg/kg	1.00E+00			7.64E+00		1.41E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.30E-03	0.00E+00	1.30E-03	4.50E-01	2.88E-03	NA	NA
Mercury	SCSS-076	0.00E+00	mg/L	0.00E+00	mg/kg	4.90E-02	mg/kg	1.00E+00			8.16E+00		1.47E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-03	0.00E+00	1.18E-03	4.50E-01	2.61E-03	NA	NA

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x \, Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (l) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	1	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.05825	kg/d
Body weight =	0.466	kg
Home range =	617.8	acres
Water intake rate =	0.0163	L/d
Site Area =	2	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Table H-6
Chemicals of Potential Concern
Exposure Doses and Hazard Quotients for the Red Fox
Sand Creek Dump
Ravenna Army Ammunition Plant, Ravenna, Ohio

Chemical		Surface Water Exposure Point Concentration	Units	Sediment Exposure Point Concentration	Units	Surface Soil Exposure Point Concentration	Units	Soil BAF	Fish BAF	Aq. Invert. BAF	Terr. Invert. BAF	Aq. Plant BAF	Terr. Plant BAF	Mammal BAF	Bird BAF	EED Surface Water	EED Sediment	EED Soil	EED Fish	EED Aq. Invert.	EED Terr. Invert.	EED Aq. Plants	EED Terr. Plants	EED Mammals	EED Birds	Total EED	TRV $_{NOAEL}$	HQ $_{NOAEL}$	TRV $_{LOAEL}$	HQ $_{LOAEL}$
								----------Unitless----------								mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d		mg/kg-d	
Metals																														
Mercury	MAX	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.72E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-03	3.11E-01	0.00E+00	3.65E-01	1.00E+00	3.65E-01	5.00E+00	7.30E-02
Mercury	AVG	0.00E+00	mg/L	0.00E+00	mg/kg	3.60E+00	mg/kg	1.00E+00			4.58E-01		2.04E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	6.91E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.33E-03	4.56E-02	0.00E+00	5.48E-02	1.00E+00	5.48E-02	5.00E+00	1.10E-02
Mercury	SCSS-057	0.00E+00	mg/L	0.00E+00	mg/kg	1.51E+01	mg/kg	1.00E+00			1.75E-01		1.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.90E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.06E-03	1.91E-01	0.00E+00	2.25E-01	1.00E+00	2.25E-01	5.00E+00	4.50E-02
Mercury	SCSS-058	0.00E+00	mg/L	0.00E+00	mg/kg	1.11E+01	mg/kg	1.00E+00			2.16E-01		1.22E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.13E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.29E-03	1.40E-01	0.00E+00	1.66E-01	1.00E+00	1.66E-01	5.00E+00	3.32E-02
Mercury	SCSS-059	0.00E+00	mg/L	0.00E+00	mg/kg	2.46E+01	mg/kg	1.00E+00			1.26E-01		8.43E-02	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.72E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-03	3.11E-01	0.00E+00	3.65E-01	1.00E+00	3.65E-01	5.00E+00	7.30E-02
Mercury	SCSS-060	0.00E+00	mg/L	0.00E+00	mg/kg	8.80E+00	mg/kg	1.00E+00			2.52E-01		1.35E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.69E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E-03	1.11E-01	0.00E+00	1.32E-01	1.00E+00	1.32E-01	5.00E+00	2.64E-02
Mercury	SCSS-061	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E+00	mg/kg	1.00E+00			5.56E-01		2.33E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.18E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.00E-03	3.42E-02	0.00E+00	4.13E-02	1.00E+00	4.13E-02	5.00E+00	8.27E-03
Mercury	SCSS-062	0.00E+00	mg/L	0.00E+00	mg/kg	5.00E-01	mg/kg	1.00E+00			1.72E+00		5.06E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	9.59E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.04E-04	6.33E-03	0.00E+00	8.09E-03	1.00E+00	8.09E-03	5.00E+00	1.62E-03
Mercury	SCSS-063	0.00E+00	mg/L	0.00E+00	mg/kg	5.50E-01	mg/kg	1.00E+00			1.61E+00		4.84E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.06E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.47E-04	6.96E-03	0.00E+00	8.86E-03	1.00E+00	8.86E-03	5.00E+00	1.77E-03
Mercury	SCSS-064	0.00E+00	mg/L	0.00E+00	mg/kg	7.80E-02	mg/kg	1.00E+00			5.97E+00		1.19E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.50E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.95E-04	9.87E-04	0.00E+00	1.43E-03	1.00E+00	1.43E-03	5.00E+00	2.86E-04
Mercury	SCSS-065	0.00E+00	mg/L	0.00E+00	mg/kg	2.90E-02	mg/kg	1.00E+00			1.16E+01		1.88E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.57E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-04	3.67E-04	0.00E+00	5.95E-04	1.00E+00	5.95E-04	5.00E+00	1.19E-04
Mercury	SCSS-066	0.00E+00	mg/L	0.00E+00	mg/kg	7.00E-02	mg/kg	1.00E+00			6.42E+00		1.25E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.34E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.78E-04	8.86E-04	0.00E+00	1.30E-03	1.00E+00	1.30E-03	5.00E+00	2.60E-04
Mercury	SCSS-067	0.00E+00	mg/L	0.00E+00	mg/kg	2.60E-02	mg/kg	1.00E+00			1.25E+01		1.97E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	4.99E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.63E-04	3.29E-04	0.00E+00	5.42E-04	1.00E+00	5.42E-04	5.00E+00	1.08E-04
Mercury	SCSS-068	0.00E+00	mg/L	0.00E+00	mg/kg	3.10E-02	mg/kg	1.00E+00			1.11E+01		1.82E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.95E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-04	3.92E-04	0.00E+00	6.31E-04	1.00E+00	6.31E-04	5.00E+00	1.26E-04
Mercury	SCSS-069	0.00E+00	mg/L	0.00E+00	mg/kg	6.10E-02	mg/kg	1.00E+00			7.04E+00		1.33E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.17E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.58E-04	7.72E-04	0.00E+00	1.15E-03	1.00E+00	1.15E-03	5.00E+00	2.29E-04
Mercury	SCSS-072	0.00E+00	mg/L	0.00E+00	mg/kg	6.30E-02	mg/kg	1.00E+00			6.89E+00		1.31E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-04	7.97E-04	0.00E+00	1.18E-03	1.00E+00	1.18E-03	5.00E+00	2.36E-04
Mercury	SCSS-073	0.00E+00	mg/L	0.00E+00	mg/kg	2.70E-01	mg/kg	1.00E+00			2.60E+00		6.72E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	5.18E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.76E-04	3.42E-03	0.00E+00	4.51E-03	1.00E+00	4.51E-03	5.00E+00	9.02E-04
Mercury	SCSS-074	0.00E+00	mg/L	0.00E+00	mg/kg	1.30E-01	mg/kg	1.00E+00			4.24E+00		9.40E-01	1.92E-01	1.92E-01	0.00E+00	0.00E+00	2.49E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.88E-04	1.64E-03	0.00E+00	2.28E-03	1.00E+00	2.28E-03	5.00E+00	4.57E-04
Mercury	SCSS-075	0.00E+00	mg/L	0.00E+00	mg/kg	5.40E-02	mg/kg	1.00E+00			7.64E+00		1.41E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	1.04E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-04	6.83E-04	0.00E+00	1.03E-03	1.00E+00	1.03E-03	5.00E+00	2.06E-04
Mercury	SCSS-076	0.00E+00	mg/L	0.00E+00	mg/kg	4.90E-02	mg/kg	1.00E+00			8.16E+00		1.47E+00	1.92E-01	1.92E-01	0.00E+00	0.00E+00	9.40E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-04	6.20E-04	0.00E+00	9.43E-04	1.00E+00	9.43E-04	5.00E+00	1.89E-04

Intake Equation:

$$Ej = \left(\frac{A}{HR} \left[\sum_{i=1}^{m} \left(\frac{IRi \, x \, Cij}{BW} \right) \right] \right)$$

Where:
Ej = Total Exposure to Chemical
A = Site Area
HR = Home Range
m = Total number of ingested media
i = counter
IRi = Consumption Rate for Medium
Cij = Chemical concentration (j) in medium (I) (mg/kg or mg/L)
BW = Body Weight

Notes:
BAF = Bioaccumulation Factor (may be BCF if this is the only value available)
EED = Estimated Exposure Dose
EEQ = Ecological Effects Quotient.
L = LOAEL based; N = NOAEL based
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
NA = Not applicable/Not available
BAF (or BCF) values from appropriate text tables (BCF = bioconcentration factor)
Some BAF (or BCF) values based on media regression equations (value in box):
LOAEL and NOAEL values from appropriate toxicity summary tables in the text.
UF = Uncertainty Factor for toxicity factor extrapolation, and Adjusted LOAEL or NOAEL = LOAEL/UF or NOAEL/UF
A "0" entry in the exposure concentration column indicates this chemical not selected as a COPEC for this medium.
Receptor diet data and home range data from appropriate text table.
Exposure point concentrations (EPCs) from appropriate text tables.

