DRAFT

FEASIBILITY STUDY

for Open Demolition Area #2

(RVAAP-04)

Ravenna Army Ammunition Plant
Ravenna, Ohio

March 2006

US Army Corps of Engineers®
Louisville District

Contract No. GS-10F-0076J
Delivery Order No. W912QR-05-F-0033

SAIC® From Science to Solutions™

Prepared for:
U.S. Army Corps of Engineers
Louisville, Kentucky

Prepared by:
Science Applications International Corporation
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

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LIST OF ACRONYMS

amsl	above mean sea level
AOC	Area of Concern
ARAR	Applicable and Relevant or Appropriate Requirements
AT123D	Analytical Transient 1-, 2-, 3-Dimensional
bgs	below ground surface
BRAC	Base Realignment and Closure
CAMU	Corrective Action Management Unit
CBP	Central Burn Pits
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMCOC	contaminant migration chemical of concern
CMCOPC	contaminant migration chemical of potential concern
COC	chemical of concern
COEC	chemicals of ecological concern
COPEC	chemical of potential ecological concern
DERR	Division of Emergency and Remedial Response
DFFO	Director's Final Findings and Orders
DI	de-ionized
DoD	Department of Defense
DQO	data quality objective
DQSR	Data Quality Summary Report
EBG	Erie Burning Grounds
EPC	exposure point concentration
ERA	ecological risk assessment
ESA	Endangered Species Act
ESV	ecological screening value
EU	exposure unit
FBQ	Fuze and Booster Quarry Landfill/Ponds
FS	Feasibility Study
FWHHRAM	Facility Wide Human Health Risk Assessor Manual
GOCO	government-owned, contractor-operated
GSA	United States General Services Administration
HHRA	human health risk assessment
HQ	Hazard quotient
ILCR	incremental lifetime cancer risk
IRP	Installation Restoration Program
LDR	land disposal requirement
LL12	Load Line 12
MCL	maximum contaminant level
MDC	maximum detected concentration

LIST OF ACRONYMS (CONTINUED)

MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MS	matrix spike
MSD	matrix spike duplicate
MTR	minimum technical requirements
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
OAC	Ohio Administrative Code
ODA2	Open Demolition Area #2
ODNR	Ohio Department of Natural Resources
OE	Ordnance and Explosives
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PBC	Performance Based Contract
PBT	persistent, bioaccumulative, and toxic
PCB	polychlorinated biphenyl
PP	Proposed Plan
PRG	USEPA Region 9 preliminary remediation goal
PWS	Performance Work Statement
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QHEI	Qualitative Habitat Evaluation Index
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RGO	remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RQL	Ramsdell Quarry Landfill
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SERA	Screening Ecological Risk Assessment
SESOIL	Seasonal Soil Compartment Model
SRC	site-related contaminant

LIST OF ACRONYMS (CONTINUED)

SVOC	semivolatile organic compound
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
THI	target hazard index
TNT	Trinitrotoluene
TR	target risk
TU	temporary unit
UCL_{95}	95% upper confidence limit
UHC	underlying hazardous constituent
USACE	United States Army Corps of Engineers
USAEHA	United States Army Environmental Hygiene Agency
USEPA	United States Environmental Protection Agency
USP&FO	United States Property and Fiscal Officer
UTS	universal treatment standards
VOC	volatile organic compound
WQC	water quality criteria
WWH	warmwater habitat

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1.0 INTRODUCTION

Science Applications International Corporation (SAIC) has been contracted by the United States Army Corps of Engineers (USACE) Louisville District to provide environmental services to achieve interim remedy for soils (including dry sediments) at six high priority areas of concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio by September 30, 2007:

- RVAAP-01 Ramsdell Quarry Landfill (RQL);
- RVAAP-02 Erie Burning Grounds (EBG);
- RVAAP-04 Open Demolition Area #2 (ODA2);
- RVAAP-12 Load Line 12 (LL12);
- RVAAP-16 Fuze and Booster Quarry Landfill/Ponds (FBQ); and
- RVAAP-49 Central Burn Pits (CBP).

This work is being performed under a firm fixed price basis in accordance with United States General Services Administration (GSA) Environmental Advisory Services Contract GS-10-F-0076J under a Performance Based Contract (PBC) as specified in the Performance Work Statement (PWS) issued by the Army on February 10, 2005 (USACE 2005h). In addition, planning and performance of all elements of this work will be in accordance with the requirements of the Director's Final Findings and Orders (DFFO) dated June 10, 2004 (Ohio EPA 2004).

1.1 PURPOSE

The feasibility studies (FSs) for the six high priority AOCs present remedial alternatives to address contaminated soil (including dry sediment). Remediation of impacts to aqueous media (groundwater and surface water) and subaqueous sediment are not included under the scope of the PBC. Implementation of an alternative to address only soil is; therefore, considered as an interim action or remedy. Groundwater and surface water media are to be addressed under future decisions. The following steps summarize the process supporting interim remedy of the six high priority AOCs:

1. Complete Remedial Investigation (RI) Reports;
2. Complete FSs and Reports;
3. Prepare Proposed Plan(s) (PP);
4. Prepare Record of Decision(s) (ROD);
5. Prepare Remedial Design (RD) Work Plans;
6. Implement the RD Work Plans; and
7. Prepare Remedial Action Reports.

Currently, the RI phase or work is complete for each of the six environmental AOCs. The ODA2 RI phase is complete with submittal of the Supplemental Phase II RI, which is appended to this FS. The RI phase work indicates evidence of impacts that requires further evaluation in an FS. This report

documents the FS for soil and dry sediment media at ODA2 in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980.

This FS evaluates remedial actions to reduce risks to the environment and human health at ODA2 in accordance with remedial action objectives (RAOs) and to obtain interim remedy for soils/dry sediments with respect to chemical contamination. Munitions and explosives of concern (MEC) contamination at ODA2 will be addressed under the Military Munitions Response Program (MMRP). RAOs are developed in the FS to protect receptors from impacted environmental media and chemicals of concern (COCs) identified in the ODA2 RI Report (USACE 2005e). Applicable and relevant or appropriate requirements (ARARs) also are identified.

Depending on the outcome of the evaluation in this FS, a preferred alternative will be submitted for public review and comment. Public comments will be considered in the final selection of an interim remedy which will be documented in a ROD. Responses to public comments will be addressed in the responsiveness summary of the ROD.

1.2 SCOPE

This FS evaluates necessary CERCLA remediation requirements with respect to chemical contamination in soils and dry sediment that will be performed to achieve interim remedy at ODA2. In addition, residual soils are evaluated to demonstrate the selected remedy for soil and dry sediment is protective of groundwater with respect to the anticipated future land use. Remediation of aqueous media (i.e., groundwater, surface water, and subaqueous sediments) is not included in the scope of this FS, nor is the MEC contamination in soils. Therefore, this remedy will be considered interim.

Although remediation of impacts to groundwater, surface water, and subaqueous sediments are not addressed under this PBC, a preliminary evaluation of options to address impacts to aqueous media (i.e., groundwater, surface water, and subaqueous sediments) is included in this FS, if appropriate. Remedies for soil and dry sediment also incorporate the necessary engineering controls during implementation to ensure protectiveness of surface water during implementation.

In addition, the following AOC features are not included in the scope of this PBC or FS:

- The Resource Conservation and Recovery Act (RCRA) unit located within ODA2 will be evaluated separately in a RCRA Closure Report and associated activities.

- "Rocket Ridge" and adjacent riparian areas of Sand Creek located within ODA2 and removal actions specifically addressing MEC issues which will be addressed in the Military Munitions Response Program (MMRP).

Ohio Army National Guard (OHARNG) has established future land uses for ODA2 based on anticipated training mission and utilization of the Ravenna Training and Logistics Site (RTLS) (USACE 2004c).

These anticipated future land uses and associated receptors form the basis for identifying RAOs and evaluating remedial alternatives.

1.3 REPORT ORGANIZATION

The organization of this report is based on the United States Environmental Protection Agency (USEPA) guidance and includes seven major sections. This report presents the findings of the FS conducted for ODA2 and is organized as follows:

- Section 2: Background Information;
- Section 3: Remedial Action Objectives;
- Section 4: Applicable or Relevant and Appropriate Requirements;
- Section 5: Agency Coordination and Public Involvement;
- Section 6: Conclusions; and
- Section 7: References.

Section 2 summarizes facility and AOC background information. Section 3 outlines the development of RAOs for the constituents and media of concern. Section 4 presents the ARARs. Section 5 summarizes partnering and public involvement activities. Section 6 presents conclusions. References are found in Section 7, followed by the appendices. The appendices provide information supporting the evaluations presented in the body of this FS Report:

- Appendix 2A: presentation/evaluation of Supplemental Phase II RI sampling results for ODA2; and

- Appendix 3A: contaminant fate and transport assessment.

2.0 BACKGROUND INFORMATION

2.1 FACILITY-WIDE BACKGROUND INFORMATION

2.1.1 General Site Description

RVAAP is a 1,481-acre portion of the 21,419-acre RTLS of the OHARNG. A total of 19,938 acres of the former 21,419-acre RVAAP was transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio in 1996 and 1999 for use by the OHARNG as a military training site. The current RVAAP consists of 1,481 acres in several distinct parcels scattered throughout the confines of the OHARNG RTLS. The RVAAP and RTLS are co-located on contiguous parcels of property and the RTLS perimeter fence encloses both installations. Since the Installation Restoration Program (IRP) encompasses past activities over the entire 21,419 acres of the former RVAAP, the site description of the RVAAP includes the combined RTLS and RVAAP properties. The RVAAP was previously operated as a government-owned, contractor-operated (GOCO) United States Army facility. Currently, the installation is jointly operated by the United States Army Base Realignment and Closure (BRAC) Office and the OHARNG.

The RVAAP is located within the confines of the RTLS which is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east northeast of the town of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the town of Newton Falls (Figure 2-1). The RVAAP portions of the installation are solely located within Portage County. The installation consists of a 17.7-kilometer (11-mile) long, 5.6-kilometer (3.5-mile)-wide tract bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garrett, McCormick and Berry roads on the west; State Route 534 to the east, and the Norfolk Southern Railroad on the north. The installation is surrounded by several communities: Windham on the north, Garrettsville 9.6 kilometers (6 miles) to the northwest, Newton Falls 1.6 kilometers (1 mile) to the east, Charlestown to the southwest, and Wayland 4.8 kilometers (3 miles) southeast.

