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The purpose of this DQO Report is to determine if there are any data gaps from the past removal action at RVAAP-34 where the extent of contamination was not adequately characterized or if there are any other efforts required for environmental closure of the AOC. The evaluation processes presented in this document and performed under this delivery order were conducted in accordance with the DQO requirements described in the FSAP, the HHRAM and the revised SOW. Data results from the 2004 MKM Remedial Design/Remedial Action Report were evaluated per the data evaluation and screening process in the HHRAM and the cleanup goals (CUGs) for the Residential Farmer (adult and child) and/or Ohio National Guard use. Given the elevated concentrations of inorganics and SVOCs above the RVAAP background values and CUGs in surface soils, the elevated arsenic and chromium levels within site sediment and the scattered contaminant hits over the remainder of the site; it is recommended that additional sampling be performed to address surface soils, subsurface soils and sediment. No additional sampling for surface water is recommended going forward. A geophysical investigation will be performed prior to intrusive activities to identify debris and suspect MEC.

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Final Data Quality Objectives Report for the RVAAP-34 Sand Creek Disposal Road Landfill
Version 1.0

Ravenna Army Ammunition Plant
8451 St. Route 5
Ravenna, Ohio 44266-9297

Contract No. W912QR-08-D-0013
Delivery Order 0002

Prepared for:

US Army Corps of Engineers ®
Louisville District
600 Martin Luther King, Jr. Place
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July 16, 2009

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USACE – U.S. Army Corps of Engineers – Louisville District
USAEC – U.S. Army Environmental Command

CONTRACTOR'S STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Shaw Environmental & Infrastructure, Inc. has completed the *Final Data Quality Objectives Report for RVAAP-34 Sand Creek Disposal Road Landfill at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy, principles, and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets customer's needs consistent with law and existing Corps policy.

Reviewed/Approved by:  Date: 7/14/2009

David Cobb
Project/Program Manager

Prepared/Approved by:  Date: 7/14/2009

David Crispo, P.E.
Technical/Regulatory Lead

Table of Contents

List of Figures

List of Tables

List of Appendices

Acronyms and Abbreviations

a	concentration is below the reporting limit
ACM	Asbestos Containing Material
A/E	Architectural/Engineering
Ag	silver
AOC	Area of Concern
As	arsenic
B	For inorganics, result is less than the RL but greater than or equal to the IDL/MDL. For organics, batch QC is greater than the reporting limit.
Ba	barium
B(a)A	benzo(a)anthracene
B(a)P	benzo(a)pyrene
B(b)F	benzo(b)fluoranthene
BDL	below detection limit
BERA	baseline environmental risk assessment
bgs	below ground surface
C&D	construction and demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Chemical of Potential Concern
CONT	contingency sample
Cr	chromium
CR	cancer risk
Co	cobalt
CUG	cleanup goal
D(a,h)A	dibenzo(a,h)anthracene
DNT	dinitrotoluene
DQO	Data Quality Objective
DO	Delivery Order
DoD	Department of Defense
DUP	Duplicate
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FSAP	Facility-wide Field Sampling and Analysis Plan
FSP	Field Sampling and Analysis Plan
HHRAM	Human Health Risk Assessment Manual
Hg	mercury
HQ	Hazard Quotient
IDL	instrument detection limit
IRP	Installation Restoration Program
J	Result is less than the RL, but greater than or equal to the MDL.
LCG	Louisville Chemistry Guidelines
µg/L	micrograms per liter

mg/kg	milligrams per kilogram
MCAWW	Method for Chemical Analysis of Water and Waste
MDL	method detection limit
MEC	munitions and explosives of concern
MI	multi-increment
MKM	MKM Engineers, Inc.
MMRP	Military Munitions Response Program
Mn	manganese
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
ND	not detected
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photo-ionization detector
PRG	Preliminary Remediation Goal
QA/QC	quality assurance/quality control
RA	removal action
RBSC	risk-based screening concentration
RD/RA	Remedial Design/Removal Action
RI	Remedial Investigation
RL	reporting limit
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
Sb	antimony
SD	sediment sample
Shaw	Shaw Environmental & Infrastructure, Inc.
SLERA	screening level environmental risk assessment
SO	surface soil sample
SOW	scope of work
SVOC	semi-volatile organic compound
SW	surface water sample
TAL	Target Analyte List
TCL	Target Compound List
TNT	trinitrotoluene
TOC	total organic carbon
USACE	United States Army Corps of Engineers
USP&FO	United States Property and Fiscal Officer
VOC	volatile organic compound

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1.0 Introduction

1.1 Purpose and Scope

This *Data Quality Objectives Report* (*DQO Report*) provides a systematic approach for evaluating data requirements to support the decision making process associated with possible future actions for RVAAP-34 Sand Creek Disposal Road Landfill (the site) located at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio (**Figure 1-1**). This *DQO Report* is being prepared by Shaw Environmental & Infrastructure, Inc. (Shaw) under Delivery Order (DO) 0002 for Architectural/Engineering (A/E) Environmental Services at RVAAP under the Indefinite Delivery/Indefinite Quantity Contract No. W912QR-08-D-0013. The DO was issued by the U.S. Army Corps of Engineers, Louisville District (USACE) on September 22, 2008.

The purpose of this *DQO Report* is to determine if there are any data gaps from the past removal action at RVAAP-34 where the extent of residual contamination was not adequately characterized or if there are any other efforts required for environmental closure of the Area of Concern (AOC). The evaluation processes presented in this document and performed under this DO were conducted in accordance with the facility-wide DQOs described in the *Facility-Wide Sampling and Analysis Plan* (*FSAP*; SAIC, 2001), the Data Collection and Evaluation process presented in the *RVAAP's Facility Wide Human Health Risk Assessor Manual* (*HHRAM*) (USACE, 2005) and the revised *Scope of Work* (*SOW*), dated August 26, 2008, included as an attachment to the DO contract.

1.2 Site Description and Background

The RVAAP is located in northeastern Ohio within Portage and Trumbull Counties, approximately 1.6 km (1 mile) northwest of the city of Newton Falls and 4.8 km (3 miles) east-northeast of the city of Ravenna (**Figure 1-1**). The facility is a parcel of property approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (**Figure 1-2**).

As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a training site. Currently, RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the Camp Ravenna Joint Military Training center (Camp Ravenna). RVAAP's remaining parcels of land are located completely within Camp Ravenna. Camp Ravenna did not

Figure 1-1
Location Map

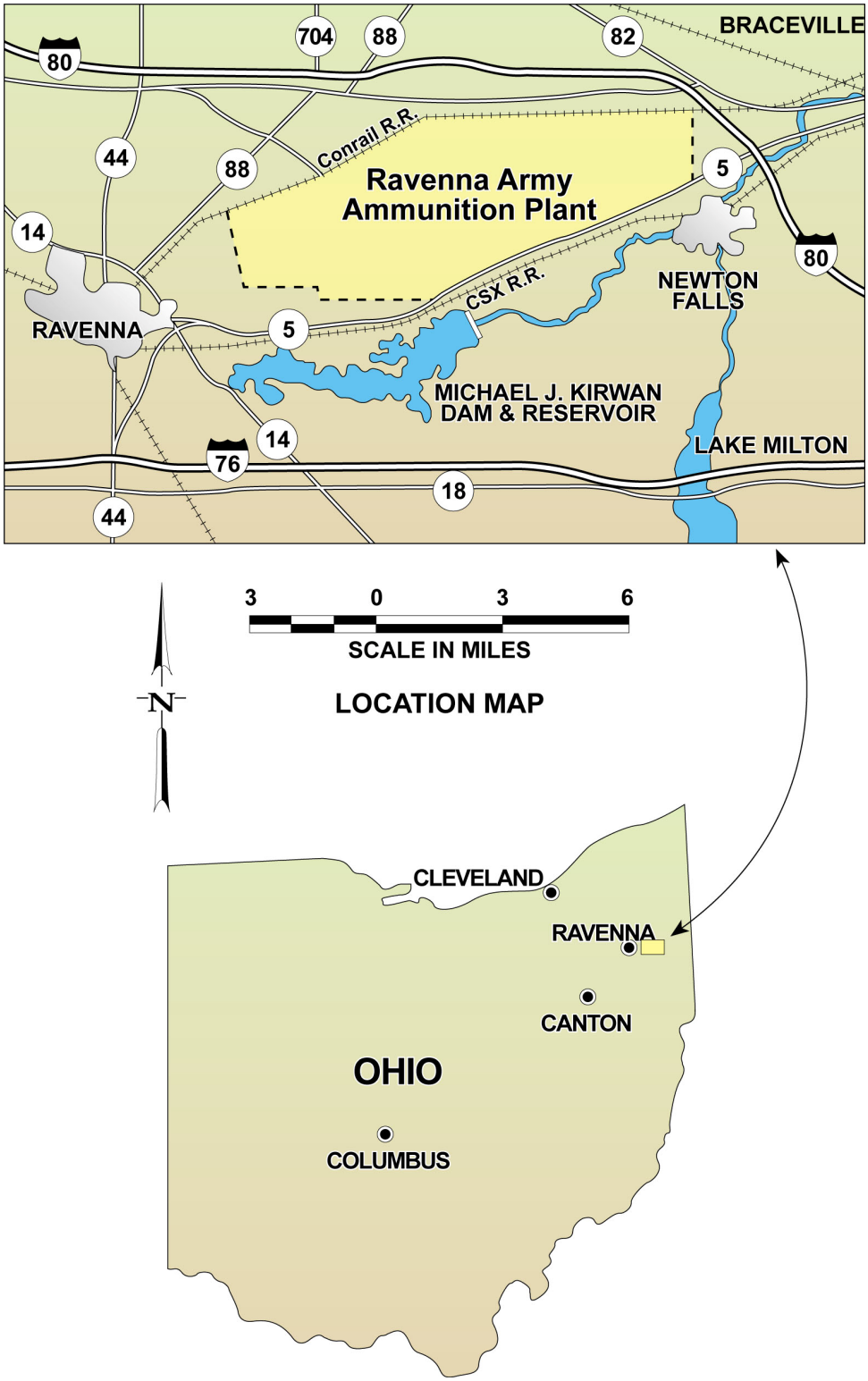
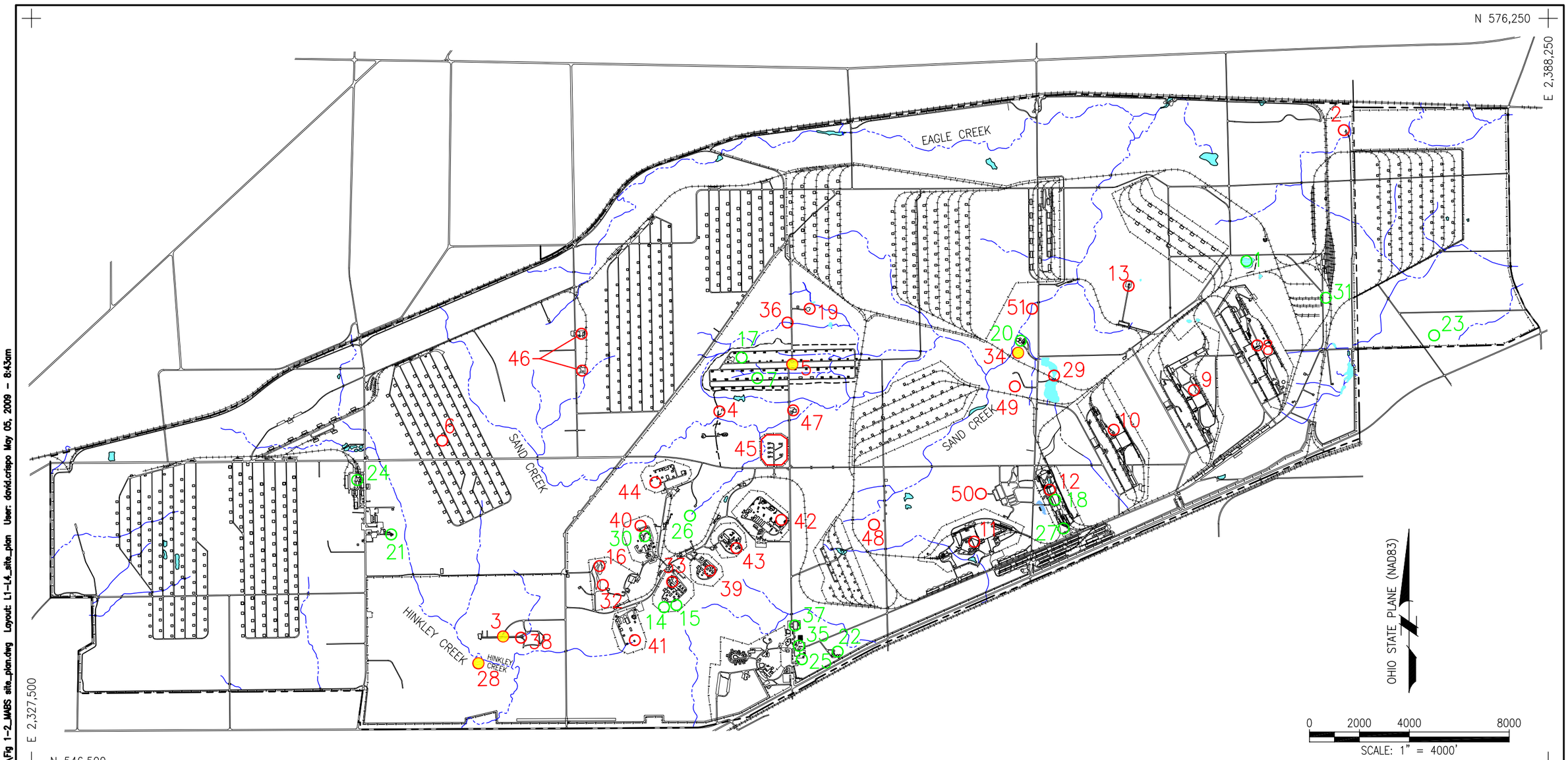


Figure 1-2
RVAAP Facility Map



Legend

1	RAMSDELL QUARRY LANDFILL	15	LOAD LINE 6, TREATMENT PLANT	29	UPPER AND LOWER COBB'S POND COMPLEX	43	LOAD LINE 10/PERCUSSION ELEMENT
2	ERIE BURNING GROUNDS	16	QUARRY LANDFILL/FORMER FUZE AND BOOSTER BURNING PITS	30	LOAD LINE 7 PINK WASTEWATER TREATMENT PLANT	44	LOAD LINE 11/ARTILLERY PRIMER
3	DEMOLITIONS AREA #1	17	DEACTIVATION FURNACE	31	ORE PILE RETENTION POND	45	WET STORAGE AREA
4	DEMOLITIONS AREA #2	18	LOAD LINE 12 PINK WASTEWATER TREATMENT	32	40– AND 60–MM FIRING RANGE	46	BUILDINGS F–15 AND F–16
5	WINKLEPECK BURNING GROUNDS	19	LANDFILL NORTH OF WINKLEPECK BURNING GROUND	33	FIRESTONE TEST FACILITY	47	BUILDING T–5301 DECONTAMINATION
6	C BLOCK QUARRY	20	SAND CREEK SEWAGE TREATMENT PLANT	34	SAND CREEK DISPOSAL ROAD LANDFILL	48	ANCHOR TEST AREA
7	BUILDING 1601 HAZARDOUS WASTE STORAGE	21	DEPOT SEWAGE TREATMENT PLANT	35	BUILDING 1037 LAUNDRY WASTEWATER SUMP	49	CENTRAL BURN PITS
8	LOAD LINE 1 AND DILUTION/SETTLING POND	22	GEORGE ROAD SEWAGE TREATMENT PLANT	36	PISTOL RANGE	50	ATLAS SCRAP YARD
9	LOAD LINE 2 AND DILUTION/SETTLING POND	23	UNIT TRAINING SITE WASTE OIL TANK	37	PESTICIDE STORAGE BUILDING T–4452	51	DUMP ALONG PARIS–WINDHAM ROAD
10	LOAD LINE 3 AND DILUTION/SETTLING POND	24	RESERVE UNIT MAINTENANCE AREA WASTE OIL TANK	38	NACA TEST AREA		CERCLA
11	LOAD LINE 4 AND DILUTION/SETTLING POND	25	BUILDING 1034 MOTOR POOL WASTE OIL TANK	39	LOAD LINE 5/FUZE LINE 1		RCRA
12	LOAD LINE 12 AND DILUTION/SETTLING POND	26	FUZE BOOSTER AREA SETTLING TANKS	40	LOAD LINE 7/BOOSTER LINE 1		OTHER REGULATORY
13	BUILDING 1200 AND DILUTION/SETTLING POND	27	BUILDING 854 PCB STORAGE	41	LOAD LINE 8/BOOSTER LINE 2		SWAMP
14	LOAD LINE 6, EVAPORATION UNIT	28	MUSTARD AGENT BURIAL SITE	42	LOAD LINE 9/DETONATOR LINE		

FENCE LINE
PROPERTY BOUNDARY
STREAM OR CREEK
BUILDING
ASPHALT ROAD
RAILROAD TRACKS
POND
SURVEY CONTROL POINT
AOC BOUNDARY
AOC UNDER A/E CONTRACT

US Army Corps of Engineers Louisville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

File: Z:\Figures\Environmental Services Contract\Fig 1-2_MABS site_plan.dwg Layout: L1-L4_site_plan User: david.crispo May 05, 2009 - 8:43am

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exist when RVAAP was operational, and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility.

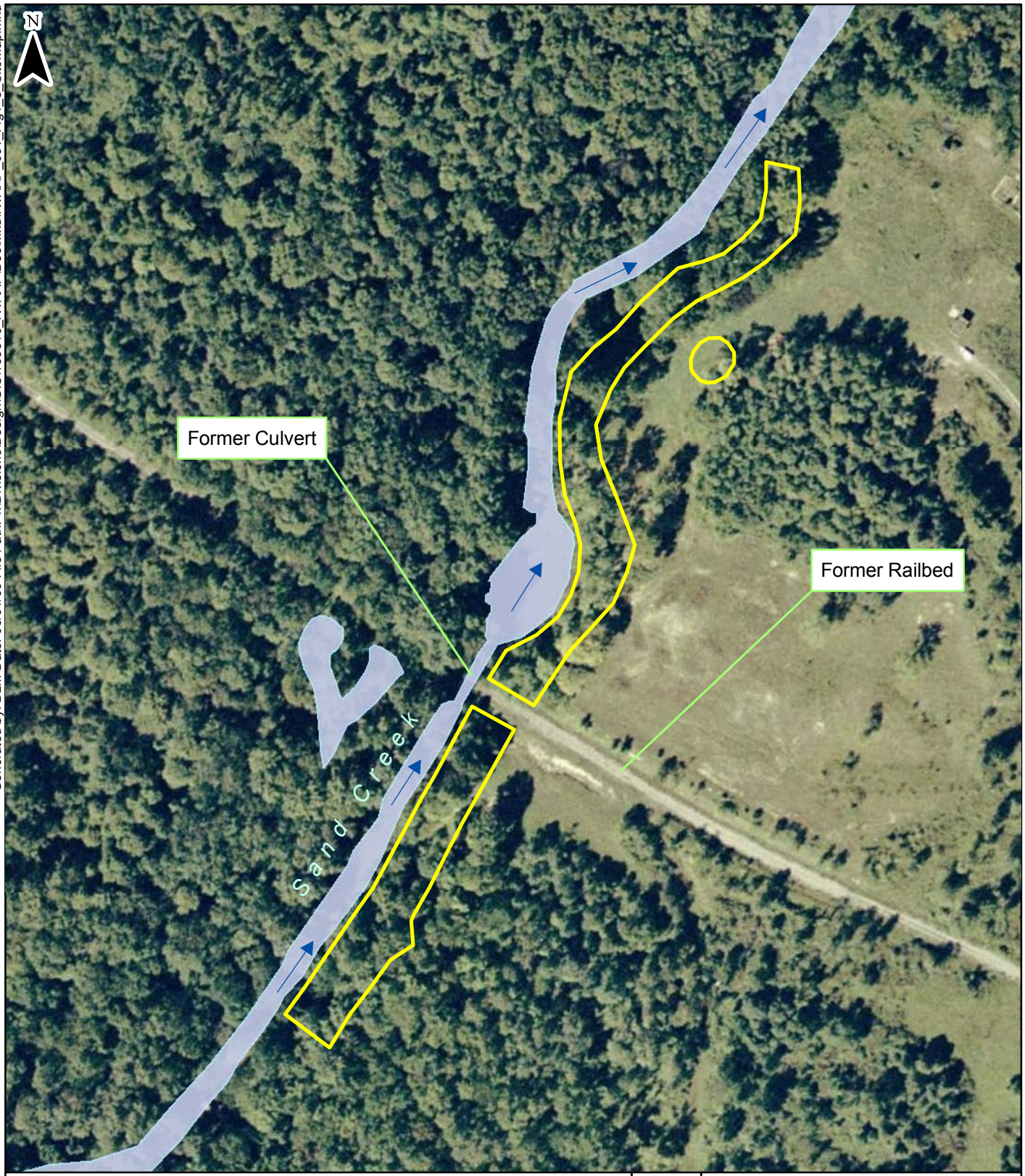
The RVAAP Installation Restoration Program (IRP) encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and; therefore, references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current Camp Ravenna and 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 Army under the U.S. Department of Defense (DoD) IRP.

1.2.1 Sand Creek Disposal Road Landfill

The Sand Creek Disposal Road Landfill is a former open dump area at the RVAAP. Construction and demolition (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 1200 feet and varied in width from 20 to 40 feet from the top of the bank to the bottom (**Figure 1-3**). 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. An inactive railroad bed bisects the AOC.