Species-Specific Factors

Terrestrial plant diet fraction =	0.046	unitless
Aquatic plant diet fraction =	0	unitless
Plant root diet fraction =	0	unitless
Fish diet fraction =	0	unitless
Aq. Invert diet fraction =	0	unitless
Terr. Invert diet fraction =	0	unitless
Mammal diet fraction =	0.954	unitless
Bird diet fraction =	0	unitless
Soil ingestion rate =	0.009	kg/d
Sediment ingestion rate =	0	kg/d
Food ingestion rate =	0.324	kg/d
Body weight =	4.69	kg
Home range =	1472.7	acres
Water intake rate =	0.399	L/d
Site Area =	2	acres
Area Use Factor (AUF) =	1	unitless
Exposure Frequency (EF) =	1	unitless

Appendix I
Investigation-Derived Waste Management

(Note: Data Submitted on Compact Disc.)

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Acronyms and Abbreviations

AOC	Area of Concern
CFR	Code of Federal Regulations
DL	decontamination liquids
FSAP	Facility-Wide Sampling and Analysis Plan
IDW	Investigation-Derived Waste
µg/l	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
Shaw	Shaw Environmental & Infrastructure, Inc.
SO	soil and dry sediment
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
USEPA	U.S. Environmental Protection Agency
Vista	Vista Environmental Sciences Corporation
VOC	volatile organic compound

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1.0 Investigation-Derived Waste Management

Three types of Investigation-Derived Waste (IDW) were generated during the remedial investigation (RI) activities conducted at the RVAAP-34 Sand Creek Disposal Road Landfill and RVAAP-05 Open Demolition Area #1, Ravenna Army Ammunition Plant (RVAAP), Ohio between September and November 2010. These IDW types consisted of the following:

- Environmental Media (soil and dry sediment) derived from the surface soil, subsurface soil and dry sediment sampling activities.
- Solid Waste (decontamination fluids) derived from decontamination of sampling equipment and drilling equipment.
- Solid Waste (expendable waste debris) including personal protective equipment (PPE) and disposable sampling equipment.

All IDW generated during the RI activities was managed in accordance with sampling requirements of the *Field Sampling and Analysis Plan Addendum No. 1* (Shaw, 2010); hereafter referred to as the Addendum and Section 7.0 of the Facility-Wide Sampling and Analysis Plan (FSAP; SAIC, 2001).

1.1 IDW Collection and Containerization

Environmental media and solid waste were contained separately. For the environmental media, unsaturated soils were segregated from saturated soils. For solid waste, decontamination fluids were containerized separately from expendable solid waste debris. Characterization and classification of the different types of IDW were based on the specific protocols described below.

- **Soils and Dry Sediment:** Drilling spoils and excess surface soils and dry sediment were placed in 55-gallon steel drums with gasketed ring-topped lids.
- **Decontamination Fluids:** Decontamination fluids were placed in 55-gallon steel drums with gaskted ring-topped lids.
- **Expendable Waste Debris:** Expendable waste debris was segregated as non-contaminated and potentially contaminated material based on visual inspection, use of the waste material and field screening using field screening instruments. Expendable waste debris considered to be non-contaminated and potentially contaminated was placed in trash bags and stored in 55-gallon drums sealed with gasketed ring-topped lids.

A summary of IDW generated is presented in **Table I-1**.

Table I-1
Summary of Remedial Investigation-Derived Waste

Drum ID Number	Container Size and Type	Contents and Volume	Generation Dates
Environmental Media			
Shaw-02	55-gallon open top	Unsaturated soil; full	9/21 to 9/30/10
Shaw-03	55-gallon open top	Unsaturated soil; full	9/21 to 9/30/10
Shaw-04	55-gallon open top	Unsaturated soil; full	9/21 to 9/30/10
Shaw-08	55-gallon open top	Unsaturated soil; full	11/09 to 11/10/10
Solid Waste			
Shaw-01	55-gallon open top	Decontamination liquids; 35 gallons	9/21 to 9/29/10
Shaw-05	55-gallon open top	PPE and used sampling equipment; full	9/21 to 11/10/10
Shaw-07	55-gallon open top	Decontamination liquids; 25 gallons	11/09 to 11/10/10

1.2 Waste Container Labeling

All containerized waste was labeled as specified in Section 7.2 of the *FSAP*. Label information on each container was written in indelible ink and included at a minimum; container number, contents, source of the waste, source location, project name and site identification, physical characteristics of the waste, and generation dates. Each label was placed on the side of each container at a location that was protected from damage or degradation.

1.3 IDW Field Staging

At the end of each day, Shaw staged all IDW at Building 1036 in accordance with the RVAAP Waste Management Guidelines. All drums were staged on wooden pallets at Building 1036 and were labeled as "On Hold Pending Analysis" until analytical results were received. To avoid potential drum rupture due to freezing conditions, drums containing liquid IDW were filled only to 75 percent capacity.

1.4 Weekly Inspection Inventories

Shaw contracted Vista Environmental Services (Vista) to conduct weekly inspection inventories of the containerized IDW in accordance with 40 CFR 262. The weekly inspections were performed by Vista for the duration of the waste storage at the facility. Once analytical results were received by Shaw, Vista placed the appropriate waste characterization label on each drum.

1.5 IDW Sampling

The IDW samples were analyzed by the following United States Environmental Protection Agency (USEPA) methods:

Table I-2
Investigation-Derived Waste Analysis Methods

Sample Name	Analysis	Methods
RVAAP-001-IDW-SO RVAAP-002-IDW-SO RVAAP-001-IDW-DL RVAAP-002-IDW-DL	RCRA List Metals RCRA List SVOCs RCRA List VOCs Explosives Propellants RCRA Characteristics[1]	6010C,7471A 8270C 8260B 8330B 8330, 9056M Various

Notes:
[1]RCRA Characteristics include analysis for reactive cyanide and sulfide, flashpoint and pH.
DL = decontamination liquids
IDW = Investigation-Derived Waste
RCRA = Resource Conservation and Recovery Act
SO = soils and dry sediment
SVOCs = semivolatile organic compounds
VOCs = volatile organic compounds

The detected analytical results for each of the IDW samples are presented in **Table I-3**. The IDW analytical data is presented in **Attachment 1**.

1.6 Listed Waste Screening

Review of available historical documents and generator knowledge, does not support that wastes generated from the either the Sand Creek Disposal Road Landfill or Open Demolition Area #1 Areas of Concerns (AOCs) meet the listed description as defined in RCRA Part 261 Subpart D. Therefore, all IDW generated from these sites were not considered listed.

1.7 Characteristic Waste Screening

All solid environmental media was evaluated to determine if it exhibited characteristics of a hazardous waste. Based on site knowledge and the nature of the media, the IDW was not anticipated to be reactive, ignitable, or corrosive. To check for the characteristic of toxicity, the analytical results from soil samples were compared to 20-times the RCRA Toxicity Characteristic Leaching Procedure (TCLP) regulatory levels. All detected analytes were below the toxicity limits (**Table I-3**).