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. The liquid, containing 2,4,6-TNT and Composition B, was known as "pink water" for its characteristic color. Pink water was collected in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, LL12 was used to produce ammonium nitrate for explosives and fertilizers prior to its use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In

addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include sites that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, waste oils, and sanitary waste. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

2.1.2 Demography and Land Use

RVAAP/RTLS consists of 8,668.3 hectares (21,419 acres) and is located in northeastern Ohio, approximately 37 kilometers (23 miles) east-northeast of Akron and 48.3 kilometers (30 miles) west-northwest of Youngstown. RVAAP/RTLS occupies east-central Portage County and southwestern Trumbull County. United States Census Bureau population estimates for 2001 indicate that the populations of Portage and Trumbull counties are 152,743 and 223,982, respectively. Population centers closest to RVAAP/RTLS are Ravenna, with a population of 12,100, and Newton Falls, with a population of 4,866.

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

RVAAP is in the process of regulatory environmental closure and is operated by the BRAC Office. The BRAC Office controls environmental AOCs at RVAAP. The National Guard Bureau (NGB) controls non-AOC areas and has licensed these areas to OHARNG for training purposes. Training and related activities at RTLS include field operations and bivouac training, convoy training, equipment maintenance, C-130 aircraft drop zone operations, helicopter operations, and storage of heavy equipment. As environmental AOCs are investigated and addressed or remediated, if needed, transfer of these AOCs from the BRAC Office to NGB is conducted.

Until May 1999, approximately 364 hectares (900 acres) of land and some existing facilities at RVAAP were used by the NGB for training purposes administered by OHARNG. In May 1999, NGB assumed operational control of 16,164 acres of RVAAP and licensed OHARNG to use the facility for training and other activities. In December 2001, operational control of an additional 1,528 hectares (3,774 acres) of RVAAP was transferred to NGB bringing the total to 8,039 hectares (19,938 acres).

OHARNG has prepared a comprehensive Environmental Assessment and an Integrated National Resources Management Plan to address future use of RTLS property (OHARNG 2001). The perimeter of RVAAP/RTLS is currently fenced and the perimeter is patrolled intermittently by the facility caretaker contractor. Access to RVAAP/RTLS is strictly controlled and any contractors, consultants, or visitors who wish to gain access to the facility must follow procedures established by RVAAP/RTLS and the facility caretaker contractor.

2.1.3 RVAAP/RTLS Physiographic Setting

RVAAP/RTLS is located within the Southern New York Section of the Appalachian Plateau physiographic province (USGS 1968). This province is characterized by elevated uplands underlain primarily by Mississippian- and Pennsylvanian-age bedrock units that are horizontal or gently dipping. The province is characterized by its rolling topography with incised streams having dendritic drainage patterns. The Southern New York Section has been modified by glaciation, which rounded ridges and filled major valleys and blanketed many areas with glacially derived unconsolidated deposits (i.e., sand, gravel, and finer-grained outwash deposits). As a result of glacial activity in this section, old stream drainage patterns were disrupted in many locales, and extensive wetland areas developed.

2.2 OPEN DEMOLITION AREA #2

2.2.1 Site History

ODA2 is situated in the central portion of the facility and is 25 acres in size (Figure 2-2). Since 1948, ODA2 was used to detonate large caliber munitions and off-specification bulk explosives that could not be demilitarized or deactivated through any other means due to their condition. Primer elements, bombs, and various caliber munitions have been treated by open detonation at ODA2. Materials destroyed by open detonation were placed in a pit excavated to a depth of at least 4 feet, then covered with 2 feet of soil, and detonated. Following detonation, the site was searched for scrap metal, shrapnel, or any unexploded ordnance; however, fragments and unexploded ordnance items were found several thousand feet from the detonation site. The fragment protection default distances range from 1,250 feet for non-fragmenting explosives to 4,000 feet for 5-inch caliber or larger munitions. In addition, past operations at this AOC have included the burial of munitions and ordnance components; including the disposition of white phosphorus on the south side of Sand Creek. Known potential contamination source areas include:

- Open Detonation Areas (including the RCRA permitted unit): Areas used for open detonation. Following detonation and the removal of metal pieces, the pits were backfilled, mulched, and seeded.

- Open Burning Area: From 1981-1986, this area within the RCRA unit was used to thermally destroy sludge from the Load Line 6 Evaporation Unit.

- 40-mm Prototype Testing Range: Projectiles were fired into targets in this area.

- Burial Sites 1 and 2: Burial Site 1 is located approximately 200 feet northeast of Building 1501 with an approximate size of 2 acres. Burial Site 2 is located approximately 100 feet north of Building 1503, with an approximate size of 1 acre. Possible munitions and explosives of concern may have been buried at both areas.

- Rocket Ridge: An area located along a 70-foot embankment northeast of Building 1503 overlooking Sand Creek. MEC may have been disposed of on the surface.

- Three explosive storage bunkers, Buildings 1501, 1502, and 1503 respectively.

Two of these source contamination areas are not within the scope of this FS: the RCRA permitted unit and "Rocket Ridge." The RCRA unit underwent MEC clearance to a depth of 4 feet (excavating and sifting) from 1999 to 2000. The RCRA unit within ODA2 is being evaluated separately and will be closed under RCRA at the appropriate time. "Rocket Ridge" MEC concerns will be addressed under the MMRP.

The extensive presence of MEC prevents most activity at ODA2, including most OHARNG training activities. ODA2 is classified as Restricted Access. The area is closed to all normal training and administrative activities. Surveying, sampling, and other essential security, safety, natural resources management, and other directed activities may be conducted at ODA2 only after authorized personnel have been properly briefed on potential hazards/sensitive areas. Individuals unfamiliar with the hazards/restrictions are escorted by authorized personnel at all times while in the restricted area (USACE 2004b). There are no immediate plans for active re-use of ODA2; however, occasional demolition of MEC will continue at the RCRA unit. Activity outside the RCRA unit would be limited to MEC technicians transporting material from storage to the RCRA unit for demolition.

2.2.2 Site and Surface Features

ODA2 is characterized by gently to steeply sloping topography (Photograph 2-1) on a weathered shale bedrock surface. Elevations vary from approximately 309 to 326 meters (1,017 to 1,071 feet) above mean seal level (amsl). The AOC is bisected by Sand Creek. Structures at ODA2 include three above-ground explosive storage bunkers and gravel access and paved roads (Figure 2-3). Site access is restricted by a locked gate to the south on the main access road.

Soils in the area are generally comprised of fine- to medium-grained sand layers containing some gravel interspersed within silty clay or clay layers. Surface soil is highly disturbed across much of the AOC down to a depth of 4 feet or more due to the detonation, disposal, and MEC clearance activities at the site. Vegetation at ODA2 includes scrublands and immature hardwoods in the areas used for detonation/disposal, and mature hardwood forest to the east, west, and south of the detonation/disposal areas. The RCRA unit is sparsely vegetated with native grasses. Wetland areas are found to the east and west of historically active parts of ODA2 along the Sand Creek drainage channel.

Photograph 2-1. Site Conditions at Open Demolition Area 2, September 2005

2.2.3 Site Investigations

Figure 2-4 shows the locations of soil, sediment, and surface water sample locations and groundwater monitoring wells for previous and current site investigations.

2.2.3.1 Previous Investigations

There have been three investigations focused exclusively on the RCRA unit within ODA2:

- Hazardous Waste Management Study No. 37-26-0442-84 (United States Army Environmental Hygience Agency [USAEHA] 1984);
- Geohydrologic Study No. 38-26-KF95-92 (USAEHA 1992); and
- RCRA Closure Field Investigation Report for the Deactivation furnace Area, Open Demolition Area, Building 1601, and Pesticides Building, RVAAP, Ravenna, Ohio (USACE 1998b).

These included sampling of surface and subsurface soil, surface water, groundwater, sediment, surface runoff, and aquatic organisms. Common contaminants found were explosives and metals. The RCRA unit underwent a MEC removal. The soil was excavated to a depth of four feet, screened for MEC,

shrapnel, and scrap metal, placed back onsite once those items were removed, and then graded and seeded.

Four studies have focused on ODA2 in general:

- Preliminary Assessment for RVAAP (USACE 1996);
- Phase I RI of High Priority Areas of Concern at the RVAAP (USACE 1998a);
- Report of Analytical Results Demolition Area #2 CERCLA Sites (USIOC 2000); and
- Phase II RI Report for the ODA2 (AOC-4) at the RVAAP, Ravenna, Ohio (USACE 2005e).

These included sampling of surface (0-1 ft below ground surface [bgs]) and subsurface (1-3 ft bgs) soil, sediment, surface water, and groundwater. Samples were contaminated with metals and explosives, and water samples were also contaminated with volatile organic compound (VOCs) and semi-volatile organic compounds (SVOCs). The Phase II investigation determined which compounds were chemicals of concern (COCs), contaminant migration chemicals of concern (CMCOCs), and chemicals of potential ecological concern (COPECs).

2.2.3.2 Supplemental Phase II RI Activities at ODA2

Implementation of supplemental Phase II RI sampling activities was completed in November 2005. This FS presents and incorporates these results into the assessment of ODA2. The primary objective of the Supplemental Phase II RI of ODA2 was to conduct surface and subsurface soil sampling to define nature and extent of contamination at ODA2 and finalize the RI. A summary of the results as well as an assessment of the impact on the completed HHRA and ecological risk assessment (ERA) is included in Section 3 and Appendix 2A.

2.2.4 Nature and Extent

Nature and extent of contamination at ODA2 was determined based on the evaluation of the Phase II RI and Supplemental Phase II RI data. Figure 2-4 shows the sampling locations, proposed sample locations and groundwater monitoring wells.

2.2.4.1 Surface Soils

Based on the Phase I/Phase II evaluation of the occurrence and distribution of contaminants in surface soil (0-1 ft bgs), site-related contaminants (SRCs), are generally found in two areas of the AOC: the floodplain north and south of Sand Creek. Explosives and propellants are found at 11 sampling locations south of Sand Creek, mostly in the floodplain adjacent to Sand Creek. The limits of explosives and propellant occurrences have been delineated in the floodplain south of Sand Creek. Adequate amounts of samples with non-detections of explosive and propellant occurrences encompass the AOC. Explosives and propellants are found at 10 sampling locations north of Sand Creek, mostly to the north and west. Supplemental Phase II sampling was performed in this area to further delineate the nature and extent of

explosive and propellant occurrences to the north of Sand Creek. The occurrences to the north of Sand Creek are surrounded by a few samples that did not have detections of explosives and propellants.