Preliminary site assessments found the site 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 site. Some of the types of C&D materials identified during the preliminary site assessment included:

- 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



Direction of Flow
RVAAP-34 Site Boundary
Stream

0 100 200
Feet

U.S. ARMY
CORPS OF ENGINEERS
LOUISVILLE DISTRICT

FIGURE NUMBER
1-3

RVAAP-34
SAND CREEK DISPOSAL ROAD LANDFILL
SITE MAP

Shaw Shaw Environmental, Inc.

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Project Number: 133616

Recent walkovers at the site have revealed that the corrugated iron culvert beneath the former railroad bed that crossed over Sand Creek has collapsed. The culvert and associated railroad ballast are now lying in Sand Creek adjacent to the site.

1.2.2 Summary of Removal Actions at Sand Creek Dump

A removal action (RA) at the Sand Creek Disposal Road Landfill was conducted by MKM Engineers, Inc. (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 (conducted as a technical modification to the original scope of work), transportation and disposal of debris and site restoration. Debris was removed using a track mounted excavator as well as by manual methods. Due to the presence of transite, all debris was disposed of as special waste (ACM). Approximately 1,118 tons of ACM material, including the subsurface transite, glass and miscellaneous debris were removed from the dump site.

1.2.3 Removal Action Sample Collection

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. Prior to sampling, the dump area was divided into thirty sampling grids to facilitate collection of the soil discrete samples. One shallow soil sample (0 to 1 foot), not including duplicates and quality control 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 site runoff.

The results and conclusions of the confirmatory sampling were evaluated and presented in the *Remedial Design/Removal Action Plan for Sand Creek* (*RD/RA Report*) (MKM, 2004). At the time the report was issued, the confirmatory results were compared to the RVAAP background concentrations for inorganics and the U.S. Environmental Protection Agency (EPA) Region 9 Preliminary Remediation Goals (PRGs), which are based on risk-based screening concentrations (RBSC) adjusted to account for additive effects between chemicals and routes of exposure.

The confirmatory *soil* samples showed elevated concentrations (i.e., greater than RVAAP background and/or the PRGs) of heavy metals in the northern third of the site with lower concentrations of heavy metals, semi-volatile 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 PRG level. Additionally, low levels of propellants and/or explosives were detected in the full suite *sediment* and *surface water* samples.

Since the submission of the MKM *RD/RA Report*, the Army has refined the cleanup goal screening process and intends to clean up the various AOCs to an unrestricted land use scenario whenever possible. A data gap analysis of the existing data and comparison to current facility-wide draft cleanup goals (CUGs), as presented in the *Draft Facility-Wide Human Health Cleanup Goals for the RVAAP* (SAIC, 2008), for the unrestricted land use scenarios as well as to the desired land use by OHARNG, are presented in **Section 3.0** of this *DQO Report*.

2.0 Data Quality Objectives

As part of the facility-wide approach to environmental investigation activities at RVAAP, facility-wide DQOs have been developed per the requirements outlined in the *FSAP* (SAIC, 2001). As stated in the *FSAP*, the DQO process is a tool to guide investigations at Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA) sites and will be incorporated to identify data gaps at Sand Creek Disposal Road Landfill. The DQOs serve two major purposes: (1) to present the facility-wide approach to sampling at the installation, and (2) to present the process that will be used to develop AOC-specific sampling and analysis plans. The DQO process culminates in the reduction of uncertainty associated with decisions related to remedial design and response actions. The following are the steps that Shaw will utilize to implement the DQO process:

1. Develop the Conceptual Site Model
2. State the problem
3. Identify decisions to be made
4. Define the study boundaries
5. Develop the decision rule (if/then)
6. Identify inputs to the decision (data uses and data needs)
7. Specify limits on uncertainty
8. Optimize the sample design

2.1 Conceptual Site Model

A conceptual site model is the cornerstone for planning a field sampling effort. It reflects an understanding of the known or expected site conditions and serves as the basis for making decisions about sample locations, frequencies, and required analytes. A conceptual model is inclusive of all available information, incorporating the hydrogeologic features and other characteristics of the site that combine to define the problem to be addressed (e.g., location of buried waste, primary contaminants and their properties, contaminant transport pathways, and potential human exposure scenarios, etc.).

The conceptual site model presented in the *FSAP* (SAIC, 2001) is applicable to Sand Creek Disposal Road Landfill for this *DQO Report*, based on current knowledge. Additional site information that adds to the conceptual site model for the site is discussed in **Section 1.2.1** of this *DQO Report.* Operational information and analytical data collected during historical environmental investigations at the site and further discussed in **Section 3.0** of this *DQO Report* have also been used to refine the conceptual model as follows:

Surface Soils

Thirty (30) confirmation surface soil samples and 3 contingency soil samples were collected at the site as part of the RA. Analysis of the sample results detected heavy metals, including arsenic, mercury, chromium, copper, iron, manganese and silver, and SVOCs that included the polynuclear aromatic hydrocarbons (PAHs) benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i) perlyene with concentrations greater than the PRGs and background values. The sample locations where heavy metals were detected above the PRGs and background values were located primarily in the northern third of the site. The soil sample where SVOCs were detected is located approximately 120 feet north of the former railroad bed.

Sediment

Twelve (12) sediment samples were collected from the neighboring floodplain to characterize potential impact associated with site runoff. The *RD/RA Report* identified arsenic levels greater than the PRGs at 11 of the 12 locations; however, none of the concentrations were greater than the RVAAP background value. Erosion transport of soil contaminants and deposition as stream sediment is a potential migration mechanism and re-suspension of sediment within Sand Creek during storm events provides a potential mechanism for downstream transport over time.

Surface Water

Three surface water samples were collected from within Sand Creek to assess surface water quality and characterize potential impact associated with site runoff. The samples identified a low level of propellant at one location; however, the result was less than the PRG. 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 be detected in surface water.

2.2 State the Problem

Although all surface debris was removed from the site in 2003, there is a potential for contaminants to be present in subsurface soils as subsurface soils were not thoroughly investigated as part of the prior investigation/remedial action. Groundwater is being evaluated separately under a facility-wide initiative and is removed from further consideration in this *DQO Report*.

2.3 Identify Decisions to be Made

The key decisions for all investigations at RVAAP have been identified in Section 3.2.4 and in Table 3-1 of the *FSAP*. Additional investigation data may be necessary to initiate the decision process and determine whether a response action is needed. Current analytical methods defined by USEPA SW-846 will be used to determine the concentrations of hazardous constituents present in the samples collected, if further sampling is deemed necessary. Data collected during the additional investigation, including environmental or Military Munitions Response Program (MMRP) results, will be incorporated into a *Remedial Investigation/Feasibility Study* (*RI/FS*) for the Sand Creek Disposal Road Landfill that would satisfy the following data needs:

- The data are to be of sufficient quality to determine if a contaminant release occurred at RVAAP-34.
- The data are to be of sufficient quality to determine if contaminants detected during the RA are related to RVAAP-34 or other sources.
- The data are to be of sufficient quality to be legally defensible.
- The data are to be of sufficient quality and quantity to support screening assessments for human health and the environment.

2.4 Define Study Boundaries

The investigation area boundary for the Sand Creek Disposal Road Landfill is that presented in **Figure 1-3**. This boundary was established to encompass all known or reported historical dumping operations and adjacent support areas (i.e., truck unloading areas at the top of the embankment) along the 1200 foot reach of the Sand Creek. If warranted, the spatial boundary of the site may increase or decrease based on geophysical investigation results or visible areas of contamination (i.e., stained soils, distressed vegetation or areas of dumping).

2.5 Identify Decision Rules

Decision rules used to guide remediation decisions are provided in the *HHRAM* and discussed further in **Section 3.0**. The purposes of the sampling assessment data in the *RD/RA Report* (MKM, 2004) are to determine the type of residual contamination, to compare these data to the facility-wide draft CUGs (SAIC, 2008) for the unrestricted land use scenarios for the Residential Farmer (adult and child) or at a minimum, the desired use of the land by OHARNG, and to determine if further investigation is needed at the site. The sampling assessment data in the *RD/RA Report* is considered initial phase sampling; therefore, per the DQO decision rules presented in Section 3.2.6 of the *FSAP* and the data evaluation and screening process described in the *HHRAM*, if levels of the residual contamination detected in surface soils (0 to 1 foot), sediment and surface water are greater than the permissible risked based draft CUGs [at a 10^{-6}

cancer risk level or a Hazard Quotient (HQ) equal to 0.1] then perform additional sampling to characterize the risk, otherwise, no additional action is required.

Application of the decision rules will result in the determination of the extent of releases at RVAAP-34. Once determined, the need for further action at the site to include additional screening, investigations or removal action will be assessed. The decision rules also provide information necessary to allow Ohio EPA to make a determination on the regulatory status of the site. Only those constituents that are identified above the facility-wide risk based draft CUGs (10^{-6} cancer risk level and HQ equal to 0.1) or otherwise retained as COPCs, based on the data screening process identified in **Section 3.0,** constitute a requirement for additional characterization.

During the RI stage, Shaw will complete a screening assessment for human health using the mean concentration of the chemicals determined for data to be collected based on the recommendations of this *DQO Report* for the RI. The screening assessment will follow the data screening procedures in the *HHRAM* (USACE, 2005) to determine the chemicals of potential concern (COPCs). For the ecological benchmarks, Shaw will complete a screening level risk assessment (SLERA) in the RI stage following procedures in the facility-wide *Ecological Risk Work Plan* and USEPA's *Ecological Risk Assessment Guidance for Superfund Sites*. Ecological screening values or benchmarks used in SLERA must be pre-approved by USACE and the Ohio EPA.

2.6 Identify Inputs to the Decision

Inputs to the decision process are the analytical results and the conceptual site model developed from field observations.

2.7 Specify Limits on Decision Error

Limits on decision errors are addressed in Section 3.2.8 of the *FSAP*.

2.8 Optimize the Sample Design

The sample design and rationale for additional investigation at the site is described in detail in **Section 4.0** of this *DQO Report*. The intent of additional sampling and analysis at the site is to focus on the criteria identified in Section 3.2.9.1 of the *FSAP* that includes the following:

- Determination of the presence of contamination
- Determination of the nature and extent of contamination
- Identification of the connections between contaminant sources and pathway media
- Thorough characterization of an AOC using comprehensive sampling methodology

A geophysical investigation will be performed over the site prior to investigation activities to identify potential source areas and materials or munitions and explosives of concern (MEC) that will require removal. Suspected and identified source areas of debris and residual contamination identified in surface soils, as presented in **Section 3.0**, represent specific focus areas for additional surface and subsurface sampling. The location of any suspected MEC will be marked using global positioning system and no intrusive activities will be performed at that location under the IRP contract as currently presented. The sediment in the floodplain adjacent to Sand Creek and along the reach of the site is also specifically targeted for sampling.

In order to accomplish the purposes of data gap sampling, biased sampling will be used. That is, historical activities, topography and any other information specific to the site will be used to identify locations where residual contamination would most probably remain. At these locations, grid areas will be established and sample analysis will be conducted for the identified COPCs and 10 percent of all samples will be subjected to the full suite of analyses. Biased sampling will be most applicable to the surface soil areas where COPCs were previously identified above the current facility-wide risk-based draft CUGs and background values, subsurface soils beneath these surface soil areas and for subsurface soils where the results of the geophysical investigation may identify remaining subsurface debris.

The site will also require characterization of the areas between the locations with detected elevated concentrations as well. For this purpose, non-biased or random grids sampling will be used to acquire representative information on areas between known or suspected areas of contamination at the site. Non-biased sampling will be most applicable to the sediments in Sand Creek floodplain along the reach of the site, the surface soil areas with detected contaminants that were below the risk-based draft CUGs and the associated subsurface soils.

For both the biased and non-biased surface soil and sediment samples, the samples will be collected using the multi-increment (MI) sampling process. Discrete subsurface samples will be collected at the biased and non-biased locations using Geoprobe (site conditions permitting) and/or hand auguring sampling procedures. Site conditions that may prevent using the Geoprobe consist of steep slopes, saturated conditions and/or overgrown vegetation.

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3.0 Data Evaluation

This section presents the data evaluation methods and screening criteria used to identify COPCs for the media sampled during the RA event. In general, the evaluation and screening methodology will initially compare constituents present at background concentrations from those present at concentrations that indicate potential impacts related to historical operations at the Sand Creek Disposal Road Landfill. The identified constituents will then be compared to the facility-wide draft CUGs for unrestricted land use scenarios for the Residential Farmer (adult and child) and the desired use of the land by OHARNG. Summary analytical results are presented in this section that addresses each data aggregate collected during the RA activities. A table summary of the analytical results for detected constituents included in the *RD/RA Report* (MKM, 2004) for surface soil discrete samples, sediment discrete samples and surface water is presented in **Tables 3-1, 3-2,** and **3-3**, respectively (at the end of this section).

3.1 Data Reduction and Screening

The data reduction process employed to identify COPCs involved identifying frequency of detection summary statistics, comparison to RVAAP facility-wide background values (inorganics only) and evaluation of essential nutrients. Historical site data was used from the *RD/RA Report* and quality control (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. Following data reduction, the data was screened to identify COPCs using the processes outlined in the following sections.

3.1.1 Frequency of Detection

The frequency of detection screening methodology is appropriate for discrete sample data sets as is the case for the environmental samples collected during the RA activities. 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 is used to determine if the chemical is AOC related. The magnitudes and clustering of the detections and the potential source of the chemical will be evaluated. If detected results are not clustered, and the chemical is not found in other media at the study area, and the concentrations are not substantially elevated relative to the detection limit, and the chemical was not used in the area being investigated, then the chemical will be considered spurious and be eliminated from further consideration. Therefore, chemicals that are detected only at low concentrations in less than 5 percent of the samples from a given medium are dropped from further consideration,

unless their presence is expected on historical information about the site, or it is likely to identify the existence of a 'hot spot' (USACE, 2005).

3.1.2 Facility-Wide Background Screen

For each inorganic constituent, concentrations were compared against established RVAAP facility-wide background values. For inorganic constituents, if the value exceeded its respective background criterion, it was considered to be a COPC. It should be noted that not all inorganic compounds, analyzed as part of the RA sampling event, have established screening levels or background values; therefore, in the event an inorganic constituent was not detected in the background data set, the background value was set to zero, and any detected result for that constituent was considered above background. This conservative process ensured that detected constituents were not eliminated as COPCs simply because they were 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.

3.1.3 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 USEPA recommends that these chemicals not be evaluated as COPCs as long as 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, 2005). For the RA investigation, analyses were conducted for calcium, iron, magnesium, potassium and sodium. These five constituents were eliminated as COPCs in all environmental media based on comparison to background values.

3.1.4 Cleanup Goal Screening Criteria

Historical data collected at the Sand Creek Disposal Road Landfill and screened as COPCs as identified in the previous sections was compared to the unrestricted land use criteria developed for the Residential Farmer (adult and child) Land Use Scenario for RVAAP. At a minimum, each AOC must be remediated to the extent that OHARNG can fully utilize the site for their desired land use. The OHARNG receptors included the National Guard Dust/Fire Control Worker, National Guard Range Maintenance Soldier and the National Guard Trainee. The most current version of these criteria or facility-wide draft CUGs is presented in the September 2008 *Draft Facility-Wide Human Health Remediation Goals at the RVAAP* prepared by Science Applications International Corporation (SAIC, 2008). This document was developed to support the environmental remediation of the remaining AOCs to complete final transfer of the land to OHARNG. The document contains calculated remediation goals that can accelerate the decision-making process for the remaining AOCs, taking advantage of the fact that many of the

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Project Number: 133616

Sediment Sample Locations

Shallow Soil Confirmation Sample Locations

Surface Water Sample Locations

Sand Creek Dump-Limits & Sample Grids

Stream

0 100 200 Feet

U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

FIGURE NUMBER 3-1

RVAAP-34
SAND CREEK DISPOSAL ROAD LANDFILL
REMOVAL ACTION SAMPLE LOCATIONS

Shaw Shaw Environmental, Inc.

risk assessment inputs and decisions for the facility have already been agreed to by stakeholders through the application of the CERCLA process as documented in the *HHRAM* (USACE, 2005).

As part of this *DQO report*, Shaw will evaluate concentrations of the screened COPCs identified in surface soil (0 to 1 foot), sediments and surface water as part of the previous investigation activities presented in the *RD/RA Report* (**Figure 3-1**) to provide a current comparison to the agreed upon draft CUGs. The sampling assessment data collected during the RA event will be screened to the 10^{-6} cancer risk level or HQ equal to 0.1 ($^{1}/_{10}$ the non-cancer risk) as discussed in **Section 2.5** and directed in the *HHRAM*.

3.1.5 Data Presentation

Data summary statistics and screening results for the COPCs in surface soil, sediment and surface water at the Sand Creek Disposal Road Landfill are presented in the following sections. For each media, detected analytical results are presented in data summary tables (**Table 3-1**, **Table 3-2**, and **Table 3-3** at the end of this section). Screened constituents and identified COPCs are addressed in the text of this section.

3.2 Surface Soil Discrete Samples

Prior to collecting the shallow surface soil confirmation samples, the site was divided into thirty, approximately 40 by 40-foot sampling grids (**Figure 3-1**). One discrete shallow soil sample was collected from each grid (30 total). Sample locations, including QC samples, were selected based on visual survey of the area conditions, such as orientation of waste piles, field screening with the photoionization detector (PID), etc. to ensure appropriate positioning of each sample point. The confirmatory shallow soil samples were collected from the surface to a depth of 1 foot (0 to 1 foot) below ground surface (bgs).

All surface soil samples were analyzed for target analyte list (TAL) metals and asbestos analysis. In addition, 10 percent of the samples (3) were submitted for the RVAAP full suite that included target compound list (TCL) volatile organic compounds (VOCs), TCL SVOCs, TCL pesticides, polychlorinated biphenyls (PCBs), explosives and propellants (nitroglycerine, nitroguanidine and nitrocellulose). Data summary statistics and screening results to identify COPCs are presented in **Table 3-4**. A comparison of the COPCs retained in **Table 3-4** to the unrestricted land use facility-wide cancer and non-cancer risk draft CUGs for the Residential Farmer (adult and child) and OHANRG receptors is presented in **Table 3-5**. These tables are provided at the end of this section.

3.2.1 Explosives and Propellants

Three explosives, 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (DNT) and 2,6-DNT, and one propellant, nitrocellulose, were considered COPCs in surface soil regardless of their frequency of detection. The explosive contaminants were detected at the two sample locations

SCSS-029-0001-SO and SCSS-CONT3-0001-SO. The propellant was detected at sample location SCSS-029-0001-SO in addition to SCSS-017-0001-SO. The results of the explosives are below the cancer risk and the 1/10 non-cancer risk draft CUGs for the Residential Farmer (adult and child) as well as the cancer and 1/10 non-cancer risk draft CUGs for the OHARNG receptors and were not retained as COPCs requiring further evaluation going forward. No facility-wide draft CUG has been developed for nitrocellulose; therefore, the chemical is automatically retained as a COPC for further evaluation.

3.2.2 Inorganics

There were 23 inorganic analytes detected in surface soil samples, 15 of which were identified as COPCs (**Table 3-4)**. Seven of the detected constituents were eliminated as COPCs because they were either considered essential nutrients (calcium, iron, magnesium, potassium and sodium) or the maximum concentration was less than background (aluminum and vanadium). Thallium was eliminated as a COPC since the frequency of detection was less than 5 percent (1 detected result out of 30 samples). Two inorganics (cadmium and silver) were retained as COPCs because no background data was available. No facility-wide draft CUGs have been developed for lead, beryllium and selenium; however, these inorganics were automatically retained as COPCs for further evaluation since the maximum detected concentrations for each constituent exceeded their respective background values.

Arsenic, lead, barium, beryllium, chromium, cobalt, copper, manganese, nickel and zinc were detected at all sample locations and exceeded their respective background values in 7 to 67 percent of the samples. The most pervasive constituent was zinc, which was detected greater than the background value at 20 of the 30 sample locations. Mercury was detected at 29 of the 30 sample locations and exceeded the background value at 14 sample locations. Remaining inorganics that were detected less frequently consisted of antimony, cadmium, selenium and silver.

The retained inorganic COPCs with developed facility-wide draft CUGs in surface soils were screened against the cancer risk and non-cancer risk criteria for the Residential Farmer (adult and child) and the OHARNG receptors (National Guard Dust/Fire Control Worker, National Guard Range Maintenance Soldier and National Guard Trainee) land use scenarios. The inorganic constituent was retained as a COPC for further evaluation at the site if the concentration was greater than the cancer risk (10^{-6}) and/or 1/10 non-cancer risk (HQ equal to 0.1) for a receptor and the concentration was also greater than background. The inorganic constituent was not retained as a COPC for a receptor if the concentration was below background, regardless of the draft CUG level.

The discussion below contains a brief summary of the nature and extent for each of the inorganic COPCs that exceeded background values and the cancer risk and/or non-cancer risk draft CUG

for the Residential Farmer or OHARNG receptors. A summary of the accumulated COPCs per sample location that were retained following comparison the facility-wide draft CUGs is presented in **Table 3-6** at the end of this section.