All liquid environmental media was evaluated to determine if the media exhibits characteristics of a hazardous waste. Based on site knowledge and the nature of the media, the IDW was not anticipated to be reactive, ignitable, or corrosive. To check for the characteristic of toxicity, the analytical results from groundwater were directly compared to the RCRA TCLP regulatory levels. All detected analytes were below the toxicity limits (**Table I-3**). Therefore, the decontamination liquid purge water in both drums did not exhibit characteristics of a hazardous waste and was not required to be managed as such.

Table I-3
Detected Analytes in Investigation-Derived Waste Samples

Sample ID	Sample Date	Test Group	Method	Analyte	Result	Units	Characteristic Waste Evaluation		
							EPA Hazardous Waste Code	RCRA TCLP Level (mg/L)[1]	TCLP x 20 (mg/L)
Environmental Media									
RVAAP-001-IDW-SO	09-Sep-10	Metals	6010C	Arsenic	14.5	mg/kg	D004	5	100
		Metals	6010C	Barium	91.1	mg/kg	D005	100	2,000
			6010C	Cadmium	0.93 J	mg/kg	D006	1	20
		Metals	6010C	Chromium	19.6	mg/kg	D007	5	100
			6010C	Lead	41.9	mg/kg	D008	5	100
	Metals		6010C	Selenium	0.65	mg/kg	D010	1	20
		Metals	6010C	Silver	8.5 J	mg/kg	D011	5	100
	Metals	Metals	7471A	Mercury	0.081	mg/kg	D009	0.2	4
	Metals	SVOCs	8270C	2-Methylnaphthalene	54 J	µg/kg			
		SVOCs	8270C	Anthracene	82 J	µg/kg			
		SVOCs	8270C	Benzo(a)anthracene	250 J	µg/kg			
		SVOCs	8270C	Benzo(a)pyrene	300 J	µg/kg			
		SVOCs	8270C	Benzo(b)fluoranthene	420 J	µg/kg			
		SVOCs	8270C	Benzo(ghi)perylene	210 J	µg/kg			
		SVOCs	8270C	Benzo(k)fluoranthene	100 J	µg/kg			
		SVOCs	8270C	Carbazole	61 J	µg/kg			
		SVOCs	8270C	Dibenzo(ah)anthracene	55 J	µg/kg			
		SVOCs	8270C	Dibenzofuran	37 J	µg/kg			
		SVOCs	8270C	Fluoranthene	540	µg/kg			

Sample ID	Sample Date	Test Group	Method	Analyte	Result	Units	Characteristic Waste Evaluation		
							EPA Hazardous Waste Code	RCRA TCLP Level (mg/L)[1]	TCLP x 20 (mg/L)
		SVOCs	8270C	Fluorene	32 J	µg/kg			
		SVOCs	8270C	Indeno(123cd)pyrene	200 J	µg/kg			
		SVOCs	8270C	Naphthalene	50 J	µg/kg			
		SVOCs	8270C	Phenanthrene	300 J	µg/kg			
		SVOCs	8270C	Pyrene	420 J	µg/kg			
		VOCs	8260B	Ethylbenzene	7.6 J	µg/kg			
		VOCs	8260B	m & p-Xylene	23 J	µg/kg			
		VOCs	8260B	o-Xylene	17 J	µg/kg			
		VOCs	8260B	Toluene	17 J	µg/kg			
RVAAP-002-IDW-SO	11-Nov-10	Metals	6010C	Arsenic	7.1	mg/kg	D004	5	100
		Metals	6010C	Barium	50 J	mg/kg	D005	100	2,000
			6010C	Cadmium	0.41	mg/kg	D006	1	20
		Metals	6010C	Chromium	12.1	mg/kg	D007	5	100
			6010C	Lead	9.5 J	mg/kg	D008	5	100
	Metals		6010C	Selenium	0.6	mg/kg	D010	1	20
		Metals	7471A	Mercury	0.04	mg/kg	D009	0.2	4
Solid Waste	Metals								
RVAAP-001-IDW-DL	30-Sep-10	Metals	6010C	Barium	71	µg/L	D005	100	
		Metals	6010C	Cadmium	0.17 J	µg/L	D006	1	
		Metals	6010C	Chromium	15.2	µg/L	D007	5	
		Metals	6010C	Lead	139	µg/L	D008	5	

Sample ID	Sample Date	Test Group	Method	Analyte	Result	Units	Characteristic Waste Evaluation		
							EPA Hazardous Waste Code	RCRA TCLP Level (mg/L)[1]	TCLP x 20 (mg/L)
		Metals	7470A	Mercury	0.47	µg/L	D009	0.2	
		SVOCs	8270C	Bis(2-ethylhexyl)phthalate	6.6 J	µg/L			
		SVOCs	8270C	Diethylphthalate	13 J	µg/L			
		Explosives	8330B	2-Nitrotoluene	5.7 J	µg/L			
		VOCs	8260B	Acetone	15,000	µg/L			
		VOCs	8260B	Toluene	59 J	µg/L			
RVAAP-002-IDW-DL	11-Nov-10	Metals	6010C	Arsenic	83.1	µg/L	D004	5	
		Metals	6010C	Barium	296	µg/L	D005	100	
		Metals	6010C	Cadmium	5.6	µg/L	D006	1	
		Metals	6010C	Chromium	295	µg/L	D007	5	
		Metals	6010C	Lead	75.9	µg/L	D008	5	
		Metals	6010C	Selenium	5.8 J	µg/L	D010	1	
		Metals	7470A	Mercury	0.71	µg/L	D009	0.2	
		SVOCs	8270C	Hexachlorobenzene	0.47 J	µg/L			

Notes:
[1]Toxicity Characteristic Leaching Procedure (TCLP), 40 CFR 261.24
DL = decontamination liquids
IDW = Investigation –Derived Waste
µg/kg = microgams per kilogram
µg/L = microgams per liter
mg/kg milligrams per kilogram
mg/L = milligrams per liter
SO = soil and dry sediment
SVOC = semivolatile organic compounds
VOC = volatile organic compound

Validation Qualifiers
J = The reported result is an estimated value

1.8 IDW Transport and Disposal

Based on the analytical data and the screening criteria discussed above, the drums containing waste soils and dry sediments and decontamination liquids did not exhibit characteristics of a hazardous solid waste. All waste disposal documents were reviewed by the RVAAP Facility Manager prior to off-site disposal in accordance with the RVAAP Waste Management Guidelines. All generated waste was transported off-site for disposal at the Spring Grove Resource Recovery, Inc. at Cincinnati, Ohio, by Clean Harbors Environmental Services out of Cleveland, Ohio on January 6, 2011. The drums of soil and dry sediment (Shaw-02, -03, -04, and -08) and PPE and sampling equipment (Shaw-05) were disposed as non-hazardous, non-DOT solid waste (non-DOT regulated). The drums of decontamination liquids (Shaw-01 and Shaw-07) were disposed as non-hazardous, non-DOT regulated liquid. The approved-waste profile and non-hazardous manifest are provided in **Attachment 2** and **Attachment 3**, respectively.