Inorganics exceeding background concentrations are found at surface soil (0-1 ft bgs) sample locations throughout the AOC. The area north of Sand Creek has eight surface soil sampling locations that have eight or more SRCs above background. These sample locations are generally centrally located in the AOC north of Sand Creek. The area south of Sand Creek had three surface soil sampling locations that had eight or more SRCs above background. These locations south of Sand Creek are in the floodplain adjacent to Sand Creek.

The areas exhibiting the greatest number of detections and concentrations of explosives and inorganics have been identified and delineated during the Supplemental Phase II RI. These results are presented in Appendix 2A.

SVOCs, VOCs, pesticides, and polychlorinated biphenyls (PCBs) are either not detected in surface soil (0-1 ft bgs), or detections are limited to low concentrations in a limited number of sample locations.

2.2.4.2 Subsurface Soil

Subsurface soil samples were collected from 1-3 ft bgs. Samples were also collected at the monitoring wells at 2-4 ft bgs. Explosives and propellants are present in subsurface soil (1-3 ft bgs) at eight sampling locations north of Sand Creek. South of Sand Creek, explosives and propellants were detected at eleven locations. 2,4,6-TNT and tetryl was detected in subsurface soil at six sampling locations south of Sand Creek. All subsurface samples had at least one SRC inorganic detected above background.

Toluene, tetrachloethylene, and 2-butanone were detected in one of seven subsurface soil samples analyzed for VOCs at ODA2. SVOCs di-n-butyl phthalate, (four detects in seven samples), bis(2-ethyhexyl) phthalate (five detects in seven samples), and n-nitrosodiphenylamine (one detect in seven samples) were also detected. Pesticides and PCBs were not detected in subsurface soil samples.

2.2.4.3 Sediment

Fourteen inorganic SRCs occur in sediment above background. SRCs in sediment above background that have migrated to the furthest downstream location east of the AOC (station DA2-103) include beryllium and cadmium.

2.2.4.4 Surface Water

Surface water sampling at ODA2 resulted in no detections of explosives. Carbon disulfide, sulfide, nitrate/nitrite, chloroform, nickel, and chromium have all been detected at concentrations above background in at least one surface water sample during at least one sampling event. Nitrocellulose and bis(2-ethylhexyl)phthalate were also detected in at least one sample during at least one sampling event. Carbon disulfide and nitrate/nitrite were detected most consistently out of all the constituents.

2.2.4.5 Groundwater

Groundwater in all monitoring wells contained site-related metals with the exception of DA2-110, DA2-112, and DA2-DET4. DA2-104 located in the northern portion of the AOC generally had the highest number of inorganic SRCs. Only monitoring wells WBG-012 and WBG-013, upgradient of ODA2, contain explosives and/or propellants. Di-n-butyl-phthalate was detected at two wells (DA2-110 and DA2-113). Carbon disulfide was detected at five wells (DA2-107, DA2-108, DET1, DET4, and WBG-012). No pesticides or PCBs were detected in any of the wells sampled.

2.2.5 Fate and Transport Analysis

Contaminant fate and transport modeling performed as part of the Phase II RI included leachate modeling (Seasonal Soil Compartment model [SESOIL]) and groundwater modeling (Analytical Transient 1-,2-3-Dimensional [AT123D]) of the two source areas (Area A north of Sand Creek and Area B floodplain area south of Sand Creek). Fate and transport modeling indicates inorganics and explosives may leach from impacted soil to groundwater beneath the source areas. Migration of many of the constituents, however, has been attenuated because of moderate to high retardation factors. Summary results for these models are as follows.

2.2.5.1 SESOIL Modeling

SESOIL modeling results indicate that beneath the source areas, the following contaminant migration chemicals of potential concern (CMCOPCs) are predicted to leach to groundwater with concentrations exceeding groundwater risk-based concentrations (RBCs)/ maximum contaminant levels (MCLs) beneath sampling points: Area A (arsenic, barium, chromium, hexavalent chromium, and copper); Area B (hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX], tetryl, antimony, chromium, hexavalent chromium, copper, and selenium). In addition arsenic, hexavalent chromium, and manganese were observed in groundwater at the site at concentrations exceeding their respective RBCs/MCLs. These compounds were combined with the compounds identified in the SESOIL modeling as CMCOPCs as final CMCOPCs to be modeled for lateral migration using AT123D.

2.2.5.2 AT123D Modeling

Based on AT123D modeling, all compounds except manganese that were identified as CMCOPCS in the SESOIL modeling were identified as contaminant migration chemicals of concern (CMCOCs). However, a refined assessment of contaminant fate and transport demonstrated that, based on modeled timeframes to attain peak leaching concentrations and on actual observed groundwater concentrations, none of the constituents identified as CMCOCs are predicted to reach downgradient receptor locations. Either the predicted peak leaching concentration has already occurred (e.g., 3 years for RDX) or actual groundwater concentrations are less than modeling results, which indicates a higher degree of attenuation than that accounted for by the conservative numerical model. A full discussion of contaminant fate and transport is presented in Section 3.5 and Appendix 3A.

2.2.6 Human Health Risk Assessment

The Human Health Risk Assessment (HHRA) was conducted to evaluate risks and hazards associated with contaminated media at the RVAAP ODA2 AOC for one potential receptor (Security Guard/Maintenance Worker) exposed to one medium (surface soil, from a depth interval of 0 to 1 ft bgs). The extensive presence of MEC prevents most activity at ODA2, including most OHARNG training activities and is anticipated to preclude unrestricted land use therefore unrestricted land use receptors were not evaluated in the RI or in this FS. The surface soil data at ODA2 data was evaluated as a single exposure unit (EU). Data from the RCRA unit was not included in this HHRA.

One metal (arsenic) was identified as a COC in surface soil (0-1 ft bgs) for the Security Guard/Maintenance Worker at ODA2.

A summary of the HHRA results is provided in Table 2-1.

Table 2-1. Summary of HHRA Risk Results for the Security Guard/Maintenance Worker Scenario Exposed to Surface Soil (0-1 ft bgs) at Open Demolition Area 2

Total HI	Total ILCR	COCs	Notes
0.051	5.3E-06	Arsenic	HI < 1. ILCR exceeds USEPA *deminimis* risk but below Ohio EPA target risk value.

COC = Chemical of concern.
HI = Hazard index.
ILCR = Incremental lifetime cancer risk.
HHRA = Human Health Risk Assessment
USEPA = United States Environmental Protection Agency
Ohio EPA = Ohio Environmental Protection Agency

Supplemental soil samples were collected from surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soil at ODA2 to complete the analysis of nature and extent of contamination. These supplemental data are presented in Appendix 2A and summarized in Section 2.3 of this FS. Evaluation of the supplemental soil data shows that these new data do not change the conclusions of the HHRA at ODA2 for shallow (0-1 ft bgs) surface soil. Note, shallow surface soil is the only exposure media evaluated in the HHRA at ODA2.

2.2.7 Ecological Risk Assessment

ODA2 contains sufficient terrestrial and aquatic (surface water and sediment) habitat to support various classes of ecological receptors. For example, terrestrial habitats at ODA2 include old fields, woodlots, and grassy areas. Various classes of receptors, such as vegetation, small and large mammals, and birds, have been observed at the site. The presence of suitable habitat and observed receptors at the site along with presence of chemically contaminated media warranted a Screening Ecological Risk Assessment (SERA). Thus, Ohio EPA protocol (Level I) was met and Level II was needed. The RVAAP Facility Wide Ecological Risk Work Plan was used to guide the work.

A Level II SERA was conducted at ODA2. The SERA process provides a very conservative evaluation of the potential for risk to ecological receptors by comparing the maximum detected concentrations (MDC) of chemicals in soil, sediment, and surface water to conservative medium-specific ecological

screening values (ESVs). Chemicals with no ESV are also retained. As part of this screen, all chemicals classified as persistant, bioaccumulative, and toxic (PBT) are retained regardless of their concentration or frequency of detection. Inorganic PBT compounds include cadmium, lead, mercury, and zinc. Organic PBT chemicals include any compound whose log K_{ow} is at least 3.0. Chemicals retained by the SERA process are considered COPECs. For the Level II Screen, specific receptors are not identified because the ESVs are conservative screening toxicity benchmarks that are intended to protect multiple receptors.

The SERA (Level II Screen) identified multiple COPECs in surface soil (0-1 ft bgs) and subsurface soil (1-3 ft bgs) from the ODA2 (USACE 2005e). For the Level II Screen, Ohio EPA does not require that hazard quotients (HQs) be calculated when comparing the maximum detect concentrations against the ESVs, so HQs were not calculated for the ODA2. Soil COPECs have the potential to pose a hazard to plants and animals.

For surface soil (0-1 ft bgs), 26 total COPECs were identified. Twelve COPECs (all inorganics) were based solely on their maximum detect exceeding the ESV (Table 2-2). Some of the inorganics included aluminum, arsenic, chromium, copper, iron, selenium, and vanadium. In addition, 4 COPECs were based solely on being PBT compounds, which included a pesticide (4,4′-DDD) and three SVOCs [bis(2-ethylhexyl)phthalate, di-n-butylphthalate, and N-nitrosodiphenylamine]. Furthermore, 4 inorganics (cadmium, lead, mercury, and zinc) were COPECs based on two criteria, including having a maximum detect concentration exceeding the ESV and being PBT compounds. Six chemicals were COPECs based on having no ESV, including 5 inorganics and one explosive (tetryl). Thus, 20 total surface soil COPECs were identified based on either having a maximum detected concentration exceeding the ESV and/or being PBT compounds (12 + 4 + 4), indicating that surface soil chemicals pose a potential for adverse effects to ecological receptors at the ODA2.

Supplemental soil samples were collected from surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soil at ODA2 to complete the analysis of nature and extent of contamination. These supplemental data are presented in Appendix 2A and summarized in Section 2.3 of this FS. Evaluation of the supplemental soil data shows that these new data do not change the conclusions of the SERA at ODA2 for surface (0-1 ft bgs) or subsurface (1-3 ft bgs) soil.