Residential Farmer (Adult)

For the unrestricted land use scenario, inorganic COPCs identified for the Residential Farmer (adult) consist of antimony, arsenic, beryllium, lead, cadmium, chromium, manganese, mercury, selenium and silver. Arsenic was the most pervasive inorganic and was identified as a COPC at eight sample locations. The maximum arsenic concentration detected was 100 milligrams per kilogram (mg/kg) at sample location SCSS-008-0001-SO. Chromium was identified as a potential cancer risk at sample location SCSS-005-0001-SO with a concentration 230 mg/kg. Chromium was identified as a non-cancer risk COPC at two other locations: SCSS-007-0001-SO and SCSS-011-0001-SO. Manganese and silver were identified as non-cancer risk COPCs on a more infrequent basis at two locations, and antimony, cadmium, and mercury were identified as non-cancer risk COPCs at one location each. Sample locations with the most COPCs with concentrations greater than the cancer risk and/or $^1/_{10}$ non-cancer risk draft CUGs for the Residential Farmer (adult) include the following: SCSS-005-0001-SO (5), SCSS-007-0001-SO (4), and SCSS-006-0001-SO (3). A review of the dispersion of the inorganic COPCs for this receptor indicates that the contaminants are primarily situated in the northern portion of the site at and between sample locations SCSS-005-0001-SO and SCSS-007-0001-SO.

Residential Farmer (Child)

In addition to the inorganic COPCs identified for the Residential Farmer (adult), barium and copper were identified as non-cancer risk COPCs for the Residential Farmer (child). For this receptor, chromium was the most pervasive COPC with concentrations greater than the non-cancer risk CUG of 90.4 mg/kg at nine sample locations. As for the Residential Farmer (adult), arsenic concentrations were greater than the cancer risk and $^1/_{10}$ non-cancer risk at eight locations. Cadmium and silver were identified as non-cancer risk COPCs at four and six locations, respectively. Antimony, copper, and mercury were identified as non-cancer risk COPCs at two locations. Sample locations with the most COPCs with concentrations greater than the cancer risk and/or $^1/_{10}$ non-cancer risk draft CUGs for the Residential Farmer (child) include the following: SCSS-005-0001-SO (8), SCSS-006-0001-SO (4), SCSS-007-0001-SO (4), SCSS-004-0001-SO (4), and SCSS-008-0001-SO (3). The aforementioned sample locations are situated at the northern portion of the site.

National Guard Dust/Fire Control Worker

Arsenic was identified as a potential cancer risk at three surface soil sample locations for the National Guard Dust/Fire Control Worker. All three sample locations are situated at the northern portion of the site at sample locations SCSS-006-0001-SO (49 mg/kg), SCSS-007-0001-SO (38

mg/kg), and SCSS-008-0001-SO (100 mg/kg). No other inorganic COPCs were detected greater than the cancer risks and 1/10 non-cancer risks for this receptor.

National Guard Range Maintenance Soldier

Arsenic was identified as the only inorganic potential cancer risk for the National Guard Range Maintenance Soldier at eight surface sample locations. The arsenic concentration at sample location SCSS-008-0001-SO (100 mg/kg) is also greater than the 1/10 non-cancer risk CUG (92.5 mg/kg) for this receptor. The highest concentrations of arsenic for the National Guard Range Maintenance Soldier are situated primarily at the northern portion of the site at and between sample locations SCSS-005-0001 through SCSS-008-0001-SO.

National Guard Trainee

Cobalt was the most pervasive inorganic under the National Guard Trainee receptor scenario and was identified as a potential cancer risk at 17 sample locations. Chromium concentrations were detected greater than both the cancer risk and 1/10 non-cancer risk at 13 locations. Arsenic was identified as a potential cancer risk at eight locations. Manganese and barium were less than the 1/10 non-cancer risk draft CUGs at two and three locations, respectively. The COPCs associated with the National Guard Trainee are considered dispersed throughout the site with the highest concentrations of arsenic and chromium situated at the northern portion of the site near sample locations SCSS-005-0001-SO through SCSS-008-0001-SO. The highest manganese and cobalt concentrations are located at sample location SCSS-017-0001-SO at the central portion of the site.

3.2.3 Semivolatile Organic Compounds

There were 12 SVOCs, consisting of PAHs, detected in the discrete surface soil samples. The SVOCs were detected at two sample locations: SCSS-017-0001-SO and SCSS-029-0001-SO. Only three surface soil samples were analyzed for SVOCs; therefore, frequency of detection screening was not applicable to this sample aggregate. All of the detected SVOCs were retained as COPCs for comparison against the cancer and 1/10 non-cancer risk draft CUGs for the Residential Farmer (adult and child) and OHARNG receptors.

Residential Farmer (Adult and Child)

Of the 12 SVOCs retained as COPCs, 4 – benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene – had maximum concentrations that were greater than the cancer risk draft CUGs for the Residential Farmer (adult). All four exceedances were identified at one sample location, SCSS-017-0001-SO, approximately 120 feet north of the former railroad bed. The maximum concentration for dibenzo(a,h)anthracene (0.69 mg/kg) was also greater than the cancer risk of 0.065 mg/kg for the Residential Farmer (child).

National Guard Receptors

The concentrations of benzo(a)pyrene (0.29 mg/kg) and dibenzo(a,h)anthracene (0.69 mg/kg) at sample location SCSS-017-0001-SO are greater than the cancer risk CUG of 0.262 mg/kg for both chemicals for the National Guard Range Maintenance Soldier. The dibenzo(a)anthracene result also exceeds the cancer risk CUG of 0.477 mg/kg for the National Guard Trainee.

3.2.4 Volatile Organic Compounds

One VOC, chloroethane, was detected in surface soil discrete sample SCSS-029-0001-SO. A facility-wide risk-based CUG has not been developed for chloroethane for the Residential Farmer or OHARNG receptors. Per the data reduction and screening process, the analyte is automatically retained as a COPC for further evaluation in surface soils at the site.

3.2.5 Asbestos, Cyanide, Pesticides, PCBs

Cyanide, pesticides and PCBs were only analyzed for in the discrete surface soil samples at SCSS-013-0001-SO, SCSS-017-0001-SO and SCSS-029-0001-SO. Asbestos was analyzed for all surface soil discrete sample locations. No concentrations of asbestos, cyanide, pesticides or PCBs were detected in any of the surface soil samples.

3.2.6 Summary of Surface Soil Discrete Samples

For the unrestricted land use scenario, 10 inorganics (antimony, arsenic, beryllium, lead, cadmium, chromium, manganese, mercury, selenium, and silver), seven SVOCs (phenanthrene, benzo(a)anthracene, bis(2-ethylhexyl)phthalate, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene), one propellant (nitrocellulose) and one VOC (chlorethane) were detected in the surface soil discrete samples and were identified as COPCs requiring further evaluation at the site for the Residential Farmer (adult) receptor. In addition to the inorganics recognized for the Residential Farmer (adult), copper and barium were identified as non-cancer risk COPCs for the Residential Farmer (child) with concentrations greater than an HQ equal to 0.1. Arsenic was the most pervasive inorganic COPC that was identified as a potential cancer risk for both receptors. Arsenic and the majority of the remaining detected inorganic COPCs occurred at the northern portion of the site in the vicinity of sample locations SCSS-005-0001-SO through SCSS-008-0001-SO. The elevated SVOC COPCs were detected in one surface soil discrete sample (SCSS-017-0001-SO) at the north central portion of the site. Nitrocellulose and chloroethane were detected at sample location SCSS-029-0001-SO at the southern portion of the site. Nitrocellulose was also detected at sample location SCSS-017-0001-SO where the elevated SVOCs were detected.

For use of the site by the OHARNG, at a minimum, arsenic would need to be addressed as a COPC at three locations for the National Guard Dust/Fire Control Worker. Arsenic and two SVOCs [benzo(a)pyrene and dibenzo(a,h)anthracene] were identified as COPCs that exceeded

the cancer risk and/or 1/10 the non-cancer risk CUG for the National Guard Range Maintenance Soldier. Five inorganics (arsenic, barium, chromium, cobalt, and manganese) and one SVOC [dibenzo(a,h)anthracene] were identified as COPCs in the surface soil discrete samples that exceeded the cancer risk and/or 1/10 the non-cancer risk draft CUGs for the National Guard Trainee.

It should be noted that confirmation surface soil discrete samples collected during the RA activities were analyzed for total chromium only, whereas the facility-wide risk-based draft CUGs developed for the Residential Farmer and OHARNG receptors also provide for comparison to hexavalent chromium. Hexavalent chromium was calculated to have the same draft CUG criteria as total chromium for each of the receptors. Therefore, going forward, where chromium is identified as a COPC in surface soil requiring further evaluation, analysis for hexavalent chromium will also be performed.

3.3 Sediment Discrete Samples

A total of 12 sediment samples were collected from separate locations within the floodplain and stream channel (**Figure 3-1**). Six of the sediment samples were taken from Sand Creek; three of these samples were co-located with the surface water samples. Six other samples were collected from the narrow floodplain situated between Sand Creek and the AOC. Sediment samples were collected to characterize potential impact associated with site run-off, if any.

All of the sediment samples were collected for TAL metals and asbestos analysis. Ten percent of the samples (2) were submitted for the RVAAP full suite that in addition to TAL metals included TCL VOCs, TCL SVOCs, TCL pesticides, PCBs, explosives, propellants (nitroglycerine, nitroguanidine and nitrocellulose) and total organic carbon (TOC). Data summary statistics and screening results to identify COPCs are presented in **Table 3-7**. A comparison of the COPCs retained in **Table 3-7** to the facility-wide cancer and non-cancer risk draft CUGs for the Residential Farmer (adult and child) and OHARNG receptors is presented in **Table 3-8.** These tables are provided at the end of this section.

3.3.1 Explosives and Propellants

One explosive, 2,6-DNT, and two propellants, nitroguanidine and nitrocellulose, were considered COPCs in sediment regardless of their frequency of detection. The explosive contaminant was detected at sample location SCSD-008-0001-SD. Nitrocellulose was also detected at sample location SCSD-007-0001-SD in addition to sample location SCSD-008-0001-SD. Nitroquanidine was detected at sample location SCSD-008-0001-SD. Facility-wide risk-based draft CUGs have not been developed for these explosive or propellant constituents for the Residential Farmer or OHARNG receptors; however, per the data screening

process for non-inorganic anlaytes, they will automatically be retained as COPCs for further evaluation in sediment at the site.

3.3.2 Inorganics

There were 23 inorganic analytes detected in the sediment samples, 9 of which were identified as COPCs in **Table 3-7**. Thirteen (13) of the detected constituents were eliminated as COPCs because they were either considered essential nutrients (calcium, iron, magnesium, potassium and sodium) or the maximum concentration was less than background (arsenic, thallium, barium, copper, manganese, selenium, vanadium and zinc). None of the inorganics were eliminated based on frequency of detection since less than 20 sediment samples were collected and analyzed for inorganics. Three inorganics (antimony, cadmium, and silver) were retained as COPCs because no background data was available. No facility-wide draft CUGs have been developed for lead and beryllium; however, these inorganics were automatically retained as COPCs for further evaluation since the maximum detected concentrations for each constituent exceeded their respective background values.

Lead, beryllium, chromium, nickel and silver were detected at all sample locations and exceeded their respective background values in 8 to 33 percent of the samples, the most pervasive constituents being beryllium and zinc, which was detected greater than the background value at 4 of 12 sample locations each. Mercury was detected at 10 of the 12 sample locations and exceeded the background value at only one sample location. Remaining inorganics that were detected less frequently consisted of antimony, cadmium and cobalt.

The retained inorganic COPCs with developed facility-wide draft CUGs in sediment were screened against the facility-wide cancer risk (10^{-6}) and $^{1}/_{10}$ non-cancer risk (HQ equal to 0.1) criteria for the Residential Farmer (adult and child) unrestricted land use scenario. The inorganic constituent was retained as a COPC for further evaluation at the site if the concentration was greater than the cancer risk and/or $^{1}/_{10}$ non-cancer risk for a receptor and the concentration was also greater than background. The inorganic constituent was not retained as a COPC for a receptor if the concentration was below background, regardless of the CUG level. The retained COPCs were also compared to the cancer risk/non-cancer risk draft CUGs for the OHARNG receptors (National Guard Dust/Fire Control Worker and National Guard Trainee) in order to ensure the site was cleaned up to their desired use.

The discussion below contains a brief summary of the nature and extent for each of the inorganic COPCs that exceeded background values and the cancer risk and/or non-cancer risk draft CUGs for the Residential Farmer or OHARNG receptors. A summary of the accumulated COPCs per sample location that were retained following comparison to the facility-wide draft CUGs is presented in **Table 3-8** at the end of this section.

Residential Farmer (adult and child)

Comparison of the retained COPCs to the draft CUGs for the Residential Farmer receptors under the unrestricted land use scenario identified only silver to be greater than the 1/10 non-cancer risk CUG (38.6 mg/kg) for the Residential Farmer (child) at only one sample location. This concentration was detected at sample location SCSD-001-0001-SD at a concentration of 40 mg/kg. No other inorganic COPCs were identified with concentrations greater than the cancer risk or 1/10 non-cancer risk draft CUGs for the Residential Farmer (adult and child) receptors.

National Guard Receptors

A chromium concentration of 19 mg/kg was found at one location, SCSD-008-0001-SD, to be greater than the cancer risk and 1/10 non-cancer risk draft CUGs of 1.64 mg/kg and 5.61 mg/kg, respectively, for the National Guard Trainee. No other COPCs were identified with concentrations greater than the cancer risk or 1/10 non-cancer risk draft CUGs for the National Guard Trainee or National Guard Dust/Fire Control Worker.

3.3.3 Volatile Organic Compounds

One VOC, acetone, was detected in sediment discrete sample SCDS-008-0001-SD. A facility-wide risk-based CUG has not been developed for acetone for the Residential Farmer or OHARNG receptors; however, per the data screening process for organics, it will be automatically retained as a COPC for further evaluation in sediment at the site. Although, retained as a COPC, the acetone concentration will also be evaluated as a potential laboratory artifact.

3.3.4 Asbestos, SVOCs, Cyanide, Pesticides, PCBs

Cyanide, SVOCs, pesticides and PCBs were only analyzed for in the sediment discrete samples at SCSD-007-0001-SD and SCSD-008-0001-SD. Asbestos was analyzed for all sediment discrete sample locations. No concentrations of asbestos, cyanide, SVOCs, pesticides or PCBs were detected in any of the sediment samples.

3.3.5 Summary of Sediment Discrete Samples

Two inorganics (lead and beryllium), two propellants (nitroguanidine and nitrocellulose), one explosive (2,6-DNT), and one VOC (acetone) were retained as COPCs for both Residential Farmer receptors (adult and child). In addition, silver at sediment sample location SCSD-001-0001-SD was identified as a COPC for the Residential Farmer (child) since the concentration was greater than 1/10 the non-cancer risk.

Comparison of the COPCs to the desired use of the site for OHARNG, identified a chromium concentration at sample location SCSD-008-0001-SO that was greater than both the applicable cancer risk and 1/10 non-cancer risk CUG for the National Guard Trainee. No other COPCs were

identified with concentrations greater than the cancer risk or 1/10 non-cancer risk draft CUGs for the National Guard Trainee or National Guard Dust/Fire Control Worker

3.4 Surface Water

A total of three surface water samples were collected from Sand Creek during the removal action to assess surface water quality near the site. One sample was located up stream of the dump site, one sample was located immediately adjacent to the site and one sample was located downstream from the site.

All surface water samples were collected for analysis of filtered TAL metals and asbestos analysis. Ten percent of the samples (1) was submitted for the RVAAP full suite that in addition to TAL metals included total cyanide, TCL VOCs, TCL SVOCs, TCL pesticides, PCBs, explosives and propellants (nitroglycerine, nitroguanidine and nitrocellulose). Data summary statistics and screening results to identify COPCs are presented in **Table 3-9**. A comparison of the COPCs retained in **Table 3-9** to the facility-wide cancer and non-cancer risk draft CUGs for the Residential Farmer (adult and child) and OHARNG receptors (National Guard Dust/Fire Control Worker and National Guard Trainee) is presented in **Table 3-10.** These tables are provided at the end of this section.

3.4.1 Explosives and Propellants

No explosives were detected in any of the surface water samples. One propellant consisting of nitrocellulose was detected at sample location SCSW-001-0001-SW and is automatically retained as a COPC in surface water regardless of its frequency of detection.

3.4.2 Inorganics

There were 11 inorganic analytes detected in the surface water samples, none of which were identified as a COPC in **Table 3-9.** All of the detected constituents were eliminated as COPCs because they were either considered essential nutrients (calcium, iron, magnesium, potassium and sodium) or the maximum concentration was less than background (arsenic, aluminum, barium, copper, manganese and zinc).

3.4.3 Asbestos, VOCs, SVOCs, Cyanide, Pesticides, PCBs

Cyanide, VOCs, SVOCs, pesticides and PCBs were only analyzed for in surface water sample SCSW-001-0001-SW. Asbestos was analyzed for all surface water sample locations. No concentrations of asbestos, cyanide, SVOCs, pesticides or PCBs were detected in any of the surface water samples.

3.4.4 Summary of Surface Water Samples

No COPCs were identified above the facility-wide risk-based draft CUGs in surface water at the Sand Creek Disposal Road Landfill for any of the potential human health receptors that include

the Residential Farmer (adult and child) and the OHARNG receptors (National Guard Dust/Fire Control Worker and National Guard Trainee). Nitrocellulose was the only chemical detected in the surface water samples besides inorganics. Although, taken from a downstream location, the nitrocellulose concentration was low and it appears that surface water conditions downstream of the site have not been impacted by previous site activities.

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Table 3-1
Detected Analytes in Surface Soil Discrete Samples (0 to 1 foot) at the Sand Creek Dump

Detected Analyte	Soil Background Criteria (0-1 ft)	Facility-Wide Draft Cleanup Goals for Surface Soil (0-1 ft)										SCSS-001-0001-SO	SCSS-002-0001-SO	SCSS-003-0001-SO	SCSS-004-0001-SO	SCSS-005-0001-SO	SCSS-006-0001-SO
		Residential Farmer				National Guard											
		Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date												9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/9/2003	9/9/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330																	
2,4,6-Trinitrotoluene	NA	32.8	21.1	28.4	3.65	3,288	1,762	495	265	464	249	NT	NT	NT	NT	NT	NT
2,4-Dinitrotoluene	NA	0.753	43.9	1.1	12.8	59.6	2,896	9.82	477	13.4	652	NT	NT	NT	NT	NT	NT
2,6-Dinitrotoluene	NA	0.769	22.4	1.1	6.42	61.2	1,485	10.1	244	13.6	331	NT	NT	NT	NT	NT	NT
TAL Metals 6010B																	
Antimony	0.96	---	13.6	---	2.82	---	1,030	---	161	---	175	0.61	BDL	BDL	1.6	**25**	2.5
Arsenic	15.4	0.425	8.21	0.524	2.02	35.7	573	5.76	92.5	2.78	114	10	13	9.2	8.4	**30**	**49**
Lead	26.1	---	---	---	---	---	---	---	---	---	---	50	19	25	390	1,600	250
Thallium	0	---	4.76	---	0.612	---	513	---	68.9	---	47.7	BDL	BDL	BDL	BDL	BDL	BDL
Mercury	0.04	---	16.5	---	2.27	---	1,659	---	230	---	172	0.72	0.46	0.072	**130**	**2.3**	0.51
Aluminum	17,700	---	52,923	---	7,380	---	1.0E+06	---	778,938	---	3,496	10,000	11,000	10,000	9,200	15,000	17,000
Barium	88.4	---	8,966	---	1,413	---	810,909	---	129,225	---	351	74	54	61	230	**1,600**	***470***
Beryllium	0.88	---	---	---	---	---	---	---	---	---	---	0.56	0.38 (B)	0.44 (B)	0.55	1.1	1.2
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	25,321	242	10.9	329	0.6	0.36	0.26	**15**	**40**	**7.2**
Calcium	15,800	---	---	---	---	---	---	---	---	---	---	3,500	4,000	4,500	12,000	24,000	38,000
Chromium (total/hexavalent)*	17.4	187	90.4	401.5	19.9	14,179	6,666	3,798	1,108	1.64	5.61	**21**	16	***18***	**45**	**230**	**60**
Cobalt	10.4	803	820	1,721	131	60,768	74,531	16,278	13,519	7.03	14	**12**	8.9	***11***	8.6	***13***	9.9
Copper	17.7	---	2,714	---	311	---	341,235	---	42,486	---	25,368	32	19	20	99	**330**	110
Iron	23,100	---	19,010	---	2,313	---	1.0E+06	---	285,369	---	184,370	23,000	23,000	25,000	26,000	44,000	29,000
Magnesium	3,030	---	---	---	---	---	---	---	---	---	---	3,000	3,000	3,400	2,900	5,100	4,600
Manganese	1,450	---	1,482	---	293	---	116,634	---	20,723	---	35.1	600	390	460	720	1,200	**1,500**
Nickel	21.1	---	1,346	---	155	---	167,541	---	20,971	---	12,639	25	20	22	24	30	110
Potassium	927	---	---	---	---	---	---	---	---	---	---	1,500	1,500	1,400	1,100	2,200	1,800
Selenium	1.4	---	---	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	0.89 (B)
Silver	0	---	324	---	38.6	---	38,421	---	4,928	---	3,105	**85**	1.2	BDL	**55**	**580**	**140**
Sodium	123	---	---	---	---	---	---	---	---	---	---	120 (B)	BDL	BDL	400	550	270
Vanadium	31.1	---	156	---	44.9	---	10,308	---	1,697	---	2,304	17	19	18	16	19	20
Zinc	61.8	---	19,659	---	2,321	---	1.0E+06	---	301,090	---	187,269	150	110	100	520	620	170
Propellants 8330																	
Nitrocellulose	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
VOCs 8260B																	
Chloroethane	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
SVOCs TCL 8270C																	
Phenanthrene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
Fluoranthene	NA	---	276	---	163	---	15,778	---	2,732	---	5,087	NT	NT	NT	NT	NT	NT
Pyrene	NA	---	207	---	122	---	11,833	---	2,049	---	3,815	NT	NT	NT	NT	NT	NT
Benzo(a)anthracene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	NT	NT
Chrysene	NA	22.1	---	65	---	1,513	---	262	---	477	---	NT	NT	NT	NT	NT	NT
Bis(2-Ethylhexyl)phthalate	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
Benzo(b)fluoranthene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	NT	NT
Benzo(k)fluoranthene	NA	2.21	---	6.5	---	151	---	26.2	---	47.7	---	NT	NT	NT	NT	NT	NT
Benzo(a)pyrene	NA	0.022	---	0.65	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	NT	NT
Indeno(1,2,3-cd)pyrene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	NT	NT
Dibenzo(a,h)anthracene	NA	0.022	---	0.065	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	NT	NT
Benzo(g,h,i)perylene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT