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ATTACHMENT 1
INVESTIGATION-DERIVED WASTE ANALYTICAL RESULTS
(DATA SUBMITTTED ON COMPACT DISK)

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Table 1
IDW Analytical Results
Liquid Waste
Sand Creek Dump/Open Demolition Area #1 AOCs
Ravenna Army Ammunition Plant

		Location Code	RVAAP-001-IDW		RVAAP-002-IDW	
		Sample Number	RVAAP-001-IDW-DL		RVAAP-002-IDW-DL	
		Sample Date	9/30/2010		11/11/2010	
		Depth	0 - 0 ft		0 - 0 ft	
		Sample Purpose	REG		REG	
Parameter	**Units**		**Result**	**Qual**	**Result**	**Qual**
Explosives						
1,3,5-Trinitrobenzene	µg/L		<0.58	U	<0.46	U
1,3-Dinitrobenzene	µg/L		<0.5	U	<0.4	U
2,4,6-Trinitrotoluene	µg/L		<0.55	U	<0.44	U
2,4-Dinitrotoluene	µg/L		<0.75	U	<0.6	U
2,6-Dinitrotoluene	µg/L		<0.6	U	<0.48	U
2-Amino-4,6-Dinitrotoluene	µg/L		<0.6	U	<0.48	U
3,5-Dinitroaniline	µg/L				<0.46	U
4-Amino-2,6-Dinitrotoluene	µg/L		<0.7	U	<0.56	U
HMX	µg/L		<0.63	U	<0.5	U
m-Nitrotoluene	µg/L		<0.58	U	<0.46	U
Nitrobenzene	µg/L		<0.55	U	<0.44	U
Nitrocellulose	µg/L		<5000	UJ	<4000	U
Nitroglycerin	µg/L		<5.5	U	<4.4	U
Nitroguanidine	µg/L		<28	U	<28	U
o-Nitrotoluene	µg/L		5.7	J	<0.8	U
Petn	µg/L		<7.5	U	<6	U
p-Nitrotoluene	µg/L		<0.55	U	<0.44	U
RDX	µg/L		<0.45	U	<0.36	U
Tetryl	µg/L		<0.53	U	<0.42	U
FIELD TESTS						
pH	STD UNIT		7.38		7.96	
GEN CHEMISTRY						
Cyanide, Total	µg/L		<10000	U	<10000	U
Flashpoint	F		140		140	
Sulfide	µg/L		<2000	U	<2000	U
Metals						
Arsenic	µg/L		<4	U	83.1	
Barium	µg/L		71		296	
Cadmium	µg/L		0.17	J	5.6	
Chromium	µg/L		15.2		295	
Lead	µg/L		139		75.9	
Mercury	µg/L		0.47		0.71	
Selenium	µg/L		<2.3	U	5.8	J
Silver	µg/L		<0.7	U	<0.7	U
Semivolatiles						
1,2,4-Trichlorobenzene	µg/L		<2	U		
1,2-Dichlorobenzene	µg/L		<2.1	U		
1,3-Dichlorobenzene	µg/L		<2.3	U		

Table 1
IDW Analytical Results
Liquid Waste
Sand Creek Dump/Open Demolition Area #1 AOCs
Ravenna Army Ammunition Plant

		Location Code	RVAAP-001-IDW		RVAAP-002-IDW	
		Sample Number	RVAAP-001-IDW-DL		RVAAP-002-IDW-DL	
		Sample Date	9/30/2010		11/11/2010	
		Depth	0 - 0 ft		0 - 0 ft	
		Sample Purpose	REG		REG	
Parameter	**Units**		**Result**	**Qual**	**Result**	**Qual**
1,4-Dichlorobenzene	µg/L		<2.2	U	<0.2	U
2,4,5-Trichlorophenol	µg/L		<13	U	<1.1	U
2,4,6-Trichlorophenol	µg/L		<12	U	<1	U
2,4-Dichlorophenol	µg/L		<12	U		
2,4-Dimethylphenol	µg/L		<9.5	U		
2,4-Dinitrophenol	µg/L		<17	U		
2,4-Dinitrotoluene	µg/L		<2.4	U	<0.22	U
2,6-Dinitrotoluene	µg/L		<3.3	U		
2-Chloronaphthalene	µg/L		<2.1	U		
2-Chlorophenol	µg/L		<10	U		
2-Methylnaphthalene	µg/L		<2	U		
2-Nitroaniline	µg/L		<2.6	U		
2-Nitrophenol	µg/L		<10	U		
3,3'-Dichlorobenzidine	µg/L		<7.7	U		
3-Nitroaniline	µg/L		<3	U		
4,6-Dinitro-2-Methylphenol	µg/L		<19	U		
4-Bromophenyl Phenyl Ether	µg/L		<2.3	U		
4-Chloro-3-Methylphenol	µg/L		<8.8	U		
4-Chloroaniline	µg/L		<1.4	U		
4-Chlorophenyl Phenyl Ether	µg/L		<2.1	U		
4-Nitrobenzenamine	µg/L		<1.7	U		
4-Nitrophenol	µg/L		<13	U		
Acenaphthene	µg/L		<2.1	U		
Acenaphthylene	µg/L		<2	U		
Anthracene	µg/L		<1.3	U		
Benzo(a)anthracene	µg/L		<1.4	U		
Benzo(a)pyrene	µg/L		<1.6	U		
Benzo(b)fluoranthene	µg/L		<2	U		
Benzo(ghi)perylene	µg/L		<2.4	U		
Benzo(k)fluoranthene	µg/L		<2.3	U		
Benzoic Acid	µg/L		<130	U		
Benzyl Alcohol	µg/L		<6.3	U		
Bis(2-Chloroethoxy)methane	µg/L		<2.2	U		
Bis(2-Chloroethyl)ether	µg/L		<2.4	U		
Bis(2-Chloroisopropyl)ether	µg/L		<2.6	U		
Bis(2-Ethylhexyl)phthalate	µg/L		6.6	J		
Butyl Benzyl Phthalate	µg/L		<5.5	U		
Carbazole	µg/L		<1.4	U		
Chrysene	µg/L		<1.9	U		

Table 1
IDW Analytical Results
Liquid Waste
Sand Creek Dump/Open Demolition Area #1 AOCs
Ravenna Army Ammunition Plant

	Location Code	**RVAAP-001-IDW**		**RVAAP-002-IDW**	
	Sample Number	**RVAAP-001-IDW-DL**		**RVAAP-002-IDW-DL**	
	Sample Date	**9/30/2010**		**11/11/2010**	
	Depth	**0 - 0 ft**		**0 - 0 ft**	
	Sample Purpose	**REG**		**REG**	
Parameter	**Units**	**Result**	**Qual**	**Result**	**Qual**
Cresols (Total)	µg/L	<16	U	<1.4	U
Dibenzo(a,h)anthracene	µg/L	<2	U		
Dibenzofuran	µg/L	<2.2	U		
Diethyl Phthalate	µg/L	13	J		
Dimethyl Phthalate	µg/L	<6.3	U		
Di-n-Butyl Phthalate	µg/L	<7.8	U		
Di-n-Octyl Phthalate	µg/L	<5.7	U		
Fluoranthene	µg/L	<1.5	U		
Fluorene	µg/L	<2.2	U		
Hexachlorobenzene	µg/L	<3.1	U	0.47	J
Hexachlorobutadiene	µg/L	<2.1	U	<0.19	U
Hexachlorocyclopentadiene	µg/L	<3	U		
Hexachloroethane	µg/L	<2.6	U	<0.23	U
Indeno(1,2,3-cd)pyrene	µg/L	<2.1	U		
Isophorone	µg/L	<2.1	U		
Naphthalene	µg/L	<2.1	U		
Nitrobenzene	µg/L	<1.9	U	<0.16	U
N-Nitroso-di-n-Propylamine	µg/L	<2.1	U		
N-Nitrosodiphenylamine	µg/L	<4.2	U		
o-Cresol	µg/L	<10	U	<0.89	U
Pentachlorophenol	µg/L	<13	U	<1.1	U
Phenanthrene	µg/L	<3.5	U		
Phenol	µg/L	<5.6	U		
Pyrene	µg/L	<1.5	U		
Pyridine	µg/L			<0.64	U
Volatiles					
1,1,1-Trichloroethane	µg/L	<42	U		
1,1,2,2-Tetrachloroethane	µg/L	<38	U		
1,1,2-Trichloroethane	µg/L	<52	U		
1,1-Dichloroethane	µg/L	<40	U		
1,1-Dichloroethylene	µg/L	<48	U	<48	U
1,2-Dibromoethane	µg/L	<32	U		
1,2-Dichloroethane	µg/L	<60	U	<60	U
1,2-Dichloropropane	µg/L	<44	U		
1,2-Dimethylbenzene	µg/L	<48	U		
2-Hexanone	µg/L	<800	U		
Acetone	µg/L	<15000			
Benzene	µg/L	<38	U	<38	U
Bromochloromethane	µg/L	<38	U		

Table 1
IDW Analytical Results
Liquid Waste
Sand Creek Dump/Open Demolition Area #1 AOCs
Ravenna Army Ammunition Plant