Table 2-2. Surface (0-1 ft bgs) and Subsurface Soil (1-3 ft bgs) COPECs at ODA2 SERA (Level II)

COPEC	Surface Soil (0-1 ft)	Subsurface Soil (1-3 ft)
COPECs with MDC greater than ESV		
Aluminum	X	—
Arsenic	X	X
Barium	—	X
Chromium	X	—
Chromium, hexavalent	X	X
Cobalt	X	—
Copper	X	X
Iron	X	X
Manganese	X	—
Nickel	X	—

Table 2-2. Surface (0-1 ft bgs) and Subsurface Soil (1-3 ft bgs) COPECs at ODA2 SERA (Level II) (continued)

COPEC	Surface Soil (0-1 ft)	Subsurface Soil (1-3 ft)
Selenium	X	X
Sulfide	X	X
Vanadium	X	—
COPECs with MDC greater than ESV and are PBTs		
Cadmium	X	X
Lead	X	X
Mercury	X	X
Zinc	X	X
COPECs with MDC less than ESV but are retained as PBTs		
4,4'-DDD	X	—
Bis(2-ethylhexyl)phthalate	X	X
Di-n-butylphthalate	X	X
N-Nitrosodiphenylamine	X	—
COPECs having no ESVs		
Calcium	X	—
Magnesium	X	X
Nitrate/Nitrite	X	X
Potassium	X	—
Sodium	X	—
2-Amino-4,6-dinitrotoluene	—	X
4-Amino-2,6-dinitrotoluene	—	X
Tetryl	X	X

bgs = below ground surface
COPECs = contaminants of potential ecological concern
ESV = ecological screening value
PBT = persistent, bioaccumulative, and toxic compound (inorganics - cadmium, lead, mercury, and zinc; organics having Log K_{ow} of at least 3.0)
"X" = chemical is a COPEC due to criterion in this column
"—" = chemical was not a COPEC at this soil depth

For subsurface soil (1-3 ft bgs), there were fewer total COPECs (18) and fewer COPECs in all categories compared to surface soil (0-1 ft bgs) (Table 2-2). Similar to surface soil, COPECs based solely on the maximum detected concentration exceeding the ESV were the most prevalent type [7 (all inorganics)]. The metals included arsenic, barium, hexavalent chromium, copper, iron, selenium, and sulfide. In addition, there were only 2 COPECs based solely on being a PBT compound, including bis(2-ethylhexyl)phthalate and Di-n-butylphthalate. Four inorganics (cadmium, lead, mercury, and zinc) were COPECs based on two criteria: having a maximum detected concentration exceeding the ESV and being a PBT compound. Five chemicals were COPECs due to not having an ESV, including two inorganics (magnesium and nitrate/nitrite) and three explosives (2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, and tetryl). Thus, 13 total subsurface COPECs were identified based on either having a maximum detected concentration exceeding the ESV and/or they were PBT compounds (7 + 2 + 4), indicating that subsurface soil chemicals pose a potential for adverse effects to ecological receptors at ODA2.

In summary, both the surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soil had multiple COPECs that exceed the ESV and/or are PBT compounds. The surface soil had more COPECs based on maximum detects exceeding ESV and based on being PBT compounds than did the subsurface soil (20 versus 13). Inorganics comprised the majority of COPECs at both soil depths. Although some of the COPECs likely overestimate the risk to ecological receptors due to low bioavailability of the chemicals for biological uptake from soil (e.g., aluminum) or low confidence in the ESVs (e.g., iron for plants), the presence of multiple COPECs indicates the potential for adverse effects to ecological receptors from these chemicals in the ODA2 surface and subsurface soil.

The SERA (Level II screen) also identified a few COPECs in sediment and surface water for the ODA2 location (USACE 2005e). Sand Creek flows through the middle of the AOC and the stream was divided into two exposure segments: downstream and upstream of the AOC. These segments corresponded to sampling areas for the facility-wide biology and surface water study that was performed after the chemical sampling for the RI study.

The following 11 COPECs including 8 inorganics and 3 SVOCs were identified in sediment in the upstream stretch:

Barium	Mercury	Bis(2-ethylhexyl)phthalate
Cadmium	Nitrate/Nitrite	Di-n-butylphthalate
Copper	Sulfide	Fluoranthene
Lead	Zinc	

The following 9 COPECs including 7 inorganics, 1 pesticide and 1 VOC were identified in sediment in the downstream stretch:

Cadmium	Nitrate/Nitrite	Dieldrin
Copper	Sulfide	Chloromethane
Lead	Zinc	
Mercury		

The sediment COPECs for upstream and downstream overlap a great deal for the inorganics, but few organics differ between upstream and downstream. Of the 11 retained COPECs for upstream, three had maximum detects (cadmium, copper, and zinc), three had no ESVs (barium, nitrate/nitrite, and sulfide), and five were solely based on being PBT compounds (lead, mercury, and three organics). Two retained (cadmium and zinc) had maximum detects that exceeded the ESV and were also PBT compounds. For downstream conditions, the nine COPECs show four that exceeded the ESV (four inorganics), three had no ESVs (nitrate/nitrite, sulfide, and chloromethane) while two were solely PBT compounds (lead and dieldrin). Three COPECs (cadmium, mercury, and zinc) exceeded the ESVs and were also PBT compounds.

The following 4 COPECs including 3 inorganics and 1 explosive were identified in surface water at the upstream stretch:

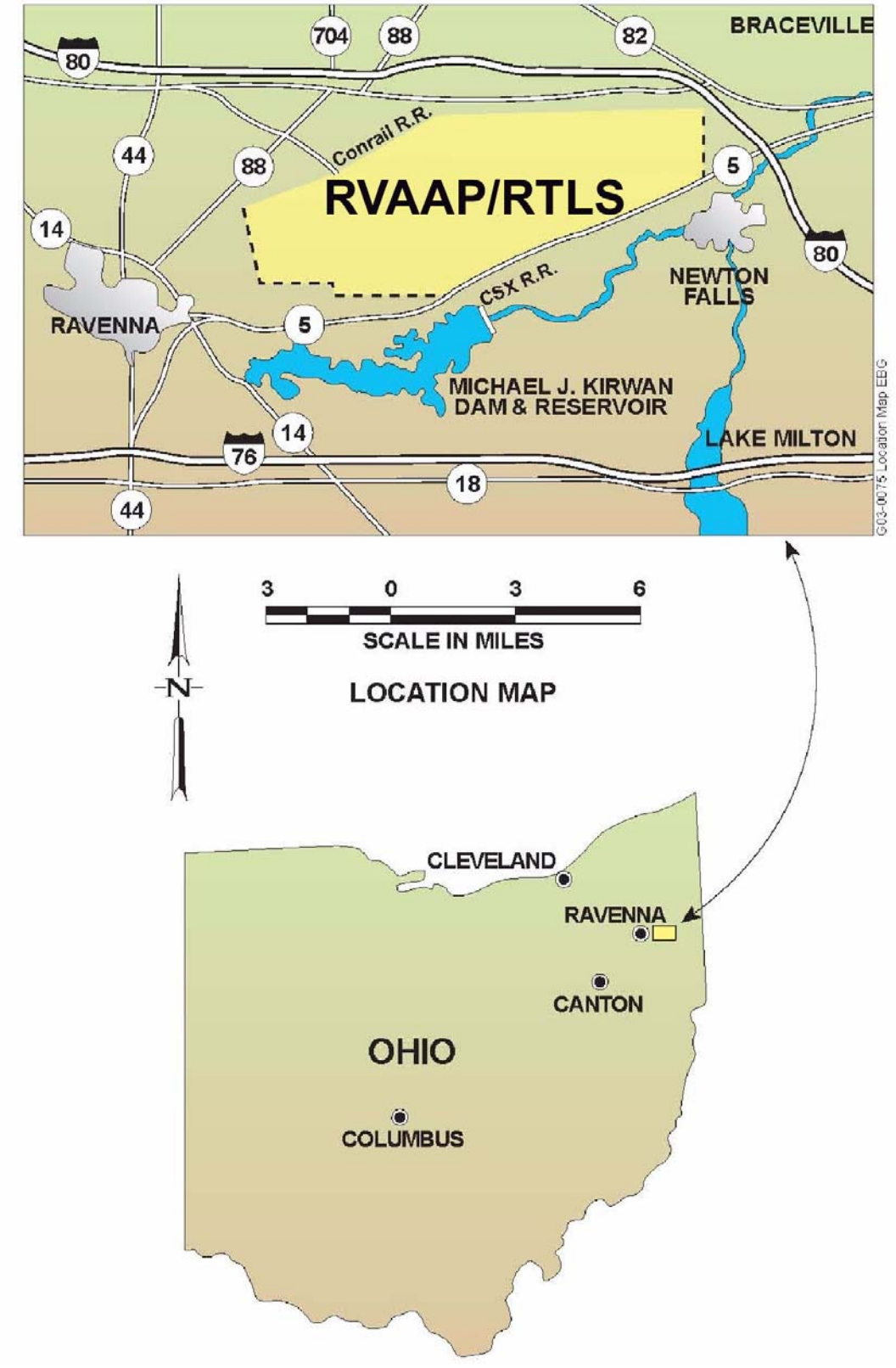
Calcium	Nitrocellulose
Magnesium	
Nitrate/Nitrite	

The following 7 COPECs including 5 inorganics, 1 explosive and 1 SVOC were identified in surface water at the downstream stretch:

Calcium	Nitrocellulose
Magnesium	Bis(2-ethylhexyl)phthalate
Nitrate/Nitrite	
Sulfide	
Zinc	

There is a great deal of overlap of COPECs between the upstream and downstream stretches. This shows that little is being introduced by ODA2. For upstream conditions, all four of the retained COPECs had no Ohio Administrative Code (OAC) water quality criteria (WQC) (calcium, magnesium, nitrate/nitrite, and nitrocellulose). None of the retained COPECs for Sand Creek had a maximum detect exceeding the OAC WQC, nor were they PBT compounds. For downstream conditions, the seven retained COPECs showed that five had no OAC WQC (calcium, magnesium, nitrate/nitrite, sulfide, and nitrocellulose) and two were COPECs solely due to being PBT compounds (zinc and bis(2-ethylhexyl)phthalate). None of the retained COPECs for downstream conditions in surface water had a maximum detect exceeding the OAC WQC.