Table 3-1 (cont)
Detected Analytes in Surface Soil Discrete Samples (0 to 1 foot) at the Sand Creek Dump

Detected Analyte	Soil Background Criteria (0-1 ft)	Facility-Wide Draft Cleanup Goals for Surface Soil (0-1 ft)										SCSS-007-0001-SO	SCSS-008-0001-SO	SCSS-009-0001-SO	SCSS-010-0001-SO	SCSS-011-0001-SO	SCSS-012-0001-SO
		Residential Farmer				National Guard											
		Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date												9/9/2003	9/9/2003	9/10/2003	9/10/2003	9/10/2003	9/10/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330																	
2,4,6-Trinitrotoluene	NA	32.8	21.1	28.4	3.65	3,288	1,762	495	265	464	249	NT	NT	NT	NT	NT	NT
2,4-Dinitrotoluene	NA	0.753	43.9	1.1	12.8	59.6	2,896	9.82	477	13.4	652	NT	NT	NT	NT	NT	NT
2,6-Dinitrotoluene	NA	0.769	22.4	1.1	6.42	61.2	1,485	10.1	244	13.6	331	NT	NT	NT	NT	NT	NT
TAL Metals 6010B																	
Antimony	0.96	---	13.6	---	2.82	---	1,030	---	161	---	175	**11**	1.6	0.12 (B)	BDL	0.42	BDL
Arsenic	15.4	0.425	8.21	0.524	2.02	35.7	573	5.76	92.5	2.78	114	**38**	**100**	10	13	10	**21**
Lead	26.1	---	---	---	---	---	---	---	---	---	---	450	80	13	20	50	13
Thallium	0	---	4.76	---	0.612	---	513	---	68.9	---	47.7	0.58	BDL	BDL	BDL	BDL	BDL
Mercury	0.04	---	16.5	---	2.27	---	1,659	---	230	---	172	1.4	0.79	0.061	0.062	0.049	0.015 (B)
Aluminum	17,700	---	52,923	---	7,380	---	1.0E+06	---	778,938	---	3,496	9,300	9,500	7,800	8,500	12,000	11,000
Barium	88.4	---	8,966	---	1,413	---	810,909	---	129,225	---	351	***800***	170	56	58	70	64
Beryllium	0.88	---	---	---	---	---	---	---	---	---	---	0.78	1	0.33 (B)	0.6	0.41 (B)	0.5
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	25,321	242	10.9	329	**18**	3.3	0.14 (B)	0.21 (B)	0.33	BDL
Calcium	15,800	---	---	---	---	---	---	---	---	---	---	8,700	4,700	1,800	4,900	14,000	2,100
Chromium (total/hexavalent)*	17.4	187	90.4	401.5	19.9	14,179	6,666	3,798	1,108	1.64	5.61	**140**	**41**	11	16	**110**	17
Cobalt	10.4	803	820	1,721	131	60,768	74,531	16,278	13,519	7.03	14	9.6	9.3	6.8	7.9	8.5	***12***
Copper	17.7	---	2,714	---	311	---	341,235	---	42,486	---	25,368	270	110	12	39	**470**	18
Iron	23,100	---	19,010	---	2,313	---	1.0E+06	---	285,369	---	184,370	40,000	31,000	17,000	30,000	23,000	25,000
Magnesium	3,030	---	---	---	---	---	---	---	---	---	---	2,400	2,100	1,800	2,100	2,900	3,500
Manganese	1,450	---	1,482	---	293	---	116,634	---	20,723	---	35.1	950	580	400	510	580	240
Nickel	21.1	---	1,346	---	155	---	167,541	---	20,971	---	12,639	38	36	14	18	53	26
Potassium	927	---	---	---	---	---	---	---	---	---	---	1,200	1,400	920	1,100	1,400	1,700
Selenium	1.4	---	---	---	---	---	---	---	---	---	---	1.3 (B)	3.2	0.66 (B)	BDL	0.57 (B)	BDL
Silver	0	---	324	---	38.6	---	38,421	---	4,928	---	3,105	**630**	**310**	BDL	BDL	0.47 (B)	BDL
Sodium	123	---	---	---	---	---	---	---	---	---	---	280	230	BDL	BDL	140	BDL
Vanadium	31.1	---	156	---	44.9	---	10,308	---	1,697	---	2,304	17	22	13	16	19	17
Zinc	61.8	---	19,659	---	2,321	---	1.0E+06	---	301,090	---	187,269	360	250	66	100	160	58
Propellants 8330																	
Nitrocellulose	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
VOCs 8260B																	
Chloroethane	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
SVOCs TCL 8270C																	
Phenanthrene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
Fluoranthene	NA	---	276	---	163	---	15,778	---	2,732	---	5,087	NT	NT	NT	NT	NT	NT
Pyrene	NA	---	207	---	122	---	11,833	---	2,049	---	3,815	NT	NT	NT	NT	NT	NT
Benzo(a)anthracene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	NT	NT
Chrysene	NA	22.1	---	65	---	1,513	---	262	---	477	---	NT	NT	NT	NT	NT	NT
Bis(2-Ethylhexyl)phthalate	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
Benzo(b)fluoranthene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	NT	NT
Benzo(k)fluoranthene	NA	2.21	---	6.5	---	151	---	26.2	---	47.7	---	NT	NT	NT	NT	NT	NT
Benzo(a)pyrene	NA	0.022	---	0.65	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	NT	NT
Indeno(1,2,3-cd)pyrene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	NT	NT
Dibenzo(a,h)anthracene	NA	0.022	---	0.065	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	NT	NT
Benzo(g,h,i)perylene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT

Table 3-1 (cont)
Detected Analytes in Surface Soil Discrete Samples (0 to 1 foot) at the Sand Creek Dump

Detected Analyte	Soil Background Criteria (0-1 ft)	Facility-Wide Draft Cleanup Goals for Surface Soil (0-1 ft)										SCSS-013-0001-SO	SCSS-014-0001-SO	SCSS-015-0001-SO	SCSS-016-0001-SO	SCSS-017-0001-SO	SCSS-018-0001-SO
		Residential Farmer				National Guard											
		Adult		Child		Dust/Fire Control Worker		Range Maintenance Worker		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date												9/10/2003	9/10/2003	9/10/2003	9/10/2003	9/15/2003	9/15/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330																	
2,4,6-Trinitrotoluene	NA	32.8	21.1	28.4	3.65	3,288	1,762	495	265	464	249	NT	NT	NT	NT	BDL	NT
2,4-Dinitrotoluene	NA	0.753	43.9	1.1	12.8	59.6	2,896	9.82	477	13.4	652	NT	NT	NT	NT	BDL	NT
2,6-Dinitrotoluene	NA	0.769	22.4	1.1	6.42	61.2	1,485	10.1	244	13.6	331	NT	NT	NT	NT	BDL	NT
TAL Metals 6010B																	
Antimony	0.96	---	13.6	---	2.82	---	1,030	---	161	---	175	0.46	BDL	0.086 (B)	BDL	0.0037 (B)	BDL
Arsenic	15.4	0.425	8.21	0.524	2.02	35.7	573	5.76	92.5	2.78	114	12	9.8	2.5	10	8.6	13
Lead	26.1	---	---	---	---	---	---	---	---	---	---	21	11	8	15	14	15
Thallium	0	---	4.76	---	0.612	---	513	---	68.9	---	47.7	BDL	BDL	BDL	BDL	BDL	BDL
Mercury	0.04	---	16.5	---	2.27	---	1,659	---	230	---	172	0.024	0.032	0.016 (B)	0.034	0.04	BDL
Aluminum	17,700	---	52,923	---	7,380	---	1.0E+06	---	778,938	---	3,496	14,000	5,700	12,000	12,000	13,000	13,000
Barium	88.4	---	8,966	---	1,413	---	810,909	---	129,225	---	351	72	34	72	57	200	69
Beryllium	0.88	---	---	---	---	---	---	---	---	---	---	0.6	0.22 (B)	0.32 (B)	0.31 (B)	0.53	0.58
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	25,321	242	10.9	329	BDL	BDL	BDL	BDL	0.23 (B)	BDL
Calcium	15,800	---	---	---	---	---	---	---	---	---	---	2,300	1,700	2,400	3,100	2,200	2,500
Chromium (total/hexavalent)*	17.4	187	90.4	401.5	19.9	14,179	6,666	3,798	1,108	1.64	5.61	***19***	8.4	13	16	16	***18***
Cobalt	10.4	803	820	1,721	131	60,768	74,531	16,278	13,519	7.03	14	***14***	4.9	3.3	***11***	***26***	***13***
Copper	17.7	---	2,714	---	311	---	341,235	---	42,486	---	25,368	20	12	7.3	8.4	9.6	20
Iron	23,100	---	19,010	---	2,313	---	1.0E+06	---	285,369	---	184,370	28,000	13,000	13,000	22,000	21,000	27,000
Magnesium	3,030	---	---	---	---	---	---	---	---	---	---	4,000	1,500	1,300	2,300	1,900	4,200
Manganese	1,450	---	1,482	---	293	---	116,634	---	20,723	---	35.1	380	270	90	340	**4,800**	310
Nickel	21.1	---	1,346	---	155	---	167,541	---	20,971	---	12,639	28	11	9.4	14	19	29
Potassium	927	---	---	---	---	---	---	---	---	---	---	1,900	800	1,400	1,200	1,300	1,900
Selenium	1.4	---	---	---	---	---	---	---	---	---	---	BDL	BDL	BDL	0.53 (B)	0.89 (B)	BDL
Silver	0	---	324	---	38.6	---	38,421	---	4,928	---	3,105	BDL	BDL	BDL	BDL	1	BDL
Sodium	123	---	---	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	31.1	---	156	---	44.9	---	10,308	---	1,697	---	2,304	22	10	17	25	23	20
Zinc	61.8	---	19,659	---	2,321	---	1.0E+06	---	301,090	---	187,269	68	49	35	55	58	65
Propellants 8330																	
Nitrocellulose	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	3.5	NT
VOCs 8260B																	
Chloroethane	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT
SVOCs TCL 8270C																	
Phenanthrene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	0.089	NT
Fluoranthene	NA	---	276	---	163	---	15,778	---	2,732	---	5,087	NT	NT	NT	NT	0.52	NT
Pyrene	NA	---	207	---	122	---	11,833	---	2,049	---	3,815	NT	NT	NT	NT	0.53	NT
Benzo(a)anthracene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	**0.31**	NT
Chrysene	NA	22.1	---	65	---	1,513	---	262	---	477	---	NT	NT	NT	NT	0.29	NT
Bis(2-Ethylhexyl)phthalate	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	0.09 (J) (a)	NT
SVOCs TCL 8270C Cont'd																	NT
Benzo(b)fluoranthene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	**0.3**	NT
Benzo(k)fluoranthene	NA	2.21	---	6.5	---	151	---	26.2	---	47.7	---	NT	NT	NT	NT	0.33 (M)	NT
Benzo(a)pyrene	NA	0.022	---	0.65	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	**0.29**	NT
Indeno(1,2,3-cd)pyrene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	0.13	NT
Dibenzo(a,h)anthracene	NA	0.022	---	0.065	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	**0.69**	NT
Benzo(g,h,i)perylene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	0.13	NT

Table 3-1 (cont)
Detected Analytes in Surface Soil Discrete Samples (0 to 1 foot) at the Sand Creek Dump

Detected Analyte	Soil Background Criteria (0-1 ft)	Facility-Wide Draft Cleanup Goals for Surface Soil (0-1 ft)										SCSS-019-0001-SO	SCSS-020-0001-SO	SCSS-021-0001-SO	SCSS-022-0001-SO	SCSS-023-0001-SO	SCSS-024-0001-SO
		Residential Farmer				National Guard											
		Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date												9/15/2003	9/15/2003	9/17/2003	9/17/2003	9/15/2003	9/17/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330																	
2,4,6-Trinitrotoluene	NA	32.8	21.1	28.4	3.65	3,288	1,762	495	265	464	249	NT	NT	NT	NT	BDL	NT
2,4-Dinitrotoluene	NA	0.753	43.9	1.1	12.8	59.6	2,896	9.82	477	13.4	652	NT	NT	NT	NT	BDL	NT
2,6-Dinitrotoluene	NA	0.769	22.4	1.1	6.42	61.2	1,485	10.1	244	13.6	331	NT	NT	NT	NT	BDL	NT
TAL Metals 6010B																	
Antimony	0.96	---	13.6	---	2.82	---	1,030	---	161	---	175	0.0059 (B)	BDL	BDL	BDL	0.064 (B)	BDL
Arsenic	15.4	0.425	8.21	0.524	2.02	35.7	573	5.76	92.5	2.78	114	**16**	13	12	8.5	**17**	13
Lead	26.1	---	---	---	---	---	---	---	---	---	---	12	14	14	20	11	20
Thallium	0	---	4.76	---	0.612	---	513	---	68.9	---	47.7	BDL	BDL	BDL	BDL	BDL	BDL
Mercury	0.04	---	16.5	---	2.27	---	1,659	---	230	---	172	0.021	0.026	0.045	0.051	0.027	0.021 (B)
Aluminum	17,700	---	52,923	---	7,380	---	1.0E+06	---	778,938	---	3,496	13,000	11,000	10,000	8,300	14,000	9,100
Barium	88.4	---	8,966	---	1,413	---	810,909	---	129,225	---	351	62	45	33	40	55	46
Beryllium	0.88	---	---	---	---	---	---	---	---	---	---	0.59	0.37 (B)	0.42 (B)	0.5	0.65	0.52
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	25,321	242	10.9	329	BDL	BDL	BDL	BDL	BDL	BDL
Calcium	15,800	---	---	---	---	---	---	---	---	---	---	2,200	340	390	1,200	1,900	1,000
Chromium (total/hexavalent)*	17.4	187	90.4	401.5	19.9	14,179	6,666	3,798	1,108	1.64	5.61	***19***	16	14	13	**20**	15
Cobalt	10.4	803	820	1,721	131	60,768	74,531	16,278	13,519	7.03	14	***12***	9.5	9.7	***11***	***13***	***12***
Copper	17.7	---	2,714	---	311	---	341,235	---	42,486	---	25,368	19	14	14	16	20	17
Iron	23,100	---	19,010	---	2,313	---	1.0E+06	---	285,369	---	184,370	29,000	23,000	22,000	23,000	32,000	25,000
Magnesium	3,030	---	---	---	---	---	---	---	---	---	---	4,100	2,800	2,600	3,200	4,700	3,500
Manganese	1,450	---	1,482	---	293	---	116,634	---	20,723	---	35.1	300	270	240	240	300	310
Nickel	21.1	---	1,346	---	155	---	167,541	---	20,971	---	12,639	28	20	18	22	32	26
Potassium	927	---	---	---	---	---	---	---	---	---	---	1,800	1,300	770	1,200	2,100	1,000
Selenium	1.4	---	---	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL
Silver	0	---	324	---	38.6	---	38,421	---	4,928	---	3,105	BDL	BDL	BDL	BDL	BDL	BDL
Sodium	123	---	---	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	31.1	---	156	---	44.9	---	10,308	---	1,697	---	2,304	20	18	20	17	21	18
Zinc	61.8	---	19,659	---	2,321	---	1.0E+06	---	301,090	---	187,269	62	57	57	69	68	71
Propellants 8330																	
Nitrocellulose	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT
VOCs 8260B																	
Chloroethane	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT
SVOCs TCL 8270C																	
Phenanthrene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT
Fluoranthene	NA	---	276	---	163	---	15,778	---	2,732	---	5,087	NT	NT	NT	NT	BDL	NT
Pyrene	NA	---	207	---	122	---	11,833	---	2,049	---	3,815	NT	NT	NT	NT	BDL	NT
Benzo(a)anthracene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	BDL	NT
Chrysene	NA	22.1	---	65	---	1,513	---	262	---	477	---	NT	NT	NT	NT	BDL	NT
Bis(2-Ethylhexyl)phthalate	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT
Benzo(b)fluoranthene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	BDL	NT
Benzo(k)fluoranthene	NA	2.21	---	6.5	---	151	---	26.2	---	47.7	---	NT	NT	NT	NT	BDL	NT
Benzo(a)pyrene	NA	0.022	---	0.65	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	BDL	NT
Indeno(1,2,3-cd)pyrene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	BDL	NT
Dibenzo(a,h)anthracene	NA	0.022	---	0.065	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	BDL	NT
Benzo(g,h,i)perylene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT

Table 3-1 (cont)
Detected Analytes in Surface Soil Discrete Samples (0 to 1 foot) at the Sand Creek Dump

Detected Analyte	Soil Background Criteria (0-1 ft)	Facility-Wide Draft Cleanup Goals for Surface Soil (0-1 ft)										SCSS-025-0001-SO	SCSS-026-0001-SO	SCSS-027-0001-SO	SCSS-028-0001-SO	SCSS-029-0001-SO	SCSS-030-0001-SO
		Residential Farmer				National Guard											
		Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date												9/17/2003	9/17/2003	9/17/2003	9/17/2003	9/17/2003	9/17/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330																	
2,4,6-Trinitrotoluene	NA	32.8	21.1	28.4	3.65	3,288	1,762	495	265	464	249	NT	NT	NT	NT	BDL	NT
2,4-Dinitrotoluene	NA	0.753	43.9	1.1	12.8	59.6	2,896	9.82	477	13.4	652	NT	NT	NT	NT	0.037 (J))(a)	NT
2,6-Dinitrotoluene	NA	0.769	22.4	1.1	6.42	61.2	1,485	10.1	244	13.6	331	NT	NT	NT	NT	0.170 (J)(a)	NT
TAL Metals 6010B																	
Antimony	0.96	---	13.6	---	2.82	---	1,030	---	161	---	175	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic	15.4	0.425	8.21	0.524	2.02	35.7	573	5.76	92.5	2.78	114	15	11	8.2	12	15	11
Lead	26.1	---	---	---	---	---	---	---	---	---	---	14	18	17	16	20	17
Thallium	0	---	4.76	---	0.612	---	513	---	68.9	---	47.7	BDL	BDL	BDL	BDL	BDL	BDL
Mercury	0.04	---	16.5	---	2.27	---	1,659	---	230	---	172	0.017 (B)	0.016 (B)	0.039	0.031	0.026	0.032
Aluminum	17,700	---	52,923	---	7,380	---	1.0E+06	---	778,938	---	3,496	8,600	10,000	7,100	9,200	9,100	8,300
Barium	88.4	---	8,966	---	1,413	---	810,909	---	129,225	---	351	41	69	30	52	47	44
Beryllium	0.88	---	---	---	---	---	---	---	---	---	---	0.45 (B)	0.6	0.30 (B)	0.45 (B)	0.5	0.47
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	25,321	242	10.9	329	BDL	BDL	BDL	BDL	BDL	BDL
Calcium	15,800	---	---	---	---	---	---	---	---	---	---	1,000	2,200	740	1,200	1,300	1,700
Chromium (total/hexavalent)*	17.4	187	90.4	401.5	19.9	14,179	6,666	3,798	1,108	1.64	5.61	13	15	9.8	13	14	12
Cobalt	10.4	803	820	1,721	131	60,768	74,531	16,278	13,519	7.03	14	***11***	***13***	5.3	***11***	***13***	***13***
Copper	17.7	---	2,714	---	311	---	341,235	---	42,486	---	25,368	15	16	7.6	12	14	13
Iron	23,100	---	19,010	---	2,313	---	1.0E+06	---	285,369	---	184,370	21,000	25,000	15,000	23,000	22,000	19,000
Magnesium	3,030	---	---	---	---	---	---	---	---	---	---	2,900	3,400	1,400	2,800	2,900	2,300
Manganese	1,450	---	1,482	---	293	---	116,634	---	20,723	---	35.1	250	330	220	340	310	270
Nickel	21.1	---	1,346	---	155	---	167,541	---	20,971	---	12,639	20	28	9.2	19	22	19
Potassium	927	---	---	---	---	---	---	---	---	---	---	980	1,100	630	900	920	980
Selenium	1.4	---	---	---	---	---	---	---	---	---	---	BDL	BDL	0.55 (B)	BDL	BDL	BDL
Silver	0	---	324	---	38.6	---	38,421	---	4,928	---	3,105	BDL	BDL	BDL	BDL	BDL	BDL
Sodium	123	---	---	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	31.1	---	156	---	44.9	---	10,308	---	1,697	---	2,304	18	19	17	20	18	17
Zinc	61.8	---	19,659	---	2,321	---	1.0E+06	---	301,090	---	187,269	61	65	41	57	62	59
Propellants 8330																	
Nitrocellulose	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	5	NT
VOCs 8260B																	
Chloroethane	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	0.091 (J)(a)	NT
SVOCs TCL 8270C																	
Phenanthrene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT
Fluoranthene	NA	---	276	---	163	---	15,778	---	2,732	---	5,087	NT	NT	NT	NT	0.0098 (J)	NT
Pyrene	NA	---	207	---	122	---	11,833	---	2,049	---	3,815	NT	NT	NT	NT	BDL	NT
Benzo(a)anthracene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	0.0044 (J)	NT
Chrysene	NA	22.1	---	65	---	1,513	---	262	---	477	---	NT	NT	NT	NT	0.0046 (J)	NT
Bis(2-Ethylhexyl)phthalate	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	0.022 (J)	NT
Benzo(b)fluoranthene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	0.0051 (J)	NT
Benzo(k)fluoranthene	NA	2.21	---	6.5	---	151	---	26.2	---	47.7	---	NT	NT	NT	NT	0.0054 (J)(M)	NT
Benzo(a)pyrene	NA	0.022	---	0.65	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	0.0047 (J)	NT
Indeno(1,2,3-cd)pyrene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT	NT	BDL	NT
Dibenzo(a,h)anthracene	NA	0.022	---	0.065	---	1.51	---	0.262	---	0.477	---	NT	NT	NT	NT	BDL	NT
Benzo(g,h,i)perylene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT	NT	BDL	NT