	Location Code	**RVAAP-001-IDW**		**RVAAP-002-IDW**	
	Sample Number	**RVAAP-001-IDW-DL**		**RVAAP-002-IDW-DL**	
	Sample Date	**9/30/2010**		**11/11/2010**	
	Depth	**0 - 0 ft**		**0 - 0 ft**	
	Sample Purpose	**REG**		**REG**	
Parameter	**Units**	**Result**	**Qual**	**Result**	**Qual**
Bromodichloromethane	µg/L	<40	U		
Bromoform	µg/L	<44	U		
Bromomethane	µg/L	<100	U		
Carbon Disulfide	µg/L	<100	U		
Carbon Tetrachloride	µg/L	<46	U	<46	U
Chlorobenzene	µg/L	<48	U	<48	U
Chloroethane	µg/L	<80	U		
Chloroform	µg/L	<30	U	<30	U
Chloromethane	µg/L	<80	U		
cis-1,2-Dichloroethene	µg/L	<50	U		
cis-1,3-Dichloropropene	µg/L	<38	U		
Dibromochloromethane	µg/L	<38	U		
Ethylbenzene	µg/L	<44	U		
Methyl Ethyl Ketone	µg/L	<480	U	<480	U
Methyl Isobutyl Ketone	µg/L	<600	U		
Methylene Chloride	µg/L	<80	U		
Styrene	µg/L	<40	U		
Tetrachloroethylene	µg/L	<60	U	<60	U
Toluene	µg/L	59	J		
trans-1,2-Dichloroethene	µg/L	<50	U		
trans-1,3-Dichloropropene	µg/L	<38	U		
Trichloroethylene	µg/L	<42	U	<42	U
Vinyl Chloride	µg/L	<36	U	<36	U
Xylene, (Total)	µg/L	<100	U		

Note:
J denotes the detection is estimated.
U denotes analtye not detected.
UJ denotes the analyte is not detected and the detection limits are approximate.

Table 2
IDW Analytical Results
Soil Drill Cuttings
Sand Creek Dump/Open Demolition Area #2 AOCs
Ravenna Army Ammunition Plant

	Location Code	RVAAP-001-IDW		RVAAP-002-IDW	
	Sample Number	RVAAP-001-IDW-SO		RVAAP-002-IDW-SO	
	Sample Date	9/30/2010		11/11/2010	
	Depth	0 - 0 ft		0 - 0 ft	
	Sample Purpose	REG		REG	
Parameter	**Units**	**Result**	**Qual**	**Result**	**Qual**
Explosives					
1,3,5-Trinitrobenzene	mg/kg	<0.13	U	<0.13	U
1,3-Dinitrobenzene	mg/kg	<0.08	U	<0.08	U
2,4,6-Trinitrotoluene	mg/kg	<0.09	U	<0.09	U
2,4-Dinitrotoluene	mg/kg	<0.2	U	<0.2	U
2,6-Dinitrotoluene	mg/kg	<0.07	U	<0.07	U
2-Amino-4,6-Dinitrotoluene	mg/kg	<0.05	U	<0.05	U
3,5-Dinitroaniline	mg/kg	<0.09	U	<0.09	U
4-Amino-2,6-Dinitrotoluene	mg/kg	<0.07	U	<0.07	U
HMX	mg/kg	<0.12	U	<0.12	U
m-Nitrotoluene	mg/kg	<0.07	U	<0.07	U
Nitrobenzene	mg/kg	<0.04	U	<0.04	U
Nitrocellulose	mg/kg	<7	U	<7	U
Nitroglycerin	mg/kg	<0.5	U	<0.5	U
Nitroguanidine	mg/kg	<0.061	U	<0.061	U
o-Nitrotoluene	mg/kg	<0.09	U	<0.09	U
Petn	mg/kg	<0.5	U	<0.5	U
p-Nitrotoluene	mg/kg	<0.07	U	<0.07	U
RDX	mg/kg	<0.16	U	<0.16	U
Tetryl	mg/kg	<0.09	U	<0.09	U
FIELD TESTS					
pH	STD UNIT	6.92		6.28	
GEN CHEMISTRY					
Cyanide, Total	mg/kg	<24.63	U	24	U
Flashpoint	F	140		140	
Sulfide	mg/kg	<4.93	U	5	U
Total Solids	Percent	81.2		81.5	
Metals					
Arsenic	mg/kg	14.5		7.1	
Barium	mg/kg	91.1		50	J
Cadmium	mg/kg	0.93	J	0.41	J
Chromium	mg/kg	19.6	J	12.1	
Lead	mg/kg	41.9		9.5	J
Mercury	mg/kg	0.081		0.04	
Selenium	mg/kg	0.65		0.6	
Silver	mg/kg	8.5	J	0.021	J
Semivolatiles					
1,2,4-Trichlorobenzene	ug/kg	<26	UJ		
1,2-Dichlorobenzene	ug/kg	<30	UJ		

Table 2
IDW Analytical Results
Soil Drill Cuttings
Sand Creek Dump/Open Demolition Area #2 AOCs
Ravenna Army Ammunition Plant

	Location Code	**RVAAP-001-IDW**		**RVAAP-002-IDW**	
	Sample Number	**RVAAP-001-IDW-SO**		**RVAAP-002-IDW-SO**	
	Sample Date	**9/30/2010**		**11/11/2010**	
	Depth	**0 - 0 ft**		**0 - 0 ft**	
	Sample Purpose	**REG**		**REG**	
Parameter	**Units**	**Result**	**Qual**	**Result**	**Qual**
1,3-Dichlorobenzene	ug/kg	<25	UJ		
1,4-Dichlorobenzene	ug/kg	<23	UJ	<23	U
2,4,5-Trichlorophenol	ug/kg	<160	U	<160	U
2,4,6-Trichlorophenol	ug/kg	<160	U	<160	U
2,4-Dichlorophenol	ug/kg	<150	U		
2,4-Dimethylphenol	ug/kg	<120	U		
2,4-Dinitrophenol	ug/kg	<850	U		
2,4-Dinitrotoluene	ug/kg	<30	U	<29	U
2,6-Dinitrotoluene	ug/kg	<30	U		
2-Chloronaphthalene	ug/kg	<28	U		
2-Chlorophenol	ug/kg	<420	UJ		
2-Methylnaphthalene	ug/kg	54	J		
2-Nitroaniline	ug/kg	<28	U		
2-Nitrophenol	ug/kg	<350	U		
3,3'-Dichlorobenzidine	ug/kg	<190	U		
3-Nitroaniline	ug/kg	<27	U		
4,6-Dinitro-2-Methylphenol	ug/kg	<330	U		
4-Bromophenyl Phenyl Ether	ug/kg	<31	U		
4-Chloro-3-Methylphenol	ug/kg	<470	U		
4-Chloroaniline	ug/kg	<48	U		
4-Chlorophenyl Phenyl Ether	ug/kg	<32	U		
4-Nitrobenzenamine	ug/kg	<37	U		
4-Nitrophenol	ug/kg	<490	U		
Acenaphthene	ug/kg	<30	U		
Acenaphthylene	ug/kg	<30	U		
Anthracene	ug/kg	82	J		
Benzo(a)anthracene	ug/kg	250	J		
Benzo(a)pyrene	ug/kg	300	J		
Benzo(b)fluoranthene	ug/kg	420	J		
Benzo(ghi)perylene	ug/kg	210	J		
Benzo(k)fluoranthene	ug/kg	100	J		
Benzoic Acid	ug/kg	<360	U		
Benzyl Alcohol	ug/kg	<100	UJ		
Bis(2-Chloroethoxy)methane	ug/kg	<28	UJ		
Bis(2-Chloroethyl)ether	ug/kg	<31	UJ		
Bis(2-Chloroisopropyl)ether	ug/kg	<37	U		
Bis(2-Ethylhexyl)phthalate	ug/kg	<110	U		
Butyl Benzyl Phthalate	ug/kg	<90	U		
Carbazole	ug/kg	61	J		

Table 2
IDW Analytical Results
Soil Drill Cuttings
Sand Creek Dump/Open Demolition Area #2 AOCs
Ravenna Army Ammunition Plant