In summary, there are more COPECs for the sediment than for the surface water. And these relatively few COPECs are similar for upstream and downstream conditions for both sediment and surface water. Some exceedances of COPECs likely overestimate the implied risk because of low bioavailability (metals), antagonisms (organics), and other factors. This is corroborated by the facility-wide biology and surface water study that shows upstream and downstream conditions are healthy and functioning and that use attainment is being met according to the Ohio EPA.



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2 **Figure 2-1. General Location and Orientation of RVAAP/RTLS**

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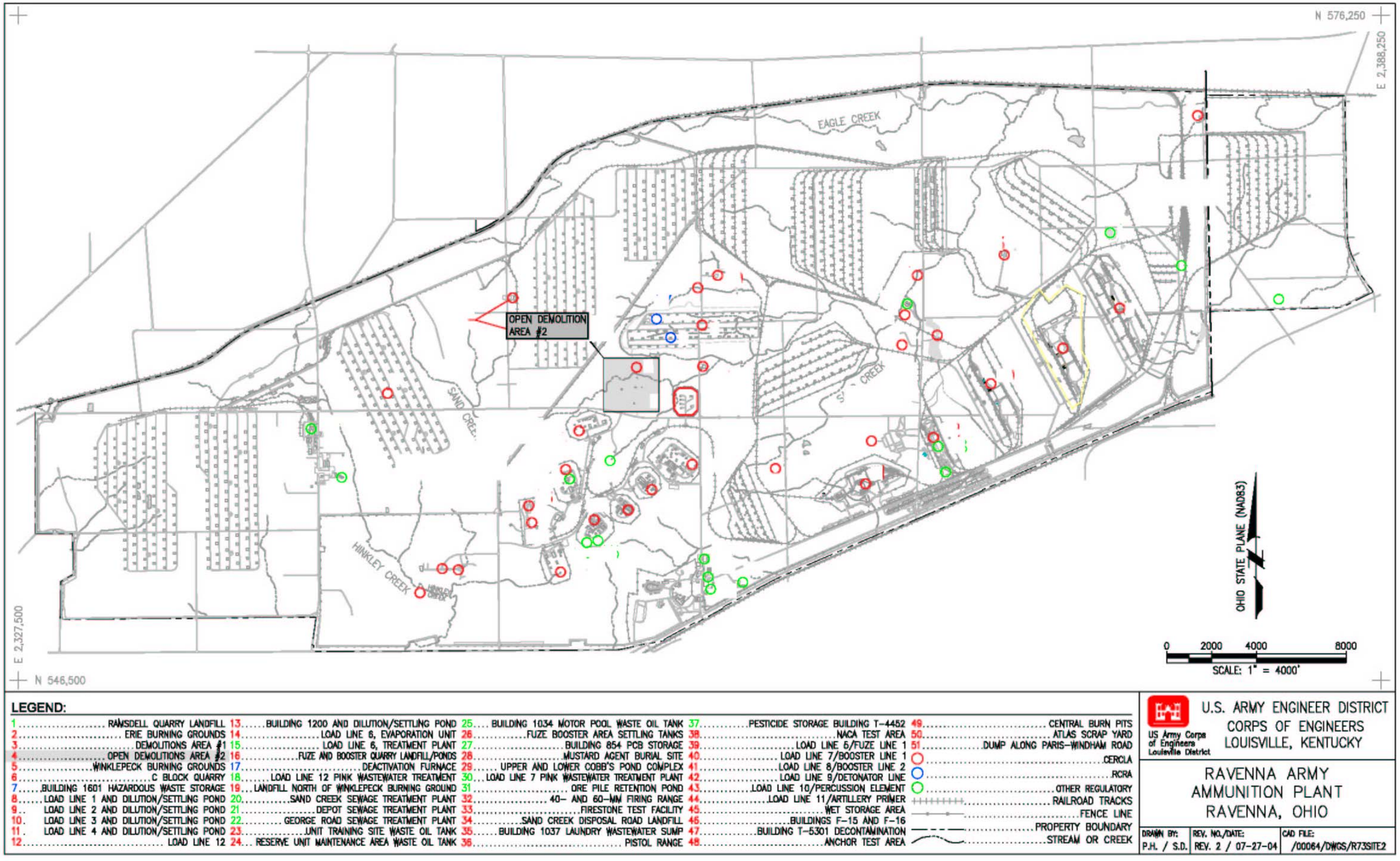