Table 3-1 (cont)
Detected Analytes in Surface Soil Discrete Samples (0 to 1 foot) at the Sand Creek Dump

Detected Analyte	Soil Background Criteria (0-1 ft)	Facility-Wide Draft Cleanup Goals for Surface Soil (0-1 ft)										SCSS-CONT1-0001-SO	SCSS-CONT2-0001-SO	SCSS-CONT3-0001-SO
		Residential Farmer				National Guard								
		Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee				
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1			
Sample Date												9/15/2003	9/22/2003	9/22/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330														
2,4,6-Trinitrotoluene	NA	32.8	21.1	28.4	3.65	3,288	1,762	495	265	464	249	NT	BDL	0.039 (J)(a)
2,4-Dinitrotoluene	NA	0.753	43.9	1.1	12.8	59.6	2,896	9.82	477	13.4	652	NT	BDL	BDL
2,6-Dinitrotoluene	NA	0.769	22.4	1.1	6.42	61.2	1,485	10.1	244	13.6	331	NT	BDL	BDL
TAL Metals 6010B														
Antimony	0.96	---	13.6	---	2.82	---	1,030	---	161	---	175	0.31	NT	NT
Arsenic	15.4	0.425	8.21	0.524	2.02	35.7	573	5.76	92.5	2.78	114	**16**	NT	NT
Lead	26.1	---	---	---	---	---	---	---	---	---	---	19	NT	NT
Thallium	0	---	4.76	---	0.612	---	513	---	68.9	---	47.7	BDL	NT	NT
Mercury	0.04	---	16.5	---	2.27	---	1,659	---	230	---	172	0.033	NT	NT
Aluminum	17,700	---	52,923	---	7,380	---	1.0E+06	---	778,938	---	3,496	8,600	NT	NT
Barium	88.4	---	8,966	---	1,413	---	810,909	---	129,225	---	351	91	NT	NT
Beryllium	0.88	---	---	---	---	---	---	---	---	---	---	0.30 (B)	NT	NT
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	25,321	242	10.9	329	BDL	NT	NT
Calcium	15,800	---	---	---	---	---	---	---	---	---	---	1,700	NT	NT
Chromium (total/hexavalent)*	17.4	187	90.4	401.5	19.9	14,179	6,666	3,798	1,108	1.64	5.61	**21**	NT	NT
Cobalt	10.4	803	820	1,721	131	60,768	74,531	16,278	13,519	7.03	14	6.4	NT	NT
Copper	17.7	---	2,714	---	311	---	341,235	---	42,486	---	25,368	28	NT	NT
Iron	23,100	---	19,010	---	2,313	---	1.0E+06	---	285,369	---	184,370	28,000	NT	NT
Magnesium	3,030	---	---	---	---	---	---	---	---	---	---	2,200	NT	NT
Manganese	1,450	---	1,482	---	293	---	116,634	---	20,723	---	35.1	98	NT	NT
Nickel	21.1	---	1,346	---	155	---	167,541	---	20,971	---	12,639	22	NT	NT
Potassium	927	---	---	---	---	---	---	---	---	---	---	2,400	NT	NT
Selenium	1.4	---	---	---	---	---	---	---	---	---	---	BDL	NT	NT
Silver	0	---	324	---	38.6	---	38,421	---	4,928	---	3,105	BDL	NT	NT
Sodium	123	---	---	---	---	---	---	---	---	---	---	BDL	NT	NT
Vanadium	31.1	---	156	---	44.9	---	10,308	---	1,697	---	2,304	14	NT	NT
Zinc	61.8	---	19,659	---	2,321	---	1.0E+06	---	301,090	---	187,269	45	NT	NT
Propellants 8330														
Nitrocellulose	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT
VOCs 8260B														
Chloroethane	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT
SVOCs TCL 8270C														
Phenanthrene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT
Fluoranthene	NA	---	276	---	163	---	15,778	---	2,732	---	5,087	NT	NT	NT
Pyrene	NA	---	207	---	122	---	11,833	---	2,049	---	3,815	NT	NT	NT
Benzo(a)anthracene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT
Chrysene	NA	22.1	---	65	---	1,513	---	262	---	477	---	NT	NT	NT
Bis(2-Ethylhexyl)phthalate	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT
Benzo(b)fluoranthene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT
Benzo(k)fluoranthene	NA	2.21	---	6.5	---	151	---	26.2	---	47.7	---	NT	NT	NT
Benzo(a)pyrene	NA	0.022	---	0.65	---	1.51	---	0.262	---	0.477	---	NT	NT	NT
Indeno(1,2,3-cd)pyrene	NA	0.221	---	0.65	---	15.1	---	2.62	---	4.77	---	NT	NT	NT
Dibenzo(a,h)anthracene	NA	0.022	---	0.065	---	1.51	---	0.262	---	0.477	---	NT	NT	NT
Benzo(g,h,i)perylene	NA	---	---	---	---	---	---	---	---	---	---	NT	NT	NT

Inorganic Qualifiers
(B) = Result is less than the RL but greater than or equal to the IDL/MDL.
(J) = Result is less than the RL, but greater than or equal to the MDL.

Organic Qualifiers
(a) = Concentration is below the MRL
(B) = Method Blank: Batch QC is greater than RL

Notes:
Draft cleanup goals taken from the *Draft Facility-wide Human Health Remediation Goals at the RVAAP, Ravenna, Ohio* (September 2008)
--- = No cleanup goal available.
* = The *RD/RA report* results for total chromium were compared to the current cleanup goal for total chromium and hexavalent chromium.
Highlighted box = Concentration is greater than the RVAAP background value for inorganic COPC.
BOLD = For unrestricted land use, the concentration is greater than the most restrictive cancer risk and/or non-cancer risk cleanup goal for the Residential Farmer (adult/child).
BOLD = Concentration is not greater than the unrestricted land use criteria for the Residential Farmer (adult/child) but is greater than the most restrictive cleanup goal for the National Guard receptors (Dust/Fire Control Worker/Range Maintenance Soldier/Trainee).

Acronyms
BDL = below detection limit
CR = Cancer Risk
COPC = Contaminant of Potential Concern
HQ = Hazard Quotient
IDL = Instrument Detection Limit
mg/kg = milligrams per kilogram
NA = data not available
ND = not detected
NT = not tested
MDL = Method Detection Limit
RL = Reporting Limit
SO = soil sample

Table 3-2
Detected Analytes in Sediment Discrete Samples at the Sand Creek Dump

Detected Analyte	Sediment Background Criteria	Facility-Wide Draft Cleanup Goals for Sediment								SCSD-001-0001-SD	SCSD-002-0001-SD	SCSD-003-0001-SD	SCSD-004-0001-SD	SCSD-005-0001-SD	SCSD-006-0001-SD
		Residential Farmer				National Guard									
		Adult		Child		Dust/Fire Control Worker		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date										9/18/2003	9/18/2003	9/18/2003	9/18/2003	9/10/2003	9/18/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330															
2,6-Dinitrotoluene	NA	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
TAL Metals 6010B															
Antimony	0	---	13.6	---	2.82	---	1,030	---	175	BDL	BDL	BDL	BDL	BDL	BDL
Arsenic	19.5	0.425	8.21	0.524	2.02	35.7	573	2.78	114	13	3.4	9	5.8	13	12
Lead	27.4	---	---	---	---	---	---	---	---	40	2.9	8.8	2.9	11	6.3
Thallium	0.89	---	4.76	---	0.612	---	513	---	47.7	0.36	BDL	BDL	BDL	BDL	BDL
Mercury	0.06	---	16.5	---	2.27	---	1,659	---	172	0.66	BDL	0.029	BDL	0.031	0.012 (B)
Aluminum	13,900	---	52,923	---	7,380	---	---	---	3,496	9,400	1,500	4,000	2,100	8,400	4,200
Barium	123	---	8,966	---	1,413	---	810,909	---	351	62	9.4	34	11	43	44
Beryllium	0.38	---	---	---	---	---	---	---	---	0.62	0.073 (B)	0.23 (B)	0.13 (B)	0.31 (B)	0.22 (B)
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	10.9	329	0.39	BDL	BDL	BDL	0.13 (B)	BDL
Calcium	5,510	---	---	---	---	---	---	---	---	3,200	790	1,600	900	2,400	1,000
Chromium (total/hexavalent)*	18.1	187	90.4	401.5	19.9	14,179	6,666	1.64	5.61	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	---	2,714	---	311	---	341,235	---	25,368	26	2.6	10	3.8	13	6.7
Iron	28,200	---	19,010	---	2,313	---	1.0E+06	---	184,370	20,000	4,300	11,000	6,800	18,000	12,000
Magnesium	2,760	---	---	---	---	---	---	---	---	2,200	620	1,200	770	2,500	1,300
Manganese	1,950	---	1,482	---	293	---	116,634	---	35.1	960	73	290	99	270	280
Nickel	17.7	---	1,346	---	155	---	167,541	---	12,639	23	3.6	9.6	5.7	17	11
Potassium	1,950	---	---	---	---	---	---	---	---	1,100	230	560	310	1,300	460
Selenium	1.7	---	---	---	---	---	---	---	---	BDL	BDL	0.57 (B)	BDL	BDL	BDL
Silver	0	---	324	---	38.6	---	38,421	---	3,105	**40**	BDL	3.2	BDL	BDL	BDL
Sodium	112	---	---	---	---	---	---	---	---	170	BDL	BDL	BDL	BDL	BDL
Vanadium	26.1	---	156	---	44.9	---	10,308	---	2,304	15	2.9	7.6	3.7	14	7.5
Zinc	532	---	19,659	---	2,321	---	1.0E+06	---	187,269	170	15	43	19	78	29
Propellants 8330															
Nitroguanidine	NA	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
Nitrocellulose	NA	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
VOCs 8260B															
Acetone	NA	---	---	---	---	---	---	---	---	NT	NT	NT	NT	NT	NT
Total Organic Carbon															
Organic Carbon	NA	---	---	---	---	---	---	---	---	NT	630	NT	600	NT	2,600

Table 3-2 (cont)
Detected Analytes in Sediment Discrete Samples at the Sand Creek Dump

Detected Analyte	Sediment Background Criteria	Facility-Wide Draft Cleanup Goals for Sediment								SCSD-007-0001-SD	SCSD-008-0001-SD	SCSD-009-0001-SD	SCSD-010-0001-SD	SCSD-011-0001-SD	SCSD-012-0001-SD
		Residential Farmer				National Guard									
		Adult		Child		Dust/Fire Control Worker		Trainee							
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1						
Sample Date										9/15/2003	9/18/2003	9/18/2003	9/15/2003	9/18/2003	9/18/2003
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Explosives 8330															
2,6-Dinitrotoluene	0	---	---	---	---	---	---	---	---	BDL	0.110 (J)(a)	NT	NT	NT	NT
TAL Metals 6010B															
Antimony	0	---	13.6	---	2.82	---	1,030	---	175	0.086 (B)	BDL	BDL	BDL	BDL	BDL
Arsenic	19.5	0.425	8.21	0.524	2.02	35.7	573	2.78	114	5.3	15	14	5.6	13	9.4
Lead	27.4	---	---	---	---	---	---	---	---	4.8	11	15	5.4	17	9.4
Thallium	0.89	---	4.76	---	0.612	---	513	---	47.7	BDL	BDL	BDL	BDL	BDL	BDL
Mercury	0.059	---	16.5	---	2.27	---	1,659	---	172	0.0091 (B)	0.013 (B)	0.046	0.024	0.028	0.039
Aluminum	13,900	---	52,923	---	7,380	---	---	---	3,496	3,100	14,000	10,000	3,500	9,200	5,500
Barium	123	---	8,966	---	1,413	---	810,909	---	351	21	53	57	29	59	38
Beryllium	0.38	---	---	---	---	---	---	---	---	0.095 (B)	0.67	0.49	0.15 (B)	0.48 (B)	0.29 (B)
Cadmium	0	1,249	22.3	2,677	6.41	94,527	1,473	10.9	329	BDL	BDL	BDL	BDL	BDL	BDL
Calcium	5,510	---	---	---	---	---	---	---	---	570	3,100	2,000	1,300	3,300	1,200
Chromium (total/hexavalent)*	18.1	187	90.4	401.5	19.9	14,179	6,666	1.64	5.61	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	---	2,714	---	311	---	341,235	---	25,368	3.9	19	17	8.7	15	14
Iron	28,200	---	19,010	---	2,313	---	1.0E+06	---	184,370	6,500	30,000	23,000	11,000	22,000	15,000
Magnesium	2,760	---	---	---	---	---	---	---	---	870	4,800	2,800	1,200	2,600	1,700
Manganese	1,950	---	1,482	---	293	---	116,634	---	35.1	52	300	580	390	390	270
Nickel	17.7	---	1,346	---	155	---	167,541	---	12,639	5.9	29	20	8.7	22	13
Potassium	1,950	---	---	---	---	---	---	---	---	360	2,300	1,300	490	1,400	720
Selenium	1.7	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL
Silver	0	---	324	---	38.6	---	38,421	---	3,105	BDL	BDL	BDL	BDL	BDL	BDL
Sodium	112	---	---	---	---	---	---	---	---	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	26.1	---	156	---	44.9	---	10,308	---	2,304	5	21	17	6.9	17	10
Zinc	532	---	19,659	---	2,321	---	1.0E+06	---	187,269	18	64	72	41	79	57
Propellants 8330															
Nitroguanidine	NA	---	---	---	---	---	---	---	---	ND	0.5 (J)	NT	NT	NT	NT
Nitrocellulose	NA	---	---	---	---	---	---	---	---	0.82 (B)	0.98 (B)	NT	NT	NT	NT
VOCs 8260B															
Acetone	NA	---	---	---	---	---	---	---	---	ND	0.011	NT	NT	NT	NT
Total Organic Carbon															
Organic Carbon	NA	---	---	---	---	---	---	---	---	NT	3,400	NT	3,500	NT	6,000

Notes
Draft cleanup goals taken from the *Draft Facility-wide Human Health Remediation Goals at the RVAAP, Ravenna, Ohio* (September 2008)
--- = No cleanup goal is available
* = The *RD/RA report* results for total chromium were compared to the current cleanup goal for total chromium and hexavalent chromium.
Highlighted box = Concentration is greater than the RVAAP background value for inorganic COPC.
BOLD = For unrestricted land use, the concentration is greater than the most restrictive cancer risk and/or non-cancer risk cleanup goal for the Residential Farmer (adult/child).
BOLD = Concentration is not greater than the unrestricted land use criteria for the Residential Farmer (adult/child) but is greater than the most restrictive cleanup goal for the National Guard receptors (Dust/Fire Control Worker/Range Maintenance Soldier/Trainee).

Inorganic Qualifiers
(B) = Result is less than the RL but greater than or equal to the IDL/MDL.
(J) = Result is less than the RL, but greater than or equal to the MDL.

Organic Qualifiers
(a) = Concentration is below the MRL

Acronyms
BDL = below detection limit
CR = Cancer Risk
HQ = Hazard Quotient
IDL = Instrument Detection Limit
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
NA = data not available
ND = not detected
NT = not tested
RF-A = Residential Farmer – Adult
RF-C = Residential Farmer - Child
RL = Reporting Limit
SD = sediment sample
TAL = Target Analyte List
TCL = Target Compound List
VOC = volatile organic compound

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Table 3-3
Detected Analytes in Surface Water Samples at the Sand Creek Dump

Detected Analyte	Surface Water Background Criteria	Facility-Wide Draft Cleanup Goals for Surface Water								SCSW-001-0001-SW	SCSW-002-0001-SW	SCSW-003-0001-SW
		Residential Farmer				National Guard						
		Adult		Child		Dust/Fire Control Worker		Trainee				
		CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1			
Sample Date										**9/18/2003**	**9/15/2003**	**9/15/2003**
Units	**µg/L**									**µg/L**	**µg/L**	**µg/L**
TAL Metals 6010B												
Antimony	0	---	17.1	---	4.91	---	89.5	---	6.45	BDL	BDL	BDL
Arsenic	3.2	1.1	21.2	1.2	4.63	24.1	387	4.17	67.0	BDL	2.2	2.8
Aluminum	3,370	---	63,895	---	14,827	---	734,195	---	73,445	28 (B)	94 (B)	7.3 (B)
Barium	47.5	---	12,131	---	2,901	---	118,053	---	10,640	36	40	38
Calcium	41,400	---	---	---	---	---	---	---	---	62,000 (H)	61,000 (H)	60,000 (H)
Copper	7.9	---	2,788	---	614	---	47,315	---	7,199	2.8 (B)	4.2 (B)	3.5 (B)
Iron	2,560	---	20,000	---	4,527	---	271,809	---	31,296	580	780	780
Magnesium	10,800	---	---	---	---	---	---	---	---	15,000	15,000	15,000
Manganese	391	---	2,476	---	633	---	18,222	---	1,449	150	230	230
Potassium	3,170	---	---	---	---	---	---	---	---	BDL	1,900	1,900
Sodium	21,300	---	---	---	---	---	---	---	---	5,100	5,600	5,500
Zinc	42	---	21,002	---	4,617	---	366,046	---	58,216	16 (B)	13 (B)	18 (B)
Propellants 8330												
Nitrocellulose	0	---	---	---	---	---	---	---	---	500	NT	NT

Inorganic Qualifiers
(B) = Result is less than the CRDL/RL but greater than or equal to the IDL/MDL.
(H) = Result is biased high.

Notes:
Draft cleanup goals taken from the *Draft Facility-wide Human Health Remediation Goals at the RVAAP, Ravenna, Ohio* (September 2008)
--- = No cleanup goal available

Acronyms
BDL = below detection limit
CR = Cancer Risk
HQ = Hazard Quotient
IDL = Instrument Detection Limit
µg/L = micrograms per liter
NA = data not available
NT = not tested
MDL = Method Detection Limit
RL = Reporting Limit
SW = surface water sample
TAL = Target Analyte List

Table 3-4
Summary of Data Reduction and Screening for COPCs for Surface Soil Discrete Samples at the Sand Creek Dump

Analyte	Units	Results >Detection Limit	Maximum Detect	Site Background Criteria	Max. Detect >Background	Retained as COPC?
Explosives 8330						
2,4,6-Trinitrotoluene	mg/kg	1/4	0.0051	NA	NA	Yes
2,4-Dinitrotoluene	mg/kg	2/4	0.037	NA	NA	Yes
2,6-Dinitrotoluene	mg/kg	1/4	0.170	NA	NA	Yes
TAL Metals 6010B						
Antimony	mg/kg	13/30	25	0.96	Yes	Yes
Arsenic	mg/kg	30/30	100	15.4	Yes	Yes
Lead	mg/kg	30/30	1,600	26.1	Yes	Yes
Thallium	mg/kg	1/30	0.58	0	Yes	No
Mercury	mg/kg	29/30	130	0.04	Yes	Yes
Aluminum	mg/kg	30/30	17,000	17,700	No	No
Barium	mg/kg	30/30	1,600	88.4	Yes	Yes
Beryllium	mg/kg	30/30	1.2	0.88	Yes	Yes
Cadmium	mg/kg	12/30	40	0	Yes	Yes
Calcium	mg/kg	30/30	38,000	15,800	Yes	No
Chromium *	mg/kg	30/30	230	17.4	Yes	Yes
Cobalt	mg/kg	30/30	26	10.4	Yes	Yes
Copper	mg/kg	30/30	470	17.7	Yes	Yes
Iron	mg/kg	30/30	44,000	23,100	Yes	No
Magnesium	mg/kg	30/30	5,100	3,030	Yes	No
Manganese	mg/kg	30/30	4,800	1,450	Yes	Yes
Nickel	mg/kg	30/30	110	21.1	Yes	Yes
Potassium	mg/kg	30/30	2,400	927	Yes	No
Selenium	mg/kg	8/30	3.2	1.4	Yes	Yes
Silver	mg/kg	9/30	630	0	Yes	Yes
Sodium	mg/kg	7/30	550	123	Yes	No
Vanadium	mg/kg	30/30	25	31.1	Yes	No
Zinc	mg/kg	30/30	620	61.8	Yes	Yes
Propellants 8330						
Nitrocellulose	mg/kg	2/3	5	NA	NA	Yes
VOCs 8260B						
Chloroethane	mg/kg	1/3	0.091	NA	NA	Yes
SVOCs TCL 8270C						
Phenanthrene	mg/kg	1/3	0.089	NA	NA	Yes
Fluoranthene	mg/kg	2/3	0.52	NA	NA	Yes
Pyrene	mg/kg	1/3	0.53	NA	NA	Yes
Benzo(a)anthracene	mg/kg	2/3	0.31	NA	NA	Yes
Chrysene	mg/kg	2/3	0.29	NA	NA	Yes
Bis(2-Ethylhexyl)phthalate	mg/kg	2/3	0.09	NA	NA	Yes
Benzo(b)fluoranthene	mg/kg	2/3	0.3	NA	NA	Yes
Benzo(k)fluoranthene	mg/kg	2/3	0.33	NA	NA	Yes
Benzo(a)pyrene	mg/kg	2/3	0.29	NA	NA	Yes
Indeno(1,2,3-cd)pyrene	mg/kg	1/3	0.13	NA	NA	Yes
Dibenzo(a,h)anthracene	mg/kg	1/3	0.69	NA	NA	Yes
Benzo(g,h,i)perylene	mg/kg	1/3	0.13	NA	NA	Yes