	Location Code	RVAAP-001-IDW		RVAAP-002-IDW	
	Sample Number	RVAAP-001-IDW-SO		RVAAP-002-IDW-SO	
	Sample Date	9/30/2010		11/11/2010	
	Depth	0 - 0 ft		0 - 0 ft	
	Sample Purpose	REG		REG	
Parameter	**Units**	**Result**	**Qual**	**Result**	**Qual**
Chrysene	ug/kg	240	J		
Cresols (Total)	ug/kg	<800	U	<790	U
Dibenzo(a,h)anthracene	ug/kg	55	J		
Dibenzofuran	ug/kg	37	J		
Diethyl Phthalate	ug/kg	<79	U		
Dimethyl Phthalate	ug/kg	<78	U		
Di-n-Butyl Phthalate	ug/kg	<98	U		
Di-n-Octyl Phthalate	ug/kg	<73	U		
Fluoranthene	ug/kg	540			
Fluorene	ug/kg	32	J		
Hexachlorobenzene	ug/kg	<35	U	<34	U
Hexachlorobutadiene	ug/kg	<77	UJ	<75	U
Hexachlorocyclopentadiene	ug/kg	<64	UJ		
Hexachloroethane	ug/kg	<41	UJ	<40	U
Indeno(1,2,3-cd)pyrene	ug/kg	200	J		
Isophorone	ug/kg	<62	U		
Naphthalene	ug/kg	50	J		
Nitrobenzene	ug/kg	<73	UJ	<72	U
N-Nitroso-di-n-Propylamine	ug/kg	<86	U		
N-Nitrosodiphenylamine	ug/kg	<62	U		
o-Cresol	ug/kg	<520	U	<510	U
Pentachlorophenol	ug/kg	<300	U	<290	U
Phenanthrene	ug/kg	300	J		
Phenol	ug/kg	<200	U		
Pyrene	ug/kg	420	J		
Pyridine	ug/kg			<47	UJ
Volatiles					
1,1,1-Trichloroethane	ug/kg	<8.1	U		
1,1,2,2-Tetrachloroethane	ug/kg	<4.8	U		
1,1,2-Trichloroethane	ug/kg	<6.5	U		
1,1-Dichloroethane	ug/kg	<8.9	U		
1,1-Dichloroethylene	ug/kg	<13	U	<20	U
1,2-Dibromoethane	ug/kg	<8.1	U		
1,2-Dichloroethane	ug/kg	<9.7	U	<15	U
1,2-Dichloropropane	ug/kg	<5.7	U		
1,2-Dimethylbenzene	ug/kg	17	J		
2-Hexanone	ug/kg	<55	U		
Acetone	ug/kg	<51	U		
Benzene	ug/kg	<4	U	<6.1	U

Table 2
IDW Analytical Results
Soil Drill Cuttings
Sand Creek Dump/Open Demolition Area #2 AOCs
Ravenna Army Ammunition Plant

	Location Code	**RVAAP-001-IDW**		**RVAAP-002-IDW**	
	Sample Number	**RVAAP-001-IDW-SO**		**RVAAP-002-IDW-SO**	
	Sample Date	**9/30/2010**		**11/11/2010**	
	Depth	**0 - 0 ft**		**0 - 0 ft**	
	Sample Purpose	**REG**		**REG**	
Parameter	**Units**	**Result**	**Qual**	**Result**	**Qual**
Bromochloromethane	ug/kg	<6.5	U		
Bromodichloromethane	ug/kg	<7.3	U		
Bromoform	ug/kg	<4.8	U		
Bromomethane	ug/kg	<24	U		
Carbon Disulfide	ug/kg	<12	U		
Carbon Tetrachloride	ug/kg	<8.9	U	<13	U
Chlorobenzene	ug/kg	<6.5	U	<9.8	U
Chloroethane	ug/kg	<15	U		
Chloroform	ug/kg	<7.3	U	<11	U
Chloromethane	ug/kg	<20	U		
cis-1,2-Dichloroethene	ug/kg	<8.1	U		
cis-1,3-Dichloropropene	ug/kg	<8.1	U		
Dibromochloromethane	ug/kg	<6.5	U		
Ethylbenzene	ug/kg	7.6	J		
Methyl Ethyl Ketone	ug/kg	<81	U	<120	U
Methyl Isobutyl Ketone	ug/kg	<66	U		
Methylene Chloride	ug/kg	<32	U		
Styrene	ug/kg	<4.8	U		
Tetrachloroethylene	ug/kg	<6.5	U	<9.8	U
Toluene	ug/kg	17	J		
trans-1,2-Dichloroethene	ug/kg	<8.9	U		
trans-1,3-Dichloropropene	ug/kg	<5.7	U		
Trichloroethylene	ug/kg	<8.1	U	<12	U
Vinyl Chloride	ug/kg	<11	U	<17	U
Xylene, (Total)	ug/kg	23	J		

Note:
J denotes the detection is estimated.
U denotes analtye not detected.
UJ denotes the analyte is not detected and the detection limits are approximate.

ATTACHMENT 2
INVESTIGATION-DERIVED WASTE PROFILES

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SHAW

WASTE MATERIAL PROFILE SHEET Soil & PPE

Clean Harbors Profile No. CH474137 Non Haz Waste

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION # *OH5210020736* GENERATOR NAME: *Ravenna Army Ammunition Plant*

GENERATOR CODE (Assigned by Clean Harbors) *RA1704* CITY *Ravenna* STATE/PROVINCE *OH* ZIP/POSTAL CODE *44266*

ADDRESS *8451 State Route 5* PHONE: *(330) 358-7312*

CUSTOMER CODE (Assigned by Clean Harbors) *SH0902* CUSTOMER NAME: *Shaw Environmental*

ADDRESS *100 Technology Center Dr* CITY *Stoughton* STATE/PROVINCE *MA* ZIP/POSTAL CODE *02072*

B. WASTE DESCRIPTION

WASTE DESCRIPTION: *Soil and PPE*

PROCESS GENERATING WASTE: **Collection of Drill cuttings and used PPE**

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ? **No**

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE
- [x] SOLID WITHOUT FREE LIQUID
- [ ] POWDER
- [ ] MONOLITHIC SOLID
- [ ] LIQUID WITH NO SOLIDS
- [ ] LIQUID/SOLID MIXTURE
  - % FREE LIQUID
  - % SETTLED SOLID
  - % TOTAL SUSPENDED SOLID
- [ ] SLUDGE
- [ ] GAS/AEROSOL

NUMBER OF PHASES/LAYERS

1 2 3

% BY VOLUME (Approx.)

TOP *0.00*
MIDDLE *0.00*
BOTTOM *0.00*

VISCOSITY (If liquid present)
- 1 - 100 (e.g. Water)
- 101 - 500 (e.g. Motor Oil)
- 501 - 10,000 (e.g. Molasses)
- > 10,000

COLOR

varies

ODOR
- [x] NONE
- [ ] MILD
- [ ] STRONG

Describe:

BOILING POINT °F (°C)
- <= 95 (<=35)
- 95 - 100 (35-38)
- 101 - 129 (38-54)
- >= 130 (>54)

MELTING POINT °F (°C)
- < 140 (<60)
- 140-200 (60-93)
- [x] > 200 (>93)

TOTAL ORGANIC CARBON
- [x] <= 1%
- [ ] 1-9%
- [ ] >= 10%

FLASH POINT °F (°C)
- < 73 (<23)
- 73 - 100 (23-38)
- 101 -140 (38-60)
- 141 -200 (60-93)
- > 200 (>93)

pH
- <= 2
- 2.1 - 6.9
- [x] 7 (Neutral)
- 7.1 - 12.4
- >= 12.5

SPECIFIC GRAVITY
- < 0.8 (e.g. Gasoline)
- 0.8-1.0 (e.g. Ethanol)
- 1.0 (e.g. Water)
- 1.0-1.2 (e.g. Antifreeze)
- [x] > 1.2 (e.g. Methylene Chloride)

ASH
- < 0.1
- 0.1 - 1.0
- 1.1 - 5.0
- 5.1 - 20.0
- > 20
- [x] Unknown

BTU/LB (MJ/kg)
- [x] < 2,000 (<4.6)
- 2,000-5,000 (4.6-11.6)
- 5,000-10,000 (11.6-23.2)
- > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
PPE (PERSONAL PROTECTIVE EQUIPMENT)	0.0000000	--	100.0000000	%
SOIL	0.0000000	--	100.0000000	%

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? YES [ ] NO [x]

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? YES [ ] NO [x]

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? YES [ ] NO [x]

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies:

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE. *G19* SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE. *W301*

E. CONSTITUENTS

Are these values based on testing or knowledge? Knowledge ☑ Testing

If constituent concentrations are based on analytical testing, analysis must be provided. Please attach document(s) using the link on the Submit tab.