Figure 2-2. RVAAP/RTLS Installation Map

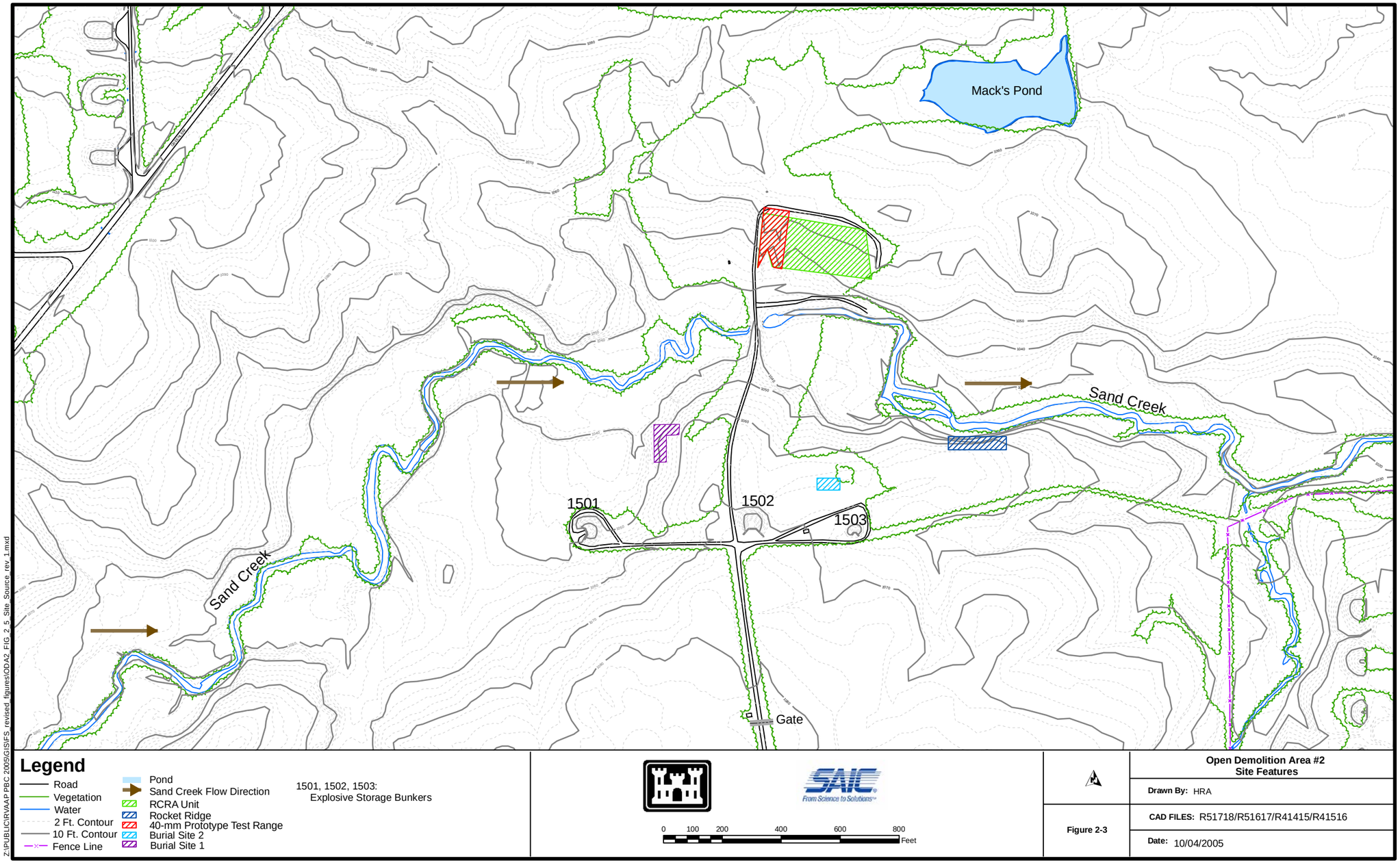

Figure 2-3. Site Features of ODA2

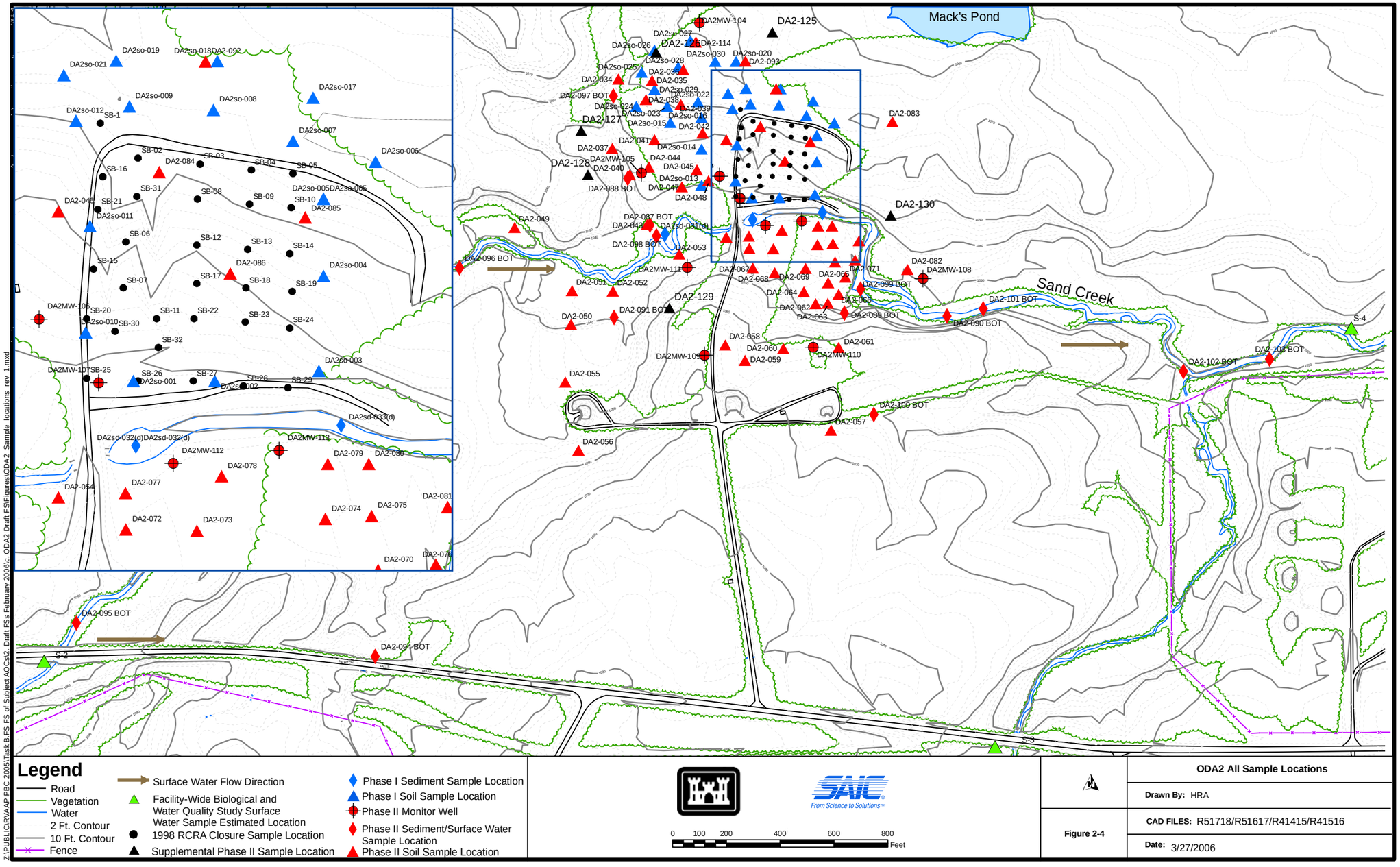

Figure 2-4. Sample Locations and Monitoring Well Locations

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3.0 REMEDIAL ACTION OBJECTIVES

This section of the FS describes the RAOs for ODA2. RAOs specify the requirements that remedial alternatives must fulfill in order to protect human health. The primary objectives of this section are:

1. To present the RAOs for ODA2;

2. To identify media-specific preliminary cleanup goals to meet these RAOs;

3. To identify areas of soil, sediment, surface water, and groundwater where remediation may be needed to meet the RAOs; and

4. To identify the extent of contamination to be used in volume calculations for evaluating removal/treatment alternatives.

The discussion in this section is organized as follows:

- RAOs are presented in Section 3.1.

- Anticipated future land use is discussed in Section 3.2.

- Human health preliminary cleanup goals and the identification of COCs requiring further evaluation for remedial alternatives to meet these RAOs are presented in Section 3.3.

- Ecological weight-of-evidence for meeting RAOs are presented in Section 3.4.

- An assessment of the potential for impacted soils to affect groundwater at the AOC and at an exposure point downgradient of the AOC is summarized in Section 3.5.

- A summary of the COCs and corresponding preliminary cleanup goals established for each AOC/medium from the information presented in Sections 3.1 through 3.4 is presented in Section 3.6.

3.1 REMEDIAL ACTION OBJECTIVES

RAOs specify the requirements remedial alternatives must fulfill to protect human health and the environment from SRCs at ODA2. In order to provide this protection, media-specific objectives that identify major contaminants and associated media-specific cleanup goals are developed. These objectives specify COCs, exposure routes and receptors, and acceptable constituent concentrations for long-term protection of receptors. The baseline HHRA conducted for ODA2 is summarized in Section 2 of this FS and detailed in Sections 6 and 7 of the Phase II RI Report for the ODA2 (USACE 2005e).

As discussed in Section 2, the HHRA includes baseline risk calculations for receptors for restricted land use scenarios. Table 3-1 lists the representative receptor for the restricted land use scenario at ODA2. The extensive presence of MEC prevents most activity at ODA2, including most OHARNG training activities and is anticipated to preclude unrestricted land use therefore unrestricted land use receptors were not evaluated in the RI or in this FS.

Table 3-1. Land Use Scenarios Assessed in the ODA2 FS

AOC	Land Use Scenario	Receptor
ODA2	Restricted	Security Guard/Maintenance Worker
	Unrestricted	Not Evaluated

The representative receptor corresponds to restricted (Security Guard/Maintenance Worker) National Guard land use. Cleanup goals are based on the evaluation of the restricted land use scenario. More information can be found in Section 3.3 regarding representative receptors, risk calculations, and preliminary cleanup goals.

The ERA performed for ODA2 identifies a variety of ecological receptor populations that could be at risk and identify the chemicals of potential ecological concern (COPECs) and chemicals of ecological concern (COECs) that could contribute to potential risks from exposure to contaminated media. Ohio EPA guidance (Ohio EPA 2003) allows a decision about remediation to be made at the completion of each level of risk assessment. A decision whether it is necessary to remediate because of potential harm to ecological receptors at ODA2 is not included in the RI Report. Section 3.4 provides weight-of-evidence input for that decision.

The necessary CERCLA remediation requirements with respect to soils and dry sediment will be performed to achieve interim remedy at ODA2. Closure with respect to groundwater, surface water, and subaqueous sediments are not included in the scope of this PBC, therefore, this remedy will be considered interim. However, interim remedy with respect to soils also must be protective of groundwater. The following RAOs are developed accordingly for impacted soil at ODA2:

- Restore impacted soils and dry sediments at ODA2 to a condition consistent with likely land use by the representative group (i.e., representative OHARNG land use receptors) by achieving cleanup goals for COCs in impacted soil and dry sediment. Preliminary cleanup goals will be used as target concentrations (e.g., 95% upper confidence limit [UCL_{95}] of the mean of site data should be $\leq$ the preliminary cleanup goal) of COCs that may remain at ODA2.

- Remedy of impacted soil and dry sediments to be protective of other environmental media (groundwater, surface water, and sediment) consistent with likely land use by the representative group (i.e., representative OHARNG land use receptors) for COCs.

- Minimize transport of soil COCs to other environmental media (groundwater, surface water, sediment, and air) during implementation of the remedial action.

- Prevent releases and other impacts that could adversely affect ecological receptors during implementation of the remedial alternative(s).

3.2 ANTICIPATED FUTURE LAND USE

OHARNG has prepared a comprehensive Environmental Assessment and an Integrated National Resources Management Plan to address future use of RTLS property (OHARNG 2001). OHARNG has established future land use for ODA2 as Restricted Access, No Digging based on anticipated training mission and utilization of the RTLS (USACE 2004b). Future land use is discussed in more detail in Section 3.3.

The perimeter of RVAAP/RTLS is currently fenced and the fence is patrolled intermittently. Access to RVAAP/RTLS is strictly controlled and any contractors, consultants, or visitors who wish to gain access to the facility must follow procedures established by RVAAP/RTLS and the facility caretaker contractor. However, the future maintenance of the RVAAP perimeter fence has not yet been determined by the Army or OHARNG.

3.3 IDENTIFICATION OF HUMAN HEALTH PRELIMINARY CLEANUP GOALS FOR ODA2

This section documents the proposed land use and corresponding preliminary cleanup goals to support the remedial alternative selection process for soil remediation at ODA2. preliminary cleanup goals are the chemical-specific numeric cleanup goals used to meet the remedial action objective for protection of human health.

The HHRA performed for ODA2 is detailed in the RI Report and summarized in Section 2 of this FS. The risk assessments included in the RI Report documents potential human receptor populations (e.g., Security Guard/Maintenance Worker) that could be at risk, and identifies the COCs that could contribute to potential risks from exposure to contaminated media at ODA2. The HHRA also documents the calculation of risk-based remedial goal options (RGOs) for human receptors for all media, all COCs, and all receptor populations evaluated in the RI Report. These risk-based RGOs are referred to as risk-based cleanup goals in this FS.

Chemical-specific preliminary cleanup goals are established for restricted land use from risk-based cleanup goals, background concentrations, and other information in this section. ODA2 is not currently a candidate for unrestricted release due to the presence of MEC and the RCRA unit and will be transferred to OHARNG.

The risk-based cleanup goals were calculated using the methodology presented in the Risk Assessment Guidance for Superfund, Part B (USEPA 1989), while incorporating site-specific exposure parameters applicable to the five potential receptors outlined in the Facility Wide Human Health Risk Assessor Manual (FWHHRAM). The process for calculating risk-based cleanup goals was a rearrangement of the cancer risk or non-cancer hazard equations, with the goal of obtaining the concentration that will produce a specific risk or hazard level. Equations, exposure parameters, and toxicity values (cancer slope factors

and non-cancer reference doses) are provided in the HHRA and were taken from the FWHHRAM (USACE 2004b).

The FWHHRAM (USACE 2004b) identifies 1E-05 as a target for cumulative incremental lifetime cancer risk (ILCR) (target risk [TR]) for carcinogens and an acceptable target hazard index (THI) of 1 for non-carcinogens consistent with Ohio EPA guidance (Ohio EPA, 2004b), with the caveat that exposure to multiple COCs might require downward adjustment of these targets for chemical-specific risks. The chemical-specific TR and THI are dependent on several factors, including the number of carcinogenic and non-carcinogenic COCs and the target organs and toxic endpoints of these COCs. For example, if numerous (i.e., more than 10) non-carcinogenic COCs with similar toxic endpoints are present, it might be appropriate to select chemical-specific preliminary cleanup goals with a THI of 0.1 to account for exposure to multiple contaminants. AOC-specific TR and THI levels are established in Section 3.3.3.

The risk-based cleanup goals assumed combined exposure through ingestion, inhalation of vapors and fugitive dust, and dermal contact with contaminated media. For chemicals having both a cancer and non-cancer endpoint, risk-based cleanup goals were calculated for both cancer risk and non-cancer hazard at the appropriate TR and THI. The preliminary cleanup goal is selected as the lower of the risk-based cleanup goal for cancer risk and non-cancer hazard, unless the risk-based cleanup goal is below background concentration. If the applicable risk-based cleanup goal concentration is less than background, the background concentration is selected as the preliminary cleanup goal.