Notes:
> = greater than
COPC = chemical of potential concern
mg/kg = milligrams per kilogram
NA = not applicable
SVOCs = semivolatile organic compounds
TAL = target analyte list
TCL = target compound list
VOCs = volatile organic compounds

Table 3-5
Comparison of COPCs to the Draft Cleanup Goals for Surface Soil Discrete Samples at the Sand Creek Dump

COPCs Targeted for Further Evaluation	Max. Detect (mg/kg)	Background Value*	Draft Cleanup Goal Criteria for the Residential Farmer									Draft Cleanup Goal Criteria for the National Guard												
			Adult				Child					Dust/Fire Control Worker				Range Maintenance Soldier				Trainee				
			Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	COPC?	Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	COPC?
Explosives 8330																								
2,4,6-Trinitrotoluene	0.0051	NA		32.8		21.1		28.4		3.65	No		3,288		1,762		495		265		464		249	No
2,4-Dinitrotoluene	0.037	NA		0.753		43.9		1.1		12.8	No		59.6		2,896		9.82		477		13.4		652	No
2,6-Dinitrotoluene	0.170	NA		0.769		22.4		1.1		6.42	No		61.2		1,485		10.1		244		13.6		331	No
TAL Metals 6010B																								
Antimony	25	0.96		---	• (1)	13.6		---	• (2)	2.82	Yes		---		1,030		---		161		---		175	No
Arsenic	100	15.4	• (8)	0.425	• (8)	8.21	• (8)	0.524	• (8)	2.02	Yes	• (3)	35.7		573	• (8)	5.76	• (1)	92.5	• (8)	2.78		114	Yes
Lead	1,600	26.1		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
Mercury	130	0.04		---	• (1)	16.5		---	• (2)	2.27	Yes		---		1,659		---		230		---		172	No
Barium	1,600	88.4		---		8,966		---	• (1)	1,413	No		---		810,909		---		129,225		---	• (3)	351	Yes
Beryllium	1.2	0.88		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
Cadmium	40	0		1,249	• (1)	22.3		2,677	• (4)	6.41	Yes		94,527		1,473		25,321		242		10.9		329	No
Chromium	230	17.4	• (1)	187	• (3)	90.4		401.5	• (9)	19.9	Yes		14,179		6,666		3,798		1,108	• (13)	1.64	• (13)	5.61	Yes
Chromium, hexavalent***	NA	17.4	• (1)	187	• (3)	90.4		401.5	• (9)	19.9	Yes		14,179		6,666		3,798		1,108	• (13)	1.64	• (13)	5.61	Yes
Cobalt	26	10.4		803		820		1,721		131	No		60,768		74,531		16,278		13,519	• (17)	7.03	• (2)	14	Yes
Copper	470	17.7		---		2,714		---	• (2)	311	Yes		---		341,235		---		42,486		---		25,368	No
Manganese	4,800	1,450		---	• (2)	1,482		---	• (2)	293	Yes		---		116,634		---		20,723		---	• (2)	35.1	Yes
Nickel	110	21.1		---		1,346		---		155	No		---		1.0E+06		---		20,971		---		12,639	No
Selenium	3.2	1.4		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
Silver	630	0		---	• (2)	324		---	• (6)	38.6	Yes		---		38,421		---		4,928		---		3,105	No
Zinc	620	61.8		---		19,659		---		2,321	No		---		1.0E+06		---		301,090		---		187,269	No
Propellants 8330																								
Nitrocellulose	5	NA		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
VOCs 8260B																								
Chloroethane	0.091	NA		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
SVOCs TCL 8270C																								
Phenanthrene	0.089	NA		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
Fluoranthene	0.52	NA		---		276		---		163	No		---		15,788		---		2,732		---		5,087	No
Pyrene	0.53	NA		---		207		---		122	No		---		11,833		---		2,049		---		3,815	No
Benzo(a)anthracene	0.31	NA	• (1)	0.221		---		0.65		---	Yes		15.1		---		2.62		---		4.77		---	No
Chrysene	0.29	NA		22.1		---		65		---	No		1,513		---		262		---		477		---	No
Bis(2-Ethylhexyl)phthalate	0.09	NA		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**
Benzo(b)fluoranthene	0.3	NA	• (1)	0.221		---		0.65		---	Yes		15.1		---		2.62		---		4.77		---	No
Benzo(k)fluoranthene	0.33	NA		2.21		---		6.5		---	No		151		---		26.2		---		47.7		---	No
Benzo(a)pyrene	0.29	NA	• (1)	0.022		---		0.65		---	Yes		1.51		---	• (1)	0.262		---		0.477		---	Yes
Indeno(1,2,3-cd)pyrene	0.13	NA		0.221		---		0.65		---	No		15.1		---		2.62		---		4.77		---	No
Dibenzo(a,h)anthracene	0.69	NA	• (1)	0.022		---	• (1)	0.065		---	Yes		1.51		---	• (1)	0.262		---	• (1)	0.477		---	Yes
Benzo(g,h,i)perylene	0.13	NA		---		---		---		---	Yes**		---		---		---		---		---		---	Yes**

Notes:
Draft cleanup goals were taken from the *Draft Human Health Remediation Goals at the RVAAP, Ravenna, Ohio* (September 2008)
*For inorganics, the background value is the default action level for COPCs with draft cleanup goals below background.
** No facility-wide draft cleanup goals have been developed for this analyte; however, for organics the analyte is automatically retained as a COPC if detected; an inorganic is automatically retained if it exceeded the RVAAP background value.
*** Hexavalent chromium was not analyzed during the RA sampling; however, the Facility-Wide Human Health Goals provide a comparison of total chromium results to hexavalent chromium if hexavalent chromium results are not available.
• (1) denotes the maximum concentration exceeds the cancer risk and/or non-cancer risk draft cleanup goals. Number in parenthesis denotes the number of samples that exceed background (inorganics only) and the risk cleanup goal (all COPCs)
--- = no cleanup goal has been established for the chemical
COPC = chemical of potential concern
CR = cancer risk
HQ = hazard quotient (non-cancer risk)
mg/kg = milligrams per kilogram
SVOCs = semivolatile organic compounds
TAL = target analyte list
TCL = target compound list
VOCs = volatile organic compounds

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Table 3-6
Summary of Accumulation Areas with COPCs Greater Than Draft Cleanup Goal Criteria (Cancer Risk =10^{-6} and HQ=0.1)

Sample Locations	Exposure Scenarios									
	Residential Farmer				National Guard					
	Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee	
	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1
Surface Soil Discrete Samples										
SCSS-001-0001-SO				Cr, Co, Ag					Cr, Co	Cr
SCSS-003-0001-SO									Cr, Co	Cr
SCSS-004-0001-SO	Hg			Hg, Cd, Cr, Ag					Cd, Cr, Ag	Cr
SCSS-005-0001-SO	As, Cr	Sb, As, Cd, Ag	As	Sb, As, Hg, Ba, Cd, Cr, Cu, Ag			As		As, Cd, Cr, Co	Ba, Cr
SCSS-006-0001-SO	As	As, Mn, Ag	As	As, Cd, Cr, Mn, Ag	As		As		As, Cr	Ba, Cr, Mn
SCSS-007-0001-SO	As	Sb, As, Cr, Ag	As	An, As, Cd, Cr, Ag	As		As		As, Cd, Cr	Ba, Cr
SCSS-008-0001-SO	As	As	As	As, Cr, Ag	As		As	As	As, Cr	Cr
SCSS-011-0001-SO		Cr		Cr, Cu					Cr	Cr
SCSS-012-0001-SO	As	As	As	As			As		As, Co	
SCSS-013-0001-SO									Cr, Co	Cr, Co
SCSS-016-0001-SO									Co	
SCSS-017-0001-SO	B(a)A, B(b)F, B(a)P, D(a,h)A	Mn		Mn, D(a,h)A			B(a)P, D(a,h)A		D(a.h)A	Mn
SCSS-018-0001-SO									Cr, Co	Cr
SCSS-019-0001-SO	As	As	As	As			As		As, Cr, Co	Cr
SCSS-022-0001-SO									Co	
SCSS-023-0001-SO	As	As	As	As, Cr			As		As, Cr, Co	Cr
SCSS-024-0001-SO									Co	
SCSS-025-0001-SO									Co	
SCSS-026-0001-SO									Co	
SCSS-028-0001-SO									Co	
SCSS-029-0001-SO									Co	
SCSS-030-0001-SO									Co	
SCSS-CONT1-0001-SO	As	As	As	As, Cr			As		As, Cr	Cr

Table 3-6 (cont)
Summary of Accumulation Areas with COPCs Greater Than Draft Cleanup Goal Criteria (Cancer Risk =10^{-6} and HQ=0.1)

Sample Locations	Exposure Scenarios									
	Residential Farmer				National Guard					
	Adult		Child		Dust/Fire Control Worker		Range Maintenance Soldier		Trainee	
	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1	CR=10^{-6}	HQ=0.1
Sediment Discrete Samples										
SCSD-001-0001-SD				Ag						
SCSD-008-0001-SD							Cr	Cr		
Surface Water Samples										
No COPCs were identified >draft CUGs at any surface water sample locations										

Notes:
Ag = silver
As = arsenic
B(a)A = benzo(a)anthracene
B(a)P = benzo(a)pyrene
B(b)F = benzo(b)fluoranthene
Ba = barium
Cr = chromium
CR = cancer risk
Co = cobalt
COPC = chemical of potential concern
CUGs = cleanup goals
D(a,h)A = dibenzo(a,h)anthracene
Hg = mercury
HQ = hazard quotient (non-cancer risk)
Mn = manganese
Sb = antimony

Table 3-7
Summary of Data Reduction and Screening for COPCs for Sediment Discrete Samples at the Sand Creek Dump

Analyte	Units	Results >Detection Limit	Maximum Detect	Site Background Criteria	Max. Detect >Background	Retained as COPC?
Explosives 8330						
2,6-Dinitrotoluene	mg/kg	1/2	0.110	NA	NA	Yes
TAL Metals 6010B						
Antimony	mg/kg	1/12	0.086	0	Yes	Yes
Arsenic	mg/kg	12/12	15	19.5	No	No
Lead	mg/kg	12/12	40	27.4	Yes	Yes
Thallium	mg/kg	1/12	0.36	0.89	No	No
Mercury	mg/kg	10/12	0.66	0.059	Yes	Yes
Aluminum	mg/kg	12/12	14,000	13,900	Yes	No
Barium	mg/kg	12/12	62	123	No	No
Beryllium	mg/kg	12/12	0.67	0.38	Yes	Yes
Cadmium	mg/kg	2/12	0.39	0	Yes	Yes
Calcium	mg/kg	12/12	3,300	5,510	No	No
Chromium	mg/kg	12/12	19	18.1	Yes	Yes
Cobalt	mg/kg	12/12	13	9.1	Yes	Yes
Copper	mg/kg	12/12	26	27.6	No	No
Iron	mg/kg	12/12	30,000	28,200	Yes	No
Magnesium	mg/kg	12/12	4,800	2,760	Yes	No
Manganese	mg/kg	12/12	960	1,950	No	No
Nickel	mg/kg	12/12	29	17.7	Yes	Yes
Potassium	mg/kg	12/12	2,300	1,950	Yes	No
Selenium	mg/kg	1/12	0.57	1.7	No	No
Silver	mg/kg	2/12	40	0	Yes	Yes
Sodium	mg/kg	1/12	170	112	Yes	No
Vanadium	mg/kg	12/12	21	26.1	No	No
Zinc	mg/kg	12/12	170	532	No	No
Propellants 8330						
Nitroquanidine	mg/kg	1/2	0.5	NA	NA	Yes
Nitrocellulose	mg/kg	2/2	0.98	NA	NA	Yes
VOCs 8260B						
Acetone	mg/kg	1/2	0.011	NA	NA	Yes

Notes:
> = greater than
COPC = chemical of potential concern
mg/kg = milligrams per kilogram
NA = not applicable
TAL = target analyte list
VOCs = volatile organic compounds

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Table 3-8
Comparison of COPCs to the Draft Cleanup Goals for Sediment Discrete Samples at the Sand Creek Dump

COPCs Targeted for Further Evaluation	Background Value	Max. Detect (mg/kg)	Draft Cleanup Goal Criteria for the Residential Farmer									Draft Cleanup Goal Criteria for the National Guard								
			Adult				Child					Dust/Fire Control Worker				Trainee				
			Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	COPC?	Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	COPC?
Explosives 8330																				
2,6-Dinitrotoluene	NA	0.110		---		---		---		---	Yes*		---		---		---		---	Yes*
TAL Metal 6010B																				
Antimony	0	0.086		---		13.6		---		2.82	No		---		1,030		---		175	No
Lead	27.4	40		---		---		---		---	Yes*		---		---		---		---	Yes*
Mercury	0.059	0.66		---		16.5		---		2.27	No		---		1,659		---		172	No
Beryllium	0.38	1.2		---		---		---		---	Yes*		---		---		---		---	Yes*
Cadmium	0	0.39		1,249		22.3		2,677		6.41	No		94,527		1,473		10.9		329	No
Chromium	18.1	19		187		90.4		401.5		19.9	No		14,179		6,666	• (1)	1.64	• (1)	5.61	Yes
Chromium, hexavalent**		19		187		90.4		401.5		19.9	No		14,179		6,666	• (1)	1.64	• (1)	5.61	Yes
Cobalt	9.1	13		---		---		---		---	Yes*		---		---		---		---	Yes*
Nickel	17.7	29		---		1,346		---		155	No		---		167,541		---		12,639	No
Silver	0	40		---		324		---	• (1)	38.6	Yes		---		38,421		---		3,105	No
Propellants 8330																				
Nitroguanidine	NA	0.5		---		---		---		---	Yes*		---		---		---		---	Yes*
Nitrocellulose	NA	0.98		---		---		---		---	Yes*									Yes*
VOCs 8260B																				
Acetone	NA	0.011		---		---		---		---	Yes*		---		---		---		---	Yes*

Notes:
Draft cleanup goals were taken from the *Draft Human Health Remediation Goals at the RVAAP, Ravenna, Ohio* (September 2008)
* No facility-wide draft cleanup goals have been developed for this analyte; however, for organics the analyte is automatically retained as a COPC if detected; an inorganic is automatically retained if it exceeded the RVAAP background value.
** Hexavalent chromium was not analyzed during the RA sampling; however, the Facility-Wide Human Health Goals provide a comparison of total chromium results to hexavalent chromium if hexavalent chromium results are not available.
• (1) denotes the maximum concentration exceeds the cancer risk and/or non-cancer risk concentrations. Number in parenthesis denotes the number of samples that exceed background (inorganics only) and the risk cleanup goal (all COPCs).
--- = no cleanup goal has been established for the chemical
COPC = chemical of potential concern
CR = cancer risk
HQ = hazard quotient (non-cancer risk)
mg/kg = milligrams per kilogram
TAL = target analyte list
VOCs = volatile organic compounds

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Table 3-9
Summary of Data Reduction and Screening for COPCs for Surface Water Samples at the Sand Creek Dump

Analyte	Units	Results >Detection Limit	Maximum Detect	Site Background Criteria	Max. Detect >Background	Retained as COPC?
TAL Metals 6010B						
Arsenic	µg/L	2/3	2.8	3.2	No	No
Aluminum	µg/L	3/3	94	3,370	No	No
Barium	µg/L	3/3	40	47.5	No	No
Calcium	µg/L	3/3	62,000	41,400	Yes	No
Copper	µg/L	3/3	4.2	7.9	No	No
Iron	µg/L	3/3	780	2,560	No	No
Magnesium	µg/L	3/3	15,000	10,800	Yes	No
Manganese	µg/L	3/3	230	391	No	No
Potassium	µg/L	2/3	1,900	3,170	No	No
Sodium	µg/L	3/3	5,600	21,300	No	No
Zinc	µg/L	3/3	18	42	No	No
Propellants 8330						
Nitrocellulose	µg/L	1/3	500	NA	NA	Yes

Notes:
> = greater than
COPC = chemical of potential concern
µg/L = micrograms per liter
NA = not applicable
TAL = target analyte list

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Table 3-10
Comparison of COPCs to the Draft Cleanup Goals for Surface Water Samples at the Sand Creek Dump

COPCs Targeted for Further Evaluation	Max. Detect (µg/L)	Draft Cleanup Goal Criteria for the Residential Farmer									Draft Cleanup Goal Criteria for the National Guard								
		Adult				Child					Dust/Fire Control Worker				Trainee				
		Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	COPC?	Risk	CR=10^{-6}	Hazard	HQ=0.1	Risk	CR=10^{-6}	Hazard	HQ=0.1	COPC?
Propellants 8330																			
Nitrocellulose	500		---		---		---		---	Yes*		---		---		---		---	Yes*

Notes:
Draft cleanup goals were taken from the *Draft Human Health Remediation Goals at the RVAAP, Ravenna, Ohio* (September 2008)
* No facility-wide draft cleanup goals have been developed for this analyte; however, for organics the analyte is retained as a COPC automatically if detected.
--- = no cleanup goal has been established for the chemical
COPC = chemical of potential concern
CR = cancer risk
HQ = hazard quotient (non-cancer risk)
µg/L = milligrams per kilogram
TAL = target analyte list

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4.0 Sample Design

This section summarizes the data gaps identified during the data evaluation in **Section 3.0** and presents the rationale for additional investigation. The selection for the areas for biased or random sampling is based on the project DQOs, the conceptual site model described in **Section 2.0**, discussions with Ohio EPA and the direction as provided in the *SOW*. Any future data collected, including environmental or MMRP results, will be incorporated into the CERCLA reporting process to include an RI/FS. The RI/FS will further evaluate the potential risks associated with the data collected at the Sand Creek Disposal Road Landfill to human health (proposed and unrestricted land use) and the environment as discussed in **Section 2.3**.

4.1 Geophysical Investigation

The previous removal effort at the Sand Creek Disposal Road Landfill consisted of removing all existing unconsolidated surface debris and the limited removal of subsurface debris. Evaluation of the confirmation sample data in **Section 3.0** that was collected following the RA activities indicates the potential for contamination in surface soils, primarily elevated inorganics at the northern portion of site, which may have resulted from previous site dumping operations. It is not known if subsurface conditions greater than 1 foot bgs have been impacted. It is recommended that additional investigation, to include surface and subsurface soil sampling, be performed at the site and is discussed further in the following sections.

Prior to the performing any intrusive sampling and/or removal activities, a geophysical investigation will be performed over the entire boundary of the Sand Creek Disposal Road Landfill site. The purposes of the geophysical investigation are to: 1) identify remaining buried anomalies, and 2) identify if any of the buried anomalies are suspect MEC. Suspected and identified source areas of debris will represent specific focus areas for additional surface and subsurface sampling and may require coordination with anomaly investigation for MEC under the MMRP. Additional details regarding the proposed geophysical investigation at the site is discussed further in the *Final Geophysical Investigation Plan for RVAAP-34 Sand Creek Disposal Road Landfill, RVAAP-03 Open Demolition Area 1, and RVAAP-28 Mustard Agent Burial Site* (Shaw, 2009).

4.2 Subsurface Soil

4.2.1 Rationales

Subsurface samples will be collected near the areas of debris that may be identified during the geophysical investigation and at biased locations identified as a result of the data evaluation for surface soil in **Section 3.0**. Subsurface samples will provide additional information as whether historical dumping activities at the site has impacted transport pathways to deeper soil horizons

for such contaminants as those described in the DQOs. In addition, subsurface sampling will verify the depths of residual contamination (if any) at the surface soil locations identified in **Section 3.0** with COPCs requiring further evaluation.

4.2.2 Subsurface Soil Sampling Locations

Subsurface sampling shall consist of both Geoprobe and hand augering sampling procedures as directed in the *SOW*. It is recommended that a minimum of 20 borings be advanced in order to: 1) provide sufficient coverage throughout the site, 2) confidently evaluate the human health concerns associated with subsurface soils at the site, and 3) adequately evaluate the frequency of detection for the COPCs to provide a weight-of-evidence approach for the subsurface soils. Site conditions consisting of steep slopes, saturated conditions and/or overgrown vegetation may prevent the advancement of Geoprobe samples at many of the proposed sample locations; therefore, hand auger sampling may be required at these areas.