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATED METALS	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
D004	ARSENIC	5.0				☑
D005	BARIUM	100.0				☑
D006	CADMIUM	1.0				☑
D007	CHROMIUM	5.0				☑
D008	LEAD	5.0				☑
D009	MERCURY	0.2				☑
D010	SELENIUM	1.0				☑
D011	SILVER	5.0				☑
	VOLATILE COMPOUNDS					
D018	BENZENE	0.5				
D019	CARBON TETRACHLORIDE	0.5				
D021	CHLOROBENZENE	100.0				
D022	CHLOROFORM	6.0				
D028	1,2-DICHLOROETHANE	0.5				
D029	1,1-DICHLOROETHYLENE	0.7				
D035	METHYL ETHYL KETONE	200.0				
D039	TETRACHLOROETHYLENE	0.7				
D040	TRICHLOROETHYLENE	0.5				
D043	VINYL CHLORIDE	0.2				
	SEMI-VOLATILE COMPOUNDS					
D023	o-CRESOL	200.0				
D024	m-CRESOL	200.0				
D025	p-CRESOL	200.0				
D026	CRESOL (TOTAL)	200.0				
D027	1,4-DICHLOROBENZENE	7.5				
D030	2,4-DINITROTOLUENE	0.13				
D032	HEXACHLOROBENZENE	0.13				
D033	HEXACHLOROBUTADIENE	0.5				
D034	HEXACHLOROETHANE	3.0				
D036	NITROBENZENE	2.0				
D037	PENTACHLOROPHENOL	100.0				
D038	PYRIDINE	5.0				
D041	2,4,5-TRICHLOROPHENOL	400.0				
D042	2,4,6-TRICHLOROPHENOL	2.0				
	PESTICIDES AND HERBICIDES					
D012	ENDRIN	0.02				
D013	LINDANE	0.4				
D014	METHOXYCHLOR	10.0				
D015	TOXAPHENE	0.5				
D016	2,4-D	10.0				
D017	2,4,5-TP (SILVEX)	1.0				
D020	CHLORDANE	0.03				
D031	HEPTACHLOR (AND ITS EPOXIDE)	0.008				

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			☑
CHLORINE			☑
FLUORINE			☑
IODINE			☑
SULFUR			☑
POTASSIUM			☑
SODIUM			☑
AMMONIA			☑
CYANIDE AMENABLE			☑
CYANIDE REACTIVE			☑
CYANIDE TOTAL			☑
SULFIDE REACTIVE			☑

HOCs

☑ NONE
< 1000 PPM
>= 1000 PPM

PCBs

☑ NONE
< 50 PPM
>=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

YES ☑ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

YES ☑ NO (If yes, explain)

CHOOSE ALL THAT APPLY

DEA REGULATED SUBSTANCE	EXPLOSIVE	FUMING	OSHA REGULATED CARCINOGENS
POLYMERIZABLE	RADIOACTIVE	REACTIVE MATERIAL	☑ NONE OF THE ABOVE

F. REGULATORY STATUS

YES ☑ NO USEPA HAZARDOUS WASTE?

YES ☑ NO DO ANY STATE WASTE CODES APPLY?

Texas Waste Code

YES ☑ NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?

YES ☑ NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?

LDR CATEGORY: ***Not subject to LDR***
VARIANCE INFO:

YES ☑ NO IS THIS A UNIVERSAL WASTE?

YES ☑ NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR (CESQG)?

YES NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?

YES ☑ NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES ☑ NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES ☑ NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 77 KPA (11.2 PSIA)?

YES ☑ NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?

YES ☑ NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?

Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?

YES NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?

YES NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

What is the TAB quantity for your facility? Megagram/year (1 Mg = 2,200 lbs)

The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing

Describe the knowledge :

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NONE, NON DOT REGULATED, (SOIL AND PPE), N/A

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY ONE TIME WEEKLY MONTHLY QUARTERLY YEARLY ☑ OTHER ***As needed***

3 Drums - Soil 1 Drum - PPE

☑ **CONTAINERIZED**

1-20 CONTAINERS/SHIPMENT

STORAGE CAPACITY: ***25***

CONTAINER TYPE:

CUBIC YARD BOX PALLET

TOTE TANK ☑ DRUM

OTHER:

DRUM SIZE: ***55***

BULK LIQUID

GALLONS/SHIPMENT: ***0 Min -0 Max*** GAL.

BULK SOLID

SHIPMENT UOM: TON YARD

TONS/YARDS/SHIPMENT: ***0 Min - 0 Max***

I. SPECIAL REQUEST

COMMENTS OR REQUESTS:

lab sample RVAAP-001-IDW-SO

GENERATOR'S CERTIFICATION

I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge. I also certify that any samples submitted are representative of the actual waste. If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
Mark Patte	Mark Patterson	Fac. Man.	12/6/10

SHAW

WASTE MATERIAL PROFILE SHEET

Decon fluids Non Haz Waste

Clean Harbors Profile No. CH473928

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION # *OH5210020736* GENERATOR NAME: *Ravenna Army Ammunition Plant*

GENERATOR CODE (Assigned by Clean Harbors) *RA1704* CITY *Ravenna* STATE/PROVINCE *OH* ZIP/POSTAL CODE *44266*

ADDRESS *8451 State Route 5* PHONE: *(330) 358-7312*

CUSTOMER CODE (Assigned by Clean Harbors) *SH0902* CUSTOMER NAME: *Shaw Environmental*

ADDRESS *100 Technology Center Dr* CITY *Stoughton* STATE/PROVINCE *MA* ZIP/POSTAL CODE *02072*

B. WASTE DESCRIPTION

WASTE DESCRIPTION: *decontamination fluids*

PROCESS GENERATING WASTE: **decontamination of sampling equipment**

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ? **No**

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE
- SOLID WITHOUT FREE LIQUID
- POWDER
- MONOLITHIC SOLID
- [x] LIQUID WITH NO SOLIDS
- LIQUID/SOLID MIXTURE
  - % FREE LIQUID
  - % SETTLED SOLID
  - % TOTAL SUSPENDED SOLID
- SLUDGE
- GAS/AEROSOL

NUMBER OF PHASES/LAYERS

[x] 1 2 3

% BY VOLUME (Approx.)

TOP *0.00*

MIDDLE *0.00*

BOTTOM *0.00*

VISCOSITY (If liquid present)
- [x] 1 - 100 (e.g. Water)
- 101 - 500 (e.g. Motor Oil)
- 501 - 10,000 (e.g. Molasses)
- > 10,000

COLOR

varies

ODOR
- NONE
- [x] MILD
- STRONG

Describe:

BOILING POINT °F (°C)
- <= 95 (<=35)
- 95 - 100 (35-38)
- 101 - 129 (38-54)
- [x] >= 130 (>54)

MELTING POINT °F (°C)
- < 140 (<60)
- 140-200 (60-93)
- > 200 (>93)

TOTAL ORGANIC CARBON
- [x] <= 1%
- 1-9%
- >= 10%

FLASH POINT °F (°C)
- < 73 (<23)
- 73 - 100 (23-38)
- 101 -140 (38-60)
- 141 -200 (60-93)
- [x] > 200 (>93)

pH
- <= 2
- 2.1 - 6.9
- 7 (Neutral)
- [x] 7.1 - 12.4
- >= 12.5

SPECIFIC GRAVITY
- < 0.8 (e.g. Gasoline)
- 0.8-1.0 (e.g. Ethanol)
- [x] 1.0 (e.g. Water)
- 1.0-1.2 (e.g. Antifreeze)
- > 1.2 (e.g. Methylene Chloride)

ASH
- < 0.1
- 0.1 - 1.0
- 1.1 - 5.0
- 5.1 - 20.0
- > 20
- [x] Unknown

BTU/LB (MJ/kg)
- [x] < 2,000 (<4.6)
- 2,000-5,000 (4.6-11.6)
- 5,000-10,000 (11.6-23.2)
- > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
WATER DECON FLUIDS	100.0000000	--	100.0000000	%

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? YES NO

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? YES [x] NO

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? YES [x] NO

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies:

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE. *G19* SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE. *W101*

E. CONSTITUENTS

Are these values based on testing or knowledge? Knowledge ☑ Testing

If constituent concentrations are based on analytical testing, analysis must be provided. Please attach document(s) using the link on the Submit tab.