The list of human health COCs for evaluation of remedial alternatives are identified for ODA2 based on risk management considerations including:

- Comparison of exposure point concentration (EPC) to preliminary cleanup goal concentrations (including background concentrations);
- Comparison of EPC to upgradient concentrations for sediment, surface water, and groundwater;
- Consideration of soil as the primary source of contamination (i.e., if soil concentrations are below background at an AOC, that AOC is not contributing to contamination in other media); and
- Other site-specific and receptor-specific considerations.

The remainder of this section provides the following detailed information:

- Land use and potential receptors at ODA2 (Section 3.3.1);
- A summary of COCs identified in the HHRA (Section 3.3.2);
- Identification of the appropriate TR level and THI for establishing preliminary cleanup goals based on the number and type of COCs identified in the HHRA (Section 3.3.3);

- Chemical-specific preliminary cleanup goals (Section 3.3.4); and

- Risk management considerations and the identification of COCs to be carried through the evaluation of remedial alternatives (Section 3.3.5).

3.3.1 Land Use and Potential Receptors at ODA2

The extensive presence of MEC prevents most activity at ODA2, including most OHARNG training activities. MEC concerns related to ODA2 will be addressed under the MMRP currently evolving. While the future MMRP has yet to determine basic parameters for this AOC, the vast amount of already unearthed and suspected large amounts of buried MEC, including burial of white phosphorous, will in all probability dictate that this AOC will never be utilized for anything but ordnance disposal related activities, and almost certainly would never be released to the public.

ODA2 is classified as Restricted Access-Authorized Personnel Only. The area is closed to all normal training and administrative activities. Surveying, sampling, and other essential security, safety, natural resources management, and other directed activities may be conducted at ODA2 only after authorized personnel have been properly briefed on potential hazards/sensitive areas. Individuals unfamiliar with the hazards/restrictions are escorted by authorized personnel at all times while in the restricted area (USACE 2005e).

There are no immediate plans for active re-use of ODA2; however, occasional demolition of MEC will continue at the RCRA unit. In the near term, limited material obtained during previous MEC removal activities may occasionally be detonated at the RCRA unit. This type of MEC demolition may occur approximately 1 week/year. Activity outside the RCRA unit would be limited to MEC technicians transporting material from storage to the RCRA unit for demolition.

Given the restricted access to ODA2, the most likely receptors will be individuals entering the area on an occasional basis to evaluate wildlife to meet the needs of natural resources management, or check the status of the area for security or safety reasons and MEC technicians transporting material from storage to the RCRA unit. Based on this information the Security Guard/Maintenance Worker scenario outlined in the FWHHRAM (USACE 2004b) is protective of potential receptors at ODA2. This scenario assumes a Security Guard/Maintenance Worker patrols ODA2 every day for one hour. Security patrols occur daily across the installation but not within ODA2 and patrolmen usually remain within their vehicles during these patrols. Although the security guard is not currently exposed to contaminated media at ODA2 on a daily basis, the potential exposure of this receptor is considered protective of receptors with more irregular exposure (e.g., a wildlife ecologist who spends a several days at the site once every few years, security personnel who may periodically evaluate the site, or MEC technicians who may periodically transport materials to the RCRA unit). Therefore, as a worst-case assumption, it is assumed that a security guard visits ODA2 and leaves his or her vehicle on a daily basis.

The Security Guard/ Maintenance Worker is the only receptor evaluated at ODA2 and is assumed to be exposed to surface soil (0-1 ft bgs) only. Because of MEC issues, there will be no intrusive activities;

therefore, subsurface soil (1-3 ft bgs) is not evaluated. This receptor is not involved in recreational or training activities that would result in exposure to surface water or sediment. Exposures to contaminants in surface soil at Demolition Area 2 are evaluated for soil ingestion, dermal contact with soil, and inhalation of soil particles and VOCs.

3.3.2 Chemicals of Concern

COCs are defined as chemicals with an incremental lifetime cancer risk greater than 1E-06 and/or HI greater than 1 for a given receptor. COCs were identified in the HHRA for each exposure medium and receptor evaluated. Only one COC (arsenic) was identified for surface soil (0-1 ft bgs) for the Security Guard/Maintenance Worker.

3.3.3 Target Risk for preliminary cleanup goals

A TR of 1E-05 and THI of 1.0 are identified as appropriate for the establishing preliminary cleanup goals for soil at ODA2 because only one COC is present.

3.3.4 Preliminary Cleanup Goals

Risk-based cleanup goals calculated in the HHRA for COCs in soil, background concentrations for inorganics, and preliminary cleanup goals are presented for the Security Guard/Maintenance Worker in Table 3-2. For chemicals having both a cancer and non-cancer endpoint, risk-based cleanup goals were calculated for both cancer risk and non-cancer hazard. The preliminary cleanup goal is selected as the lower of the risk-based cleanup goal for cancer risk and non-cancer hazard unless the risk-based cleanup goal is below background concentration. If the applicable risk-based cleanup goal concentration is less than background, the background concentration is selected as the preliminary cleanup goal.

Table 3-2. Soil Preliminary Cleanup Goals for Security Guard/Maintenance Worker Scenario at ODA2[a]

COC	EPC (mg/kg)	Risk-Based Cleanup Goal from HHRA (mg/kg)		Background[b] (mg/kg)	Preliminary Cleanup Goal (mg/kg)
		HI = 1.0	ILCR = 1E-05		
Inorganics					
Arsenic	14	420	26	15	26

[a] Shallow (0 to 1 ft below ground surface) surface soil is used for Security Guard/Maintenance Worker.
[b] Final facility-wide background values for the Ravenna Army Ammunition Plant from the Phase II RI Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 1999).
COC = Chemical of concern.
EPC = Exposure point concentration.
HHRA = Human Health Risk Assessment.
HI = Hazard Index.
ILCR = incremental lifetime cancer risk.
NA = Not applicable. Background concentrations are used for inorganic COCs only.

The estimated EPC of arsenic (14 mg/kg) is less than the preliminary cleanup goal established for this metal for the Security Guard/Maintenance Worker.

3.3.5 Risk Management Considerations

Only one COC (arsenic) was identified in the HHRA. The estimated EPC of arsenic (14 mg/kg) is less than the preliminary cleanup goal established for this metal for the Security Guard/Maintenance Worker land use and background; therefore, no remedial action is needed for arsenic.

3.4 ECOLOGICAL PROTECTION

The ERA performed for ODA2 is available in the RI Report and summarized in Section 2 of this FS. Ohio EPA Levels I and II were performed for ODA2 and show a number of exceedances of observed concentrations compared to ESVs. The risk assessment in the RI Report identify a variety of ecological receptor populations that could be at risk and identify the COPECs and COECs that could contribute to potential risks from exposure to contaminated media.

The ERA for ODA2 also reported the ecological field work conducted at the site: ecological reconnaissance of existing vegetation and animal life. These findings were published in the RI Report and are summarized in Section 2.2.7. A facility-wide biology and surface water study provided further information for consideration at ODA2. This information has been published in a separate report (USACE 2005a) and summarized in the RI Report with a further short summary in Section 3.4.2.1. All the studies document the presence of healthy and functioning terrestrial and aquatic ecosystems.

These two pieces of information, risk assessment predictions (e.g., HQs) and field observations, were combined in a weight-of-evidence assessment. This combination of information shows that (1) while ESV exceedance and HQs being greater than one suggest risk to plants and selected animals at each AOC, (2) the field observations reveal the ecological system with the plants and animals is functioning well and organisms appear to be healthy. Further, where surface water is involved, the use attainments are being met per Ohio guidance. Because of the combined finding that ecological systems are healthy as well as other reasons; no ecological preliminary cleanup goals are recommended and no remediation for ecological risks is justified at ODA2. The rationale for this is explained in detail and summarized below.

3.4.1 Ecological Preliminary Cleanup Goals for ODA2

It is recommended that no quantitative preliminary cleanup goals to protect ecological receptors be developed at ODA2. This recommendation is based principally on three major conclusions:

- Field observations indicate that there are currently few adverse ecological effects, and there is ample nearby habitat to maintain ecological communities at ODA2 and elsewhere on RVAAP/RTLS. These observations imply that remediation to protect ecological resources is not necessary.

- Contamination is at very low concentrations and; therefore, is not expected to impact ecological resources such as populations and communities.

- Removal of soil to further reduce any adverse ecological effects would destroy habitat without substantial benefit to the ecological resources at ODA2.

Stewardship of the environment will be a major consideration in all phases of planning, design, and implementation of the military mission at ODA2. Presently, ecological risk is possible based on the conservative risk assessment. Biological measurements (healthy stream ecology) near (upstream and downstream) ODA2 corroborate the likely low ecological risk to aquatic receptors. Any chemical remediation for ecological protection must be balanced by the negative consequences to the physical habitat. Remediation is likely to destroy valuable habitat, potentially including aquatic resources. Considering the rather low concentrations of most COPECs and the lack of readily observed harm to the environment, remediation or habitat destruction is not justified at ODA2.

3.4.2 Ecological Cleanup Goal Development Weight of Evidence

Ohio EPA guidance (Ohio EPA 2003) allows decisions regarding the need for remediation to be made at the completion of each level of the ERA process. The remedial alternatives evaluation process includes the development of USEPA Region 9 preliminary remediation goals (PRGs) or COEC concentrations used to define areas where remediation is needed to achieve protectiveness for ecological resources. A decision whether it is necessary to remediate because of potential harm to ecological receptors and whether it is necessary to set PRGs for ecological receptors at ODA2 is not included in the Phase I RI Report. The following weight-of-evidence discussions provide input for that decision.

This section provides a rationale for why remediation for protection of ecological receptors, and the associated development of quantitative preliminary cleanup goals, is not warranted for ecological risks at this time. The rationale has the following elements:

- Onsite or near site field studies show a healthy aquatic ecosystem (implying a healthy terrestrial ecosystem) and full attainment status according to Ohio EPA guidance, despite the identification of COPECs in the SERA.

- No unique ecological resources are found at ODA2, and nearby habitat offer home ranges for wildlife.

- Contamination is at very low concentrations and; therefore, is not expected to impact ecological resources such as populations and communities.

- Significant contaminant migration is not expected to occur from soil to nearby aquatic environments.

- Mitigations are of two types (chemical and physical) where removal of impacted soil/sediment (i.e., chemical) would lower the exposure and ecological risk and physical alteration such as vegetation removal is a trade-off.

Each of these elements is explained below regarding the need for ecological preliminary cleanup goals or remediation to protect ecological receptors and a recommendation follows.