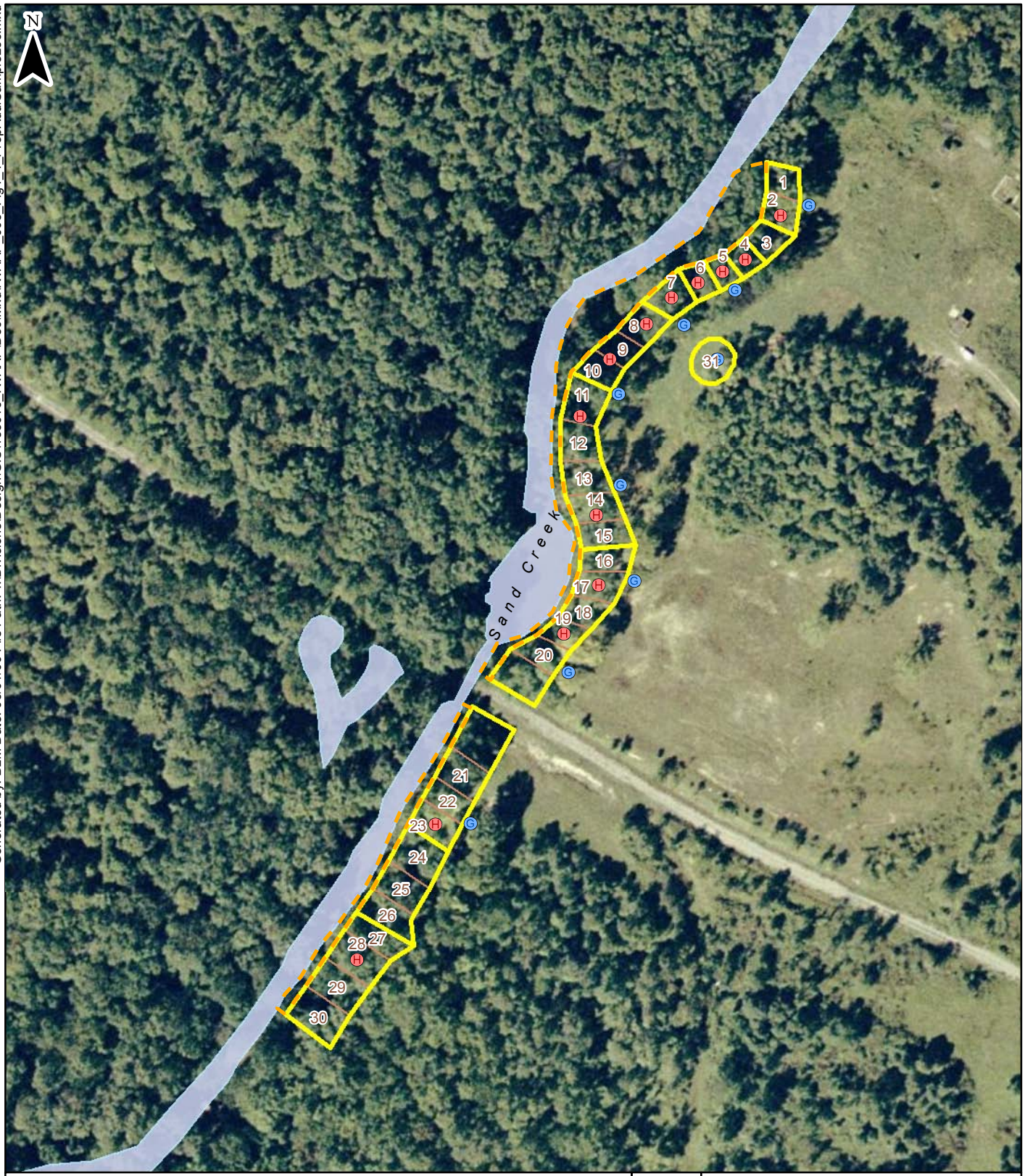
In all, Shaw proposes to advance 22 subsurface borings (combined Geoprobe and hand auger) that will be located based on the surface soil sample locations with elevated concentrations of COPCs as evaluated in **Section 3.0**. Subsurface borings will be advanced at a lesser frequency near surface soil sample locations identified with lesser concentrations of residual contaminants.

4.2.2.1 Geoprobe Samples

A minimum of nine Geoprobe holes will be advanced at the locations shown on **Figure 4-1**. Each boring will be advanced approximately 5 feet adjacent to the top of slope of each grid. The top 0 to 1 foot sample interval at each boring location will be collected as part of MI surface soil sampling for each grid area as is discussed in **Section 4.3**. Subsurface samples will begin at 1 foot bgs and will be collected continuously from each Geoprobe hole to the bottom of each boring at 20 feet bgs. Subsurface samples will be collected at a maximum of 4 foot intervals (1 to 5 feet, 5 to 9 feet, 9 to 13 feet, 13 to 17 feet, and 17 to 20 feet) using the MI sampling approach. In general, 30 increments of soil will be collected from the Geoprobe soil column for each 4-foot interval to generate an MI sample. Contingency Geoprobe samples may be necessary based on the results of the geophysical investigation or detected elevated contaminant concentrations identified from the previous sampling event.

4.2.2.2 Hand Auger Samples

A minimum of 13 hand auger holes will be advanced at the locations shown on **Figure 4-1** to a maximum depth of 5 feet bgs. The top 0 to 1 foot sample interval at each boring location will be collected as part of MI surface soil sampling for each grid area as is discussed in **Section 4.3**. Subsurface samples will be collected for the 1 to 5-foot interval using the MI sampling approach at each location. In general, 30 increments of soil will be collected from the 1 to 5-foot interval to generate an MI sample. Contingency hand auger samples may be necessary based on the



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Project Number: 133616

Geoprobe Sample Location (9)

Hand-Auger Sample Location (13)

Multi-Increment Sediment Sample Area (2)

Multi-Increment Soil Sample Area (12)

16 2003 Removal Action Sample Grids

0 100 200 Feet

U.S. ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT

FIGURE NUMBER 4-1

RVAAP-34
SAND CREEK DISPOSAL ROAD LANDFILL
PROPOSED ADDITIONAL INVESTIGATION
SAMPLE LOCATIONS

Shaw Shaw Environmental, Inc.

results of the geophysical investigation or detected elevated contaminant concentrations identified from the previous sampling event.

4.2.3 Sample Analysis

All subsurface soil samples, including quality assurance/quality control (QA/QC) samples will be submitted for laboratory analysis for TAL metals, hexavalent chromium, SVOCs and explosives since these were the most prevalent contaminants detected in surface soil discrete samples collected during the RA. A minimum of 10 percent of the samples will be analyzed for the RVAAP full suite to include total cyanide, TCL VOCs, pesticides, PCBs and propellants. It should be noted that hexavalent chromium is not considered part of the RVAAP full suite but was identified as a contaminant in the *HHRAM* (USACE, 2005) that may require further evaluation at a site based on the total chromium concentrations as was the case for the surface soil discrete sample results from the RA event.

4.3 Surface Soil

4.3.1 Rationales

A total of 26 contaminants were retained as COPCs in surface soils at the site that included inorganics, SVOCs, one propellant, and one VOC. Additional surface soil samples (0 to 1 foot) will be necessary to further characterize the areas with COPCs as evaluated in **Section 3.0** as having been potentially impacted as a result of past disposal activities. Additional sampling of surface soils will further illustrate the potential for contaminant migration via leaching or erosional processes from surface soils to media such as sediment.

4.3.2 Surface Soil Sampling Locations

A minimum of 13 surface soil samples will be collected within the boundaries of the site. The proposed sampling grid locations were selected on the basis of the DQOs and the conceptual site model developed from operational information and analytical results from the RA sampling event. The area of each sample grid will vary based on the extent of residual contamination previously identified; however, the minimum sample grid size will be approximately 40 by 40 feet. It is expected that the more COPC accumulated at a location will require a smaller sample grid size in order to adequately characterize the extent of the residual contamination. Former grid areas identified as having similar COPCs will be combined for this sampling event. Proposed sample grid locations for the additional investigation are presented in **Figure 4-1**.

Surface soil samples will be collected from each of the proposed sample grids using the MI sampling approach in accordance with the *Guidance for Multi-Increment Sampling* procedures included in Appendix A of the Shaw *Field Sampling and Analysis Plan, Addendum No. 1* (*FSP*) (Shaw, 2006). Each MI sample will consist of random samples from depths between 0 and 1 foot. In general, 30 random samples will be collected from each grid location. Contingency samples may also be collected; however, the locations will be determined in the field.

Contingency surface soil samples will be used to characterize any identified areas exhibiting visual evidence of contamination. The rationale for locating contingency surface soil samples is to target areas of obvious staining, discoloration, debris, stressed vegetation or areas in which additional samples may be deemed necessary based on field observations.

4.3.3 Sample Analysis

All surface soil samples, including QA/QC samples will be submitted for laboratory analysis for the most prevalent contaminants, TAL metals, hexavalent chromium, SVOCs and explosives, detected in the previous surface soil sample collected during the RA. A minimum of 10 percent of the samples will be analyzed for the RVAAP full suite to include total cyanide, TCL VOCs, pesticides, PCBs and propellants. Selection of these samples will be based, whenever possible, on visual evidence of contamination (i.e., stained soils, distressed vegetation or areas of dumping). It should be noted that hexavalent chromium is not considered part of the RVAAP full suite but was identified as a contaminant in the *HHRAM* that may require further evaluation at a site based on the total chromium concentrations as was the situation for the surface soil discrete samples collected during the RA.

4.4 Sediments

4.4.1 Rationales

A total of 13 contaminants consisting of inorganics, 2 propellants, 1 explosive constituent and 1 VOC were retained as COPCs in sediment as a result of the data screening process in **Section 3.0**. Only chromium and silver exceeded the facility-wide draft CUGs; however, the sediment samples collected following the RA activities were discrete-type samples only. Additionally, concentrations of arsenic and chromium were persistent in all 12 sediment samples. Based on discussions with the Ohio EPA, a MI sampling approach was recommended 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 dump site (Shaw, 2008).

4.4.2 Sediment Sampling Locations

Two MI sediment samples will be collected in the floodplain along the reach of the Sand Creek Dump site in accordance with the *Guidance for Multi-Increment Sampling* procedures included in Appendix A of the Shaw *FSP* (Shaw, 2006). MI sediment samples will be collected north and south of the former rail bed that bisects the site, respectively. The MI samples will consist of random samples from depths between 0 to 0.5 feet along the east bank of Sand Creek that runs along the former dump site. In general, 30 random samples will be collected for each MI sediment sample at the north and south reaches of the site. The proposed sampling strategy for sediment was selected on the basis of the DQOs, the conceptual site model developed from operational information, analytical results from previous sampling events and discussion with the Ohio EPA (Shaw, 2008). The proposed sampling locations are presented in **Figure 4-1**.

4.4.3 Sample Analysis

Sediment samples collected along the reach of the site, including QA/QC samples, will be analyzed for the RVAAP full suite to include TAL metals, hexavalent chromium, total cyanide, explosives, TCL VOCs, SVOCs, pesticides, PCB and propellants. Analysis of the MI sediment samples for the full suite will provide a representative result of metals along the reach of the Sand Creek site where concentrations of arsenic and chromium were detected in the previous sediment discrete samples collected during the RA. In addition, the full suite analyses will verify the results of the previous sediment samples did not contain explosives, SVOCs, pesticides, PCBs or propellants greater than the draft CUGs. It should be noted that hexavalent chromium is not considered part of the RVAAP full suite but was identified as a contaminant in the *HHRAM* that may require further evaluation at a site based on the total chromium concentrations, which was the case for the sediment samples collected during the RA event.

4.5 Surface Water

Only nitrocellulose, at a low concentration, was retained as a COPC in surface water adjacent and downstream of the Sand Creek Disposal Road Landfill as a result of the data screening process in **Section 3.0**. Currently, surface water at the RVAAP, including Sand Creek, is primarily used by only wildlife. As detailed in the CSM, 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 be detected in surface water at a concentration that would impact human health or the environment. Due to non-persistent contaminant concentrations in the surface water samples collected following the RA and discussion with the Ohio EPA (Shaw, 2008), no additional surface water sampling is recommended for further evaluation at the site.

5.0 Summary of Conclusions

This *DQO Report* has utilized the DQO process provided in the *FSAP* (SAIC, 2001) and the data evaluation and screening process in the *HHRAM* (USACE, 2005) to identify data gaps from the past removal action at the Sand Creek Disposal Road Landfill where the extent of residual contamination was not adequately characterized or to evaluate if any additional efforts were necessary for environmental closure of the AOC. Data results from the *RD/RA Report* have been compared to the RVAAP background values and the unrestricted land use scenarios that included the Residential Farmer (adult and child). The data results were also compared to the OHARNG receptors that included the National Guard Dust/Dire Control Worker, National Guard Range Maintenance Soldier and National Guard Trainee so that at a minimum, the OHARNG could use the site to their desired use. Given the elevated concentrations of inorganics and SVOCs above the RVAAP background values and CUG screening criteria for the unrestricted land use scenarios in surface soils, the persistent arsenic and chromium levels within site sediment and the scattered contaminant concentrations over the remainder of the site; it is recommended that additional sampling be performed to address surface soils, subsurface soils and sediment. No additional sampling of surface water is recommended going forward.

The RA at the Sand Creek Disposal Road Landfill consisted of removing all existing unconsolidated surface debris and the limited removal of subsurface debris. Evaluation of the confirmation sample data that was collected following the RA activities indicates the potential for contamination in surface soils, primarily elevated inorganics at the northern portion of site, which may have resulted from previous site dumping operations. It is not known if subsurface conditions greater than 1 foot bgs have been impacted; therefore, it is recommended that additional investigation, to include surface and subsurface soil sampling, be performed at the site.

Prior to the performing any intrusive sampling and/or removal activities, a geophysical investigation will be performed over the entire boundary of the Sand Creek Disposal Road Landfill site. The purposes of the geophysical investigation are to: 1) identify remaining buried anomalies, and 2) identify if any of the buried anomalies are suspect MEC that will be addressed under the MMRP. Suspected and identified source areas of debris will represent specific focus areas for additional surface and subsurface sampling

A total of 22 MI subsurface samples will be collected from 9 Geoprobe boring locations and 13 hand auger locations. The sample locations will be near the areas of debris that may be identified during the geophysical investigation and at biased locations based on the surface soil sample locations evaluated to contain accumulated COPCs. Subsurface samples will provide additional information as whether historical dumping activities at the site has impacted transport

pathways to deeper soil horizons for such contaminants as those described in the DQOs. In addition, subsurface sampling will verify the depths of residual contamination (if any) at the surface soil locations with COPCs requiring further evaluation.

Additional MI surface soil samples (0-1 foot) will be collected at 13 locations to further characterize the areas with elevated COPC concentrations previously identified as having been potentially impacted as a result of past disposal activities. Additional sampling of surface soils will further illustrate the potential for contaminant migration via leaching or erosional processes from surface soils to receptor media such as sediment.

Two sediment samples will be collected in the floodplain along the reach of Sand Creek adjacent to the site using the MI sampling approach. The purpose of the samples are to evaluate the true average concentration of the contaminants, primarily arsenic and chromium that were persistent in all of the sediment discrete samples collected during the RA event.

Contingency samples of the environmental media (surface and subsurface soils and sediment) proposed to be sampled may be necessary based on the results of the geophysical investigation, visible contamination (i.e., stained soils, distressed vegetation or areas of dumping) or detected elevated contaminant concentrations identified from the previous sampling event.

6.0 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.

SAIC, 2004, *Remedial Design/Removal Action Plan for RVAAP-34 Sand Creek Disposal Road Landfill, Ravenna Army Ammunition Plant, Ravenna, Ohio*, March.

SAIC, 2008, *Draft Facility-Wide Human Health Remediation Goals, Ravenna Army Ammunition Plant, Ravenna, Ohio*, September.

USACE, 2005, *Ravenna Army Ammunition Plant Facility-Wide Human Health Risk Assessor Manual, Amendment 1*, December 1.

Shaw, 2006, *Final Sampling and Analysis Plan Addendum No. 1 for the Remediation of Soils at LLs 1, 2, 3 and 4, Ravenna Army Ammunition Plant*, November.

Shaw, 2008, *Data Quality Objective Meeting Minutes for conversation between Shaw, U.S. Army Corps of Engineers – Louisville District and Ohio EPA*, December 31.

Shaw, 2009, *Geophysical Investigation Plan for RVAAP-34 Sand Creek Disposal Road Landfill. RVAAP-03 Open Demolition Area 1, and RVAAP-28 Mustard Agent Burial Site*, Final, July.

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APPENDIX A
COMMENT RESPONSE TABLE

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DRAFT DATA QUALITY OBJECTIVES FOR THE RVAAP-34 SAND CREEK DISPOSAL ROAD LANDFILL, VERSION 1.0
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO
COMMENT RESPONSE TABLE
July 7, 2009

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
OHARNG Environmental – Katie Elgin (April 27, 2009)					
R-1	General		Change all "Ravenna Training and Logistics Site (RTLS)" references to "Camp Ravenna Joint Military Training Center (Camp Ravenna)".		All "Ravenna Training and Logistics Site (RTLS)" references will be changed to "Camp Ravenna Joint Military Training Center (Camp Ravenna)".
R-2	Pg 1-5, Line 12		"The C&D material consisted of transite (asbestos containing material) roofing and siding that were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek." Here it sounds like only transite was dumped at this site. Weren't other types of debris dumped here? Please clarify.		Lines 10-14 will be revised to state: "The Sand Creek Disposal Road Landfill is a former dump area at the RVAAP. Construction and demolition (C&D) type material were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek." The types of debris disposed at Sand Creek are listed in lines 28-34 on page 1-5.
R-3	Pg. 1-5, Line 19		"The only structures near the site include the sewage treatment works buildings that are located on the northeast end of the site." This statement is conflicting as it indicates that the buildings are on the site and also near the site.	Suggested revised text: "Several buildings associated with the former Sand Creek Sewage Treatment Plant are located northeast of the site."	There are no buildings on the AOC; therefore, the sentence will be revised to state: "Several buildings associated with the former Sand Creek Sewage Treatment Plant are located northeast of the site."
R-4	Pg. 1-5, Line 22		"A railroad bed ran through the center of the site and crossed over Sand Creek." Based on maps provided in this report, the former railroad track is not located within the AOC. Additionally, this statement is in past tense like the	Delete "A railroad bed ran through the center of the site and crossed over Sand Creek."	Reference to the rail bed will remain; however, the sentence will be revised to state: "An inactive railroad bed bisects the AOC."

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			railroad bed no longer exists. Recommend deleting this statement.		
R-5	Pg 1-5, Line 24-34		"Preliminary site assessments found the site 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 site. Some of the types of C&D materials identified include: • 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 and naturally occurring tree components" Was this debris identified during	Suggested text revision: "Preliminary site visits (conducted as part of the remedial action activities) revealed that the site was heavily vegetated. The entire site was littered with debris with large piles concentrated mostly in the southern portion of the site. Debris identified included: 1. Asbestos-containing materials such as corrugated transite roofing and flat transite siding; 2. Rubble (i.e., concrete, brick and masonry fragments); 3. Drywall and plaster; 4. Glass bottles, fluorescent light tubes, and broken glass; 5. Scrap metal items including wire fencing; 6. Wood debris; and 7. Tree debris. All surface debris was removed from the AOC in 2003 as part of the Removal	The preliminary site assessment was not conducted as part of the RA. The assessments were conducted as a precursor to the RA to evaluate the need for corrective measures and additional investigation that may have been required at the site. The C&D materials were identified during the preliminary site assessment stage of the site investigations. Sentence 26-27 on page 1-5 will be revised to state: "Some of the types of C&D materials identified *during the preliminary site assessment* include:" The RA at the site consisted of removing all existing unconsolidated surface debris and the limited removal of subsurface debris as described in Section 1.2.2. Reference to the transite ACM will be removed from sentences 12 and 13, page 1-5 for consistency in the report and to avoid further confusion. Reference to the type of debris disposed at the site was taken from the approved RD/RA report prepared for Sand Creek. Although some of the materials such as glass bottles may not be typically associated with C&D type materials, it appears that most of the materials identified at

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			recent site visits or prior site visits? Additionally, has most of this material been removed? Please clarify. Also, here you indicate what type of C&D materials were found. In the prior paragraph, you indicate that the C&D found was transite roofing and siding. Please be consistent throughout the report. Glass bottles, fluorescent light tubes and broken glass are not typically considered C&D materials. Additionally, what is a naturally-occurring tree component? I think you meant parts of trees such as stumps or branches. Please revise this text.	Action activities."	the site were. Classification of these materials as C&D debris did not appear to impact the waste characterization of the material; therefore, delineation of the exact type of solid wastes identified at the site does not appear to be warranted at this time. The description of "naturally occurring tree components" was referenced in the approved RD/RA report. The report did not specify the parts of the tree that were disposed. 07/08/09 – Katie Elgin requested that "naturally-occurring tree components" be revised to either "tree debris" or "wood debris". "Naturally-occurring tree components" was removed from the text.
R-6	Pg 1-7, Line 1		"Recent walkovers at the site have revealed that the corrugated iron culvert beneath the former railroad bed that crossed over Sand Creek has collapsed. The culvert and associated railroad ballast are now lying in Sand Creek adjacent to the site." Why is this included in the site	Delete "Recent walkovers at the site have revealed that the corrugated iron culvert beneath the former railroad bed that crossed over Sand Creek has collapsed. The culvert and associated railroad ballast are now lying in Sand Creek adjacent to the site."	Reference to the culvert collapsing has a direct impact to the site since it shows changing conditions at the site that have occurred since the removal action. The metal culvert and railroad ballast (slag) have collapsed into the creek upgradient of sediment sample locations to be collected as part of additional sampling at the site and have the potential to impact analytical results, in particular inorganics. The purpose of referencing the collapsed culvert is