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATED METALS	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
D004	ARSENIC	5.0				☑
D005	BARIUM	100.0				☑
D006	CADMIUM	1.0				☑
D007	CHROMIUM	5.0				☑
D008	LEAD	5.0				☑
D009	MERCURY	0.2				☑
D010	SELENIUM	1.0				☑
D011	SILVER	5.0				☑

	VOLATILE COMPOUNDS	
D018	BENZENE	0.5
D019	CARBON TETRACHLORIDE	0.5
D021	CHLOROBENZENE	100.0
D022	CHLOROFORM	6.0
D028	1,2-DICHLOROETHANE	0.5
D029	1,1-DICHLOROETHYLENE	0.7
D035	METHYL ETHYL KETONE	200.0
D039	TETRACHLOROETHYLENE	0.7
D040	TRICHLOROETHYLENE	0.5
D043	VINYL CHLORIDE	0.2
	SEMI-VOLATILE COMPOUNDS	
D023	o-CRESOL	200.0
D024	m-CRESOL	200.0
D025	p-CRESOL	200.0
D026	CRESOL (TOTAL)	200.0
D027	1,4-DICHLOROBENZENE	7.5
D030	2,4-DINITROTOLUENE	0.13
D032	HEXACHLOROBENZENE	0.13
D033	HEXACHLOROBUTADIENE	0.5
D034	HEXACHLOROETHANE	3.0
D036	NITROBENZENE	2.0
D037	PENTACHLOROPHENOL	100.0
D038	PYRIDINE	5.0
D041	2,4,5-TRICHLOROPHENOL	400.0
D042	2,4,6-TRICHLOROPHENOL	2.0
	PESTICIDES AND HERBICIDES	
D012	ENDRIN	0.02
D013	LINDANE	0.4
D014	METHOXYCHLOR	10.0
D015	TOXAPHENE	0.5
D016	2,4-D	10.0
D017	2,4,5-TP (SILVEX)	1.0
D020	CHLORDANE	0.03
D031	HEPTACHLOR (AND ITS EPOXIDE)	0.008

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			☑
CHLORINE			☑
FLUORINE			☑
IODINE			☑
SULFUR			☑
POTASSIUM			☑
SODIUM			☑
AMMONIA			☑
CYANIDE AMENABLE			☑
CYANIDE REACTIVE			☑
CYANIDE TOTAL			☑
SULFIDE REACTIVE			☑

HOCs

☑ NONE
< 1000 PPM
>= 1000 PPM

PCBs

☑ NONE
< 50 PPM
>=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

YES ☑ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

YES ☑ NO (If yes, explain)

CHOOSE ALL THAT APPLY

DEA REGULATED SUBSTANCE	EXPLOSIVE	FUMING	OSHA REGULATED CARCINOGENS
POLYMERIZABLE	RADIOACTIVE	REACTIVE MATERIAL	☑ NONE OF THE ABOVE

F. REGULATORY STATUS

YES ☑ NO USEPA HAZARDOUS WASTE?

YES ☑ NO DO ANY STATE WASTE CODES APPLY?

Texas Waste Code

YES ☑ NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?

YES ☑ NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?

LDR CATEGORY: ***Not subject to LDR***
VARIANCE INFO:

YES ☑ NO IS THIS A UNIVERSAL WASTE?

YES ☑ NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR (CESQG)?

YES ☐ NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?

YES ☑ NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES ☐ NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES ☑ NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES ☐ NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES ☑ NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 77 KPA (11.2 PSIA)?

YES ☑ NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?

YES ☑ NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?

Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES ☐ NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?

YES ☐ NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?

YES ☐ NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

What is the TAB quantity for your facility? ☐ Megagram/year (1 Mg = 2,200 lbs)

The basis for this determination is: Knowledge of the Waste Or Test Data ☐ Knowledge ☐ Testing

Describe the knowledge :

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NONE, NON HAZARDOUS, NON D.O.T. REGULATED LIQUID, (DECON WATER), N/A

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY ☑ ONE TIME ☐ WEEKLY ☐ MONTHLY ☐ QUARTERLY ☐ YEARLY ☐ OTHER

1 - Drum approx ~25 gal.

☑ **CONTAINERIZED**

1-15 CONTAINERS/SHIPMENT

STORAGE CAPACITY: ***15***

CONTAINER TYPE:

☐ CUBIC YARD BOX ☐ PALLET

☐ TOTE TANK ☑ DRUM

☐ OTHER:

DRUM SIZE: ***55***

BULK LIQUID

GALLONS/SHIPMENT: ***0 Min -0 Max*** GAL.

BULK SOLID

SHIPMENT UOM: ☐ TON ☐ YARD

TONS/YARDS/SHIPMENT: ***0 Min - 0 Max***

I. SPECIAL REQUEST

COMMENTS OR REQUESTS:

GENERATOR'S CERTIFICATION

I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge. I also certify that any samples submitted are representative of the actual waste. If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
Mark Patterson	Mark Patterson	Fac. Man.	12/6/10

ATTACHMENT 3
INVESTIGATION-DERIVED WASTE MANIFEST

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NON-HAZARDOUS WASTE MANIFEST

D53263905

Please print or type (Form designed for use on elite (12 pitch) typewriter)

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: OH5210020736

Manifest Document No.: 63905

2. Page 1 of 1

3. Generator's Name and Mailing Address
Ravenna Army Ammunition Depot
8451 State Route 5
Ravenna OH 44266
4. Generator's Phone ( )

Site Address :
SAME

5. Transporter 1 Company Name: Clean Harbors Environmental Services Inc

6. US EPA ID Number: MAD039322250

A. State Transporter's ID

B. Transporter 1 Phone: (781)792-5000

7. Transporter 2 Company Name: ROBBIE D WOOD

8. US EPA ID Number: ALD 067138921

C. State Transporter's ID

D. Transporter 2 Phone

9. Designated Facility Name and Site Address
Spring Grove Resource Recovery Inc
4879 Spring Grove Avenue
Cincinnati, OH 45232

10. US EPA ID Number: OHD000816629

E. State Facility's ID

F. Facility's Phone: (513) 681-5738

11. WASTE DESCRIPTION	Containers No.	Containers Type	13. Total Quantity	14. Unit Wt./Vol.
a. NON HAZARDOUS, NON D.O.T. REGULATED LIQUID, (DECON WATER)	2	DM	110	G
b. NON DOT REGULATED, (SOIL AND PPE)	5	DM	1000	P
c.				
d.				

GENERATOR

G. Additional Descriptions for Materials Listed Above
11a.CH473928
11b.CH474137

H. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

Emergency Phone Number: (800) 483-3718

NON-HAZARDOUS WASTE

16. **GENERATOR'S CERTIFICATION:** I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this manifest are not subject to federal hazardous waste regulations.

Printed/Typed Name: X Mark Patterson
Signature: X Mark Patterson for
Date: Month 01 Day 06 Year 11

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Josin Beleaua
Signature:
Date: Month 01 Day 06 Year 11

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name: DAVID RIPPLE
Signature:
Date: Month 1 Day 14 Year 11

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of the waste materials covered by this manifest, except as noted in item 19.

Printed/Typed Name:
Signature:
Date: Month 01 Day 20 Year 11

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