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			description if it is not located on the site? This seems more like an infrastructure item than an IRP-related item. Recommend deleting this statement as it is not directly related to the investigation and cleanup of this AOC.		show precedence for any analytical exceedances that may be attributed to it. The presence of the culvert also must be referenced because of its potential impact to the performance of proposed geophysical surveys in which the corrugated metal that makes up the culvert may cause interference when performing the surveys.
R-7	Pg 1-6, Figure 1-3		The creek looks like a lake because the streams lines are not continuous. Recommend continuing the stream line and identifying the symbol in the figure key. The culvert is not a 'former culvert' as the culvert is still there (it just needs repaired). Recommend identifying that structure as a 'former railroad track'.		Drawings 1-3, 3-1 and 4-1 will be revised to show the stream as continuous. Reference to the culvert in Figure 1-6 will be revised to "collapsed culvert". The culvert essentially no longer exists. The soils associated with the culvert have all washed downstream leaving just a crushed piece of corrugated metal with ballast lying around it.
R-8	Pg 2-2, Line 8		"The location of the metals was primarily in the northern third of the site and the SVOCs were identified in one soil sample approximately 120 feet north of the former railroad culvert." Again, the culvert is not a former culvert.	Suggested revised text "The sample locations where heavy metals were detected above PRGs and background values were located primarily in the northern third of the site. The soil sample location where SVOCs were detected is located approximately 120 feet north of the former railroad track."	The sentence will be revised to state: "The sample locations where heavy metals were detected above PRGs and background values were located primarily in the northern third of the site. The soil sample location where SVOCs were detected is located approximately 120 feet north of the former railroad track."
R-9	Pg 2-2, Line 17		"All visible surface debris was removed during the RA; however, only minimal subsurface debris was	Delete "All visible surface debris was removed during the RA; however, only minimal subsurface debris was removed	Lines 16-19 will be removed.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			removed during the event. The presence of subsurface debris could result in runoff or leaching from the site." This is a strange place to put this statement (sediment section) especially since it is not mentioned in the surface soil or surface water sections. Additionally, the statement about erosional transport of contaminants to sediment is mentioned in the prior line. Recommend deleting this statement.	during the event. The presence of subsurface debris could result in runoff or leaching from the site."	
R-10	Pg 2-2, Line 31		"Although all surface waste material has been removed from the site, historical dumping activities at this location indicate the potential for release of hazardous constituents and/or hazardous waste in the site's underlying soil and adjacent sediment and surface water." Hazardous waste is improperly used here. Please revise.	Suggested text revision: "Although all surface debris was removed from the site in 2003, there is a potential for contaminants to be present in subsurface soils as subsurface soils were not thoroughly investigated as part of the prior investigation/remedial action."	Sentence will be revised to state: "Although all surface debris was removed from the site in 2003, there is a potential for contaminants to be present in subsurface soils as subsurface soils were not thoroughly investigated as part of the prior investigation/remedial action."
R-11	Pg 2-3, Line 6		"Data collected during the additional investigation, including environmental or Military Munitions Response Program (MMRP) results, will be incorporated into a Remedial Investigation/Feasibility Study (RI/FS) for the Sand Creek Disposal Road Landfill …" Here it sounds like you are taking the results from	Suggested text revision: "Data collected during the upcoming additional investigation, including environmental and geophysical results, will be incorporated into a Remedial Investigation/Feasibility Study (RI/FS) for the Sand Creek Disposal Road Landfill …"	Shaw's current scope of work is to prepare documents RI through ROD that include all investigation results, both environmental and MMRP; however, it is not in Shaw's scope of work to perform the MMRP work. Sand Creek is not considered a "high priority" site under the MMRP and it may be up to five years before any MMRP work is performed at the site once the contract is awarded. It was originally the

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
			the upcoming MMRP investigation and incorporating them into your RI/FS. To my knowledge, you are doing the geophysical investigation to help facilitate the removal action related to the restoration (IRP).		USACE intent to achieve an NFA ROD at the site under both the IRP and the MMRP which is why the language was included in the SOW. USACE will revisit the SOW and determine the path forward if the MMRP investigation information cannot be included in the IRP documents to be prepared by Shaw. Going forward, text in the DQO report regarding the MMRP will remain until USACE has made a determination on how to proceed.
R-12	Pg 2-3, Line 10		"The data are to be of sufficient quality to determine if a release of hazardous waste/constituents occurred at RVAAP-34." Again, 'hazardous waste' is being improperly used.	Suggested revised text: "The data are to be of sufficient quality to determine if a contaminant release occurred at RVAAP-34."	The sentence will be revised to state: "The data are to be of sufficient quality to determine if a contaminant release occurred at RVAAP-34."
R-13	Pg 2-3, Line 20		"The boundary was established to encompass all known or reported historical dumping operations and adjacent support areas along the 1,200 foot reach of Sand Creek." What is an adjacent support area? Please clarify.		The support areas consist of the dumping areas at the top of slope where trucks apparently unloaded the debris material. Lines 19-20 will be revised to state: "This boundary was established to encompass all known or reported historical dumping operations and adjacent support areas (truck unloading areas at the top of the embankment) along the 1200 foot reach of the Sand Creek Dump.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
R-14	Pg 2-4, Line 15		"For the environmental benchmarks, Shaw will complete a screening level risk assessment (SLERA) in the RI stage…" Should 'environmental' be changed to 'ecological'?		'environmental' will be changed to 'ecological'.
R-15	General		Flood plain is one word. Please change throughout the document.		'flood plain' will be changed to 'floodplain' throughout the document.
R-16	Pg 3-3, Figure 3-1		Delete railroad track symbol and identify as a 'former railroad track'. Add in a continuous stream line/symbol so that Sand Creek does not look like a lake. Also add in a stream symbol in the key. Please also revise Figure 4-1.		The railroad track symbol will be removed from all drawings 1-3, 3-1 and 4-1 and will be identified as a 'former railroad track'. Sand Creek will be extended on both ends to make it appear continuous on all three figures. A stream symbol will be added to all three figures.
R-17	Pg 3-8, Line 2		"… approximately 120 feet north of the former railroad culvert." This is not a former culvert.	Suggested revised text: "…approximately 120 feet north of the former railroad track."	This sentence will be revised to state: "All four exceedances were identified at one sample location, SCSS-017-0001-SO, approximately 120 feet north of the *former railroad track*."
R-18	Pg 4-1, Line 5		"Any future data collected, including environmental or MMRP results, will be incorporated into the CERCLA reporting process to include a RI/FS." Again, I would not indicate MMRP results as this is not a MMRP investigation.	Suggested revised text: "Any data collected as part of this investigation will be incorporated into a RI/FS.	See response to Comment R-11.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
R-19	Pg 4-5, Line 25		Delete "common facility-wide contaminants".		"common facility-wide contaminants" will be removed. The sentence will be revised to state: "Additionally, concentrations of arsenic and chromium were persistent in all 12 sediment samples."
R-20	Pg 4-6, Line 19		"Currently surface water at the RVAAP, including Sand Creek, is primarily used by only wildlife. However, projected use of the surface water includes dust suppression, fire control, fishing (catch/release), trapping, and waterfowl hunting." Surface water throughout the facility is currently used for other purposes besides wildlife as mentioned here. Additionally, this project is not addressing surface water; therefore, please delete this statement.		This statement will be revised to state the following: "The projected use of surface at the RVAAP, including Sand Creek, includes dust suppression, fire control, fishing, trapping, waterfowl hunting and occasional foot traffic during military training." 07/08/09 - Katie Elgin did not agree with revised statement and requested the entire statement referencing future surface water use at RVAAP be removed from the document.
Ohio EPA – Bonnie Buthker/Eileen Mohr (May 5, 2009)					
O-1	General		Throughout the document there are numerous references to the facility wide CUGs. Please be advised that these are draft.	Do a search on the entire document and insert draft in front of Cleanup Goals and CUGs in all instances.	Shaw will perform a word search and insert draft in front of Cleanup Goals and CUGS in all instances.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-2	General		Even though the CUGs that are referenced in this document are draft, the Ohio EPA does not have issues with the way that the draft CUGs are proposed for use.	No text changes required. However, there were some mistakes in the initial draft CUG chart, and as such, make sure that what you have are the correct values.	Shaw will request the most recent version of the RVAAP facility-wide cleanup goals from the Army and will make sure the correct values are referenced and included in the tables.
O-3	General		Given the presence of transite in the Sand Creek Dump, we need to add asbestos to the list of analytes.	Add asbestos to list of analytes at every sample location.	After discussion between the Army, Ohio EPA and Shaw on 5/26/09, it was agreed that since confirmatory surface soil, sediment and surface water samples from 33, 12 and 3 locations, respectively, collected following RA activities at the site were all reported as non-detect, additional sampling for asbestos would not be necessary unless suspect ACM was identified during the proposed sampling activities. If suspect ACM is identified, Shaw would notify the Army and Ohio EPA and establish a procedure for collecting samples for asbestos analysis.
O-4	Doc Dist page		Fix Ohio EPA acronym.	Change OEPA to Ohio EPA.	Shaw will change ‘OEPA’ to ‘Ohio EPA’ in the document distribution list.
O-5	Page iv/ line 6		Change acronym.	Antimony is Sb.	Shaw will revise the acronym list to replace ‘An’ with ‘Sb’ for antimony.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-6	Page 1-5/ lines 10-14		Text expansion requested.	Add more description into the text that describes the types of materials dumped at Sand Creek.	The types of debris disposed at Sand Creek are listed in lines 28-34 on page 1-5. For clarity, lines 10-14 will be revised to state: "The Sand Creek Disposal Road Landfill is a former dump area at the RVAAP. Construction and demolition (C&D) type material were delivered to the site and dumped over an embankment located immediately adjacent to Sand Creek."
O-7	Fig 1-3/ page 1-6		Clarification requested.	Clarify the boundaries of the investigation area that are depicted on this figure. Why the distance of the boundary from the former RR tracks? Has it been determined that no waste is present?	No known investigations have occurred along the former rail bed and it has not been determined if waste is present. The boundaries of the AOC were taken from the RD/RA report. Although, not specifically stated in the RD/RA report, Shaw assumed the boundaries of the AOC to end where the ballast along the north and south side slopes of the former rail bed begins. Todd Fisher of Ohio EPA concurred with this assumption during the 5/26/09 conference call between the Army, Ohio EPA and Shaw and requested that Shaw revise the drawings to move the AOC boundaries closer to the rail bed to provide a more accurate depiction. Shaw agreed and will make the requested changes to the drawings.
O-8	Page 1-7/ line 27		Text revision requested.	Change IX to 9.	'Region IX' will be revised to 'Region 9'.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-9	Page 2-2/ line 29		The text states that it would be unlikely that any contaminants originating from the site would be detected in the surface water. Yet, table 3-3 indicates that nitrocellulose was detected in one of three surface water samples.	Rectify the disconnect.	Lines 27-29 will be revised to state: "Sand Creek is a constant flowing stream and it is unlikely that any contaminants that could be originating from the site would be detected at concentrations that would impact human health and the environment."
O-10	Page 2-2/ line 34		Text revision requested.	Please change text to read: "…. being evaluated separately under a facility-wide initiative and is….."	Lines 33-34 will be revised to state: "Groundwater is being evaluated separately under a facility-wide initiative and is removed from further consideration in this *DQO report*."
O-11	Page 2-3, line 10		The text references figure 1-3 that depicts the Sand Creek Dump boundary.	See comment #7.	See response to Comment O-7.
O-12	Page 2-4/ Line 18		Text revision requested.	Change text to read: "…. SLERA must be pre-approved by USACE and Ohio EPA." Delete the rest of the sentence.	Lines 17-20 will be revised to state: "Ecological screening values or benchmarks used in the SLERA must be pre-approved by USACE and the Ohio EPA."
O-13	Page 2-5/ lines 3-5		Clarification re: MEC issues.	In any areas of potential MEC, would these really represent areas that would have additional surface or sub-surface sampling? Or are you doing this for MEC avoidance?	Shaw will not perform sampling in the area where suspect MEC is identified as part of the geophysical investigation. Lines 3-5 will be revised to state: "Suspected and identified source areas of debris and residual contamination in surface soils, as presented in Section 3.0, represent specific focus areas for additional surface and subsurface sampling. The location of any suspected MEC will be marked using GPS and no intrusive activities will be performed at that location under this IRP

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					contract as currently presented."
O-14	Page 2-5/ line 7		Text revision.	Revise text to read: "… is also specifically targeted for sampling."	Lines 2-4 will be revised to state: "The sediment in the floodplain adjacent to Sand Creek and along the reach of the site is also specifically targeted for sampling."
O-15	Page 2-5/ line 21		Text revision requested.	Change soils to soil.	'soils' will be changed to 'soil'.
O-16	Page 2-5/ line 24		The text indicates that discrete subsurface samples will be obtained.	Additional discussion regarding this issue is needed. (Sub-surface MI sampling is an issue that has periodically come up but which has not been resolved.)	Additional discussion regarding subsurface MI sampling was conducted between USACE and the Ohio EPA on 6/9/09. The results of the discussion concluded in agreement that subsurface MI sampling would not be performed at Sand Creek. Therefore, the current sampling description for discrete subsurface sampling as presented in the DQO report will remain.
O-17	Page 3-1/ line 4		Clarification requested.	Is "ambient" being used synonymously with "background?"	The word 'ambient' is being used synonymously with 'background'; however, in order to be consistent throughout the document 'ambient' will be replaced with 'background'.
O-18	Page 3-1/ line 8		Text revision requested.	Remove "at a minimum" from this sentence.	"at a minimum" will be removed from line 8 and the sentence will be revised to state: "The identified constituents will then be compared to the draft facility-wide CUGs for unrestricted land use scenarios for the Residential Farmer (adult and child) and the desired land use by OHARNG."

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-19	Page 3-2/ line 1		Clarification requested.	Should "unlikely" actually be "likely?"	'unlikely' is a typo in this sentence and will be changed to 'likely'.
O-20	Page 3-3/ figure 3-1		Clarification requested.	Clarify the boundaries of the investigation area that are depicted on this figure. Why the distance of the boundary from the former RR tracks? Has it been determined definitively that no waste is present?	See response to Comment O-7.
O-21	Page 3-5/ lines 28-29		Clarification requested.	Clarify whether the residential farmer for adult and child were the only scenarios utilized.	Lines 33-35 on page 3-5 and lines 1-2 on page 3-6 will be removed and lines 27-29 on page 3-5 will be revised to state: "The retained inorganic COPCs with developed draft facility-wide CUGs in surface soils were screened against the cancer risk and non-cancer risk criteria for the Residential Farmer (adult and child) and the OHARNG receptors (National Guard Dust/Fire Control Worker, National Guard Range Maintenance Soldier and National Guard Trainee) land use scenarios."
O-22	Page 3-11/ lines 17-20		Text addition requested.	Also evaluate acetone as a potential lab artifact.	The following sentence will be added after line 20: "Although retained as a COPC, the acetone concentration will also be evaluated as potential lab artifact."
O-23	Table 3-1		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The header for the cleanup goals in Table 3-1 will be revised to: "Draft Facility-Wide Cleanup Goals for Surface Soil (0-1 ft)". Reference to the cleanup goal document in the footer will be revised to the most current version.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					b. Shaw has reviewed the draft CUGs for the detected analytes presented in Table 3-1 to ensure the corrected values are used. No changes have been identified.
O-24	Table 3-2		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The header for the cleanup goals in Table 3-2 will be revised to: "Draft Facility-Wide Cleanup Goals for Sediment". Reference to the cleanup goal document in the footer will be revised to the most current version. b. Shaw has reviewed the draft CUGs for the detected analytes presented in Table 3-2 to ensure the corrected values are used. No changes have been identified.
O-25	Table 3-3		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The header for the cleanup goals in Table 3-3 will be revised to: "Draft Facility-Wide Cleanup Goals for Surface Water". Reference to the cleanup goal document in the footer will be revised to the most current version. b. Shaw has reviewed the draft CUGs for the detected analytes presented in Table 3-3 to ensure the corrected values are used. No changes have been identified.
O-26	Table 3-5		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The headers for the cleanup goals in Table 3-5 will be revised to: "Draft Cleanup Goal Criteria for the Residential Farmer" and Draft Cleanup Goal Criteria for the National Guard". Reference to the cleanup goal

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					document in the footer will be revised to the most current version. b. Shaw has reviewed the draft CUGs for the detected analytes presented in Table 3-5 to ensure the corrected values are used. The surface soils CUGs for cobalt were mistakenly used in this table. There are currently no CUGs for cobalt in sediment. The table has been corrected.
O-27	Table 3-6		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The Table 3-6 title header will be revised to "Summary of Accumulated Areas with COPCs Greater than Draft Cleanup Goals. b. Shaw has reviewed the draft CUGs for the analytes presented in Tables 3-1, 3-2 and 3-3 to ensure the corrected values are used. No changes were identified for the analytes; therefore, there are no changes to Table 3-6.
O-28	Table 3-8		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The Table 3-8 title header will be revised to "Comparison of COPCs to the Draft Cleanup Goals for Sediment Discrete Samples at the Sand Creek Dump". The cleanup goal headers in the table will be revised to "Draft Cleanup Goal Criteria for the Residential Farmer" and "Draft Cleanup Goal for the National Guard". Reference to the cleanup goal document in the footer will be revised to the most current version. b. Shaw has reviewed the draft CUGs for the

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					detected analytes presented in Table 3-8 to ensure the corrected values are used. The surface soils CUGs for cobalt were mistakenly used in this table. There are currently no CUGs for cobalt in sediment. Table 3-8 has been revised to retain cobalt as COPC since there are no CUGs in sediment and the maximum concentration exceeds background.
O-29	Table 3-10		Corrections requested.	a. Indicate that the CUGs are draft. b. Ensure that the corrected CUG values are used.	a. The Table 3-10 title header will be revised to "Comparison of COPCs to the Draft Cleanup Goals for Surface Water Samples at the Sand Creek Dump". The cleanup goal headers in the table will be revised to "Draft Cleanup Goal Criteria for the Residential Farmer" and "Draft Cleanup Goal for the National Guard". Reference to the cleanup goal document in the footer will be revised to the most current version. b. Shaw has reviewed the draft CUGs for the analyte presented in Table 3-10 to ensure the corrected values for nitrocellulose is used. Thre is currently no surface water CUG for nitrocellulose; therefore, there are no changes required to Table 3-10.
O-30	Page 4-1/ line 6		The text indicates that discrete subsurface samples will be obtained.	Additional discussion regarding this issue is needed. (Sub-surface MI sampling is an issue that has periodically come up but which has not been resolved.)	See response to Comment O-16

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-31	Page 4-2/ lines 14-16		Clarification requested.	Why not utilize a Little Beaver in some of the less accessible areas? Then greater than 5 foot depths could be achieved. Let's discuss.	The methodology for manual sampling for discrete subsurface samples at the less accessible areas using a hand auger was specified in the contract SOW. Using a Little Beaver can easily access soils at depths greater than 5 feet; however, this piece of equipment is a small diameter rotary auger machine typically used for minor construction operations such as installing fence posts and Shaw is not aware of a sampling procedure that is able to utilize a Little Beaver to yield continuous representative environmental samples that you would get similar to a DPT or HSA split spoon. Therefore, Shaw does not recommend utilizing a Little Beaver in the less accessible areas. However, if an approved procedure is available, Shaw is willing to discuss the issue further.
O-32	Page 4-2/ lines 14-16		The text indicates that the WOE approach will only apply to the 5' samples.	Provide additional clarification regarding this issue. Also, see the above comment in terms of utilizing a Little Beaver.	Shaw suggests removing reference to the WOE approach to the 5' depth only. The HHRAM does not specify that the WOE approach be applied to specific sample intervals and typical risk assessments evaluate all subsurface data in order to evaluate frequency of detection. Therefore, with the exception of propellants and explosives, all chemicals detected in subsurface soils (1-20 feet) will be evaluated using the data statistics methodology presented in Section 3.4.1 of the HHRAM. See response to Comment O-31 regarding use of a Little Beaver.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-33	Page 4-2/ line25		Clarification requested.	Clarify how the listed depths were chosen. For example, the following intervals are missing: 6-7' bgs, 11-12' bgs, and 16-17' bgs.	The sample intervals included in this DQO report were provided to Shaw by the Army in the contract SOW; however, per discussions between Shaw, Army and Ohio EPA, the sampling intervals will be revised to include the entire depth of each boring or hand auger location. The top 0-1 feet of each deep boring or hand auger location will be included with each MI surface sample within its designated sample grid area. After the top 0-1 feet has been sampled, subsurface sampling will be performed at 4 foot intervals beginning at 1 foot bgs. For the 20 foot borings, the sample intervals will now be 1-5', 5-9' 9-13', 13-17' and 17-20'. For the 5-foot deep hand augers, only one sample will be collected at the 1-5' intervals. For each 4-foot interval a total of 30 discrete samples will be combined in a sample container and processed off-site as an MI sample.
O-34	Page 4-2/ line 25		The text indicates that discrete subsurface samples will be obtained.	Additional discussion regarding this issue is needed. (Sub-surface MI sampling is an issue that has periodically come up but which has not been resolved.)	See response to Comment O-16
O-35	Page 4-2/ lines 33-34 through page 4-3 line 2		The text indicates that discrete subsurface samples will be obtained.	Additional discussion regarding this issue is needed. (Sub-surface MI sampling is an issue that has periodically come up but which has not been resolved.)	See response to Comment O-16
O-36	Figure 4-1		Clarification requested.	Clarify the boundaries of the investigation	See response to Comment O-7.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
				area that are depicted on this figure. Why the distance of the boundary from the former RR tracks? Has it been determined definitively that no waste is present?	
O-37	Figure 4-1		The figure depicts only one sediment MI sample for the entire reach of the stream.	This needs to be discussed. One sample is not adequate. Minimally I would recommend dividing the area in half. (I could also re-confirm with our Division of Surface Water as to reach distances that are traditionally sampled.)	As agreed upon by Ohio EPA during the 5/26/09 conference call, Shaw will split the proposed sediment sample coverage area in two; one north and one south of the former rail road tracks, respectively.
O-38	Page 4-5/ lines 33-36		Only 1 MI sample over the entire reach of Sand Creek adjacent to the dump is proposed.	This needs to be discussed. Justify why one sample would be considered adequate. Minimally I would recommend dividing the area in half. (I could also re-confirm with our Division of Surface Water as to reach distances that are traditionally sampled.)	See response to Comment O-37.
O-39	Page 5-2/ line 9		Only 1 MI sample over the entire reach of Sand Creek adjacent to the dump is proposed.	This needs to be discussed. Justify why one sample would be considered adequate. Minimally I would recommend dividing the area in half. (I could also re-confirm with our Division of Surface Water as to reach distances that are traditionally sampled.)	See response to Comment O-37.