3.4.2.1 Onsite and Near Site Biological Studies Show Functioning Ecological System

Level IV of the ERA process (Ohio EPA 2003) is an evaluation of exposures and any observable adverse ecological effects at the site. Observation of a healthy ecological community can mitigate against the conclusions resulting from risk calculations based on theoretical exposure models. Although a Level IV risk assessment was not done, some field observations have been made at ODA2. These observations indicate that despite the presence of COPECs at potentially harmful concentrations, little adverse ecological effect has occurred at the site.

Ecological Reconnaissance

Vegetation and animals are found at ODA2, descriptions of which are detailed in the RI Report (USACE 2005e): Briefly, vegetation consists of many old-field communities with corridors and patches of forest vegetation. Animals consist of soil invertebrates, many species of insects, mammals, and birds. However, no known threatened or endangered species or unique natural resources are present at ODA2; substantiation of this is provided in Section 7 (ERA, natural resources section) of the RI Report for ODA2. Therefore, National Guard land use (restricted access) would be carried out in an environment in which the impact would be limited to "normal" ecological resources.

The aquatic resource consists of Sand Creek that flows through the southern portion of ODA2. Aquatic life, such as macroinvertebrates and fish, are found in the creek upstream and downstream of ODA2.

Special Status Waters

Sand Creek bisects ODA2 as it flows west to east. Boundary to boundary (using an ODA2 boundary map provided by SpecPro), Sand Creek meanders about 1.2 miles through ODA2. Sand Creek, being a tributary of Eagle Creek, is designated as a State Resource Waters. With this designation, a stream and its tributaries fall under the state anti-degradation policy. These waters are protected from any action that would degrade the existing water quality (OHARNG 2001).

Streams and Fish

The fish communities at RVAAP/RTLS were surveyed by the Ohio Department of Natural Resources (ODNR) in the early 1990s (ODNR 1993). Two survey sites from this study can be used to describe the fish community in Sand Creek above and below ODA2. Site 18 (upstream of ODA2) was located in Sand Creek on Newton Falls Road 0.25 mile east of Greenleaf Road. Site 17 (downstream of ODA2) was located in Sand Creek at George Road downstream from the bridge. Thirteen fish species were found upstream of ODA2 at Site 18 and 12 fish species were found downstream of ODA2 at Site 17. Species included Northern hog sucker (Hypentelium nigricans), white sucker (Catostomus commersoni), blacknose dace (Rhinichthys atratulus), grass pickerel (Esox americanus vermicula), creek chub (Semotilus atromaculatus), stoneroller (Campostoma anomalum), redbelly dace (Phoxinus erythrogaster),

rock bass (Ambloplites rupestris), striped shiner (Luxilus chrysocephalus), silverjaw minnow (Notropis buccatus), bluntnose minnow (Pimephales notatus), green sunfish (Lepomis cyanellus), Johnny darter (Etheostoma nigrum), and fantail darter (Etheostoma flabellare). The grass pickerel and rock bass were found only upstream of ODA2, while the Northern hog sucker only appeared downstream of the site. All other species were collected at both locations.

USACE/Ohio EPA Surface Water Study

A facility-wide surface water investigation was made by USACE with the cooperation of the Ohio EPA (USACE 2005i). Sand Creek near ODA2 was among the locations sampled with results as follows.

A total of 7.5 miles of Sand Creek were assessed in 2003. This includes a stretch in ODA2. Based on the performance of the biological communities, the entire 7.5 miles of Sand Creek were in full attainment of the Warmwater Habitat (WWH) aquatic life use. None of the chemicals measured in the surface water of Sand Creek exceeded criteria protective of the WWH aquatic life use. Aside from one chemical, all organic parameters tested (explosives, SVOCs, pesticides, and PCBs) in the water were reported as non-detect. Nutrients, metals, and dissolved solids were at low levels in Sand Creek surface water, and were largely reflective of the undeveloped condition of the watershed. Metals in sediments were below Ohio sediment reference values and organic compounds were either non-detect or at low levels. Stream physical habitat conditions were good to excellent. Qualitative Habitat Evaluation Index (QHEI) scores for Sand Creek averaged 75.2, demonstrating the potential to support WWH biological communities. Mountain brook lamprey, a state endangered fish, and the caddisfly Psilotreta indecisa, a state threatened insect, were collected from Sand Creek. The lamprey was collected downstream by at least 2.6 miles from ODA2 and the caddisfly was collected upstream of ODA2. It is not likely that the lamprey is found near ODA2 nor geographically close the downstream AOC of CBP, but it is possible that there are occasion psilotreta indecisa near ODA2 because of the water flowing from the caddisfly habitat downstream towards ODA2.

Based on sampling results from Sand Creek, no biological impairment associated with chemical contaminants was observed. Fish communities in Sand Creek were assessed by ODNR during 1999 and 1993. Results of those collections were generally comparable to the 2003 results, with a majority of sites attaining the WWH biocriterion. Thus, downstream sampling locations near ODA2 showed a healthy stream and use attainment was met per Ohio EPA guidance.

3.4.2.2 Nearby Habitats Offer Home Ranges to Wildlife

As stated above, ecological resources are "normal," and nearby terrestrial and aquatic habitats are available. Wildlife can leave and enter adjacent old fields and forest patches and vegetative corridors and other creeks. As inferred earlier, RVAAP/RTLS has thousands of acres of habitat like that at ODA2, and wildlife can find new home ranges there; therefore, any lack of protection as a result of not deriving and applying ecological preliminary cleanup goals would be minimal because sufficient reservoirs of habitat and wildlife exist to maintain RVAAP/RTLS-wide ecological communities.

3.4.2.3 Limited Extent of Soil Contamination

The identification of COPECs is a very conservative screening process and COPEC concentrations are not necessarily at harmful levels. For example, of the 22 inorganic surface soil COPECs (Table 3-3):

- 5 (calcium, magnesium, nitrate/nitrite, potassium, and sodium) do not have ESVs and are generally only toxic at very high concentrations;
- 9 have EPCs < background criteria, and another 3 have EPCs < three times background criteria;
- 2 have EPCs more than three times background and greater than the ESVs; however, the background criteria for these 2 inorganics are also greater than the ESVs; and
- 3 inorganics have no background criteria available. The EPC for one (cadmium) is less than its ESV. The EPCs for hexavalent chromium and sulfide exceed ESVs by an order of magnitude or more.

Thus the inorganic COPECs are not highly elevated above background and such a small factor is assumed to mean low exposure and low risk. Furthermore, while the preliminary cleanup goals for 12 inorganic COPECs exceed the ESVs, the background criteria for 10 of these inorganics is also greater than the ESVs and the other 2 have no background criteria.

For the 7 organic surface soil COPECs:

- 3 have no ESV; and
- 4 have no detected concentrations that exceed ESVs.

These results indicate that the contamination is at very low concentrations and; therefore, is not expected to impact ecological resources such as populations and communities. Results for subsurface soil (1-3 ft bgs) are similar.

Table 3-3. COPECs in Surface Soil (0-1 ft bgs) at ODA2 Compared to Background and ESV

COPEC	Freq of Detect	Average Result (mg/kg)	Maximum Detect (mg/kg)	EPC (mg/kg)	Bkg (mg/kg)	Number of Detects >Bkg.	ESV (mg/kg)	Number of Detects >ESV
Inorganics								
Aluminum	63/ 63	11050	23400	11870	17700	3	600	63
Arsenic	63/ 63	13	20	14	15	12	9.9	56
Barium	63/ 63	79	175	85	88	16	283	0
Cadmium	61/ 63	1.2	9.5	1.5	0	61	4	1
Chromium	63/ 63	16	61	18	17	14	0.40	63
Chromium, Hexavalent	2/ 6	7.6	28	16	NA	NA	0.40	2
Cobalt	63/ 63	8.5	25	9.1	10	8	20	1

Table 3-3. COPECs in Surface Soil (0-1 ft bgs) at ODA2 Compared to Background and ESV (continued)

COPEC	Freq of Detect	Average Result (mg/kg)	Maximum Detect (mg/kg)	EPC (mg/kg)	Bkg (mg/kg)	Number of Detects >Bkg.	ESV (mg/kg)	Number of Detects >ESV
Copper	63/ 63	106	1210	147	18	55	14	60
Iron	63/ 63	23940	39300	25000	23100	35	200	63
Lead	63/ 63	33	218	40	26	27	41	8
Manganese	63/ 63	518	2140	597	1450	5	100	63
Mercury	51/ 63	0.68	9.9	1.3	0.040	51	0.00051	51
Nickel	63/ 63	18	31	20	21	14	30	2
Selenium	6/ 63	0.36	1.9	0.44	1.4	3	0.21	6
Sulfide	6/ 6	529	2200	2200	NA	NA	0.0036	6
Vanadium	63/ 63	19	38	20	31	1	2	63
Zinc	63/ 63	138	557	160	62	56	8.5	63
Organic Pesticides								
4,4-DDD	1/6	0.0045	0.026	0.011	NA	NA	0.758	0
Organic-Semivolatiles								
bis(2-ethylhexyl) phthalate	2/ 6	0.15	0.10	0.10	NA	NA	0.93	0
di-n-Butyl Phthalate	2/ 6	0.30	0.86	0.52	NA	NA	200	0
n-Nitrosodiphenylamine	1/ 6	0.18	0.10	0.10	NA	NA	20	0

Bkg = Background criteria
EPC = Exposure point concentration
ESV = Ecological screening value
COPEC = Chemical of potential ecological concern

3.4.2.4 No to Low Contaminant Migration

The facility-wide surface water sampling and assessment revealed that, in general, surface water quality at the RVAAP/RTLS in the streams was good to excellent with few exceedances of Ohio Water Quality Standards criteria. Intact riparian buffers around the streams contributed to good habitat and absence of substantial silt deposits. Evidence suggests that an additional remedial investigation effort, on an installation-wide basis, of the streams included in that report is not warranted. Contamination is not currently present in the sediments in the sampled reaches, and the surface water appears to be similarly free of contaminants. However, this does not preclude investigating surface water and sediment on an individual basis as required by Ohio EPA.

At ODA2, offsite migration is possible because Sand Creek traverses the southern part of the AOC. This stream could move contamination via the surface water and sediment to offsite locations. However, the biology and surface water study placed a sampling location downstream of ODA2, as explained elsewhere in this WOE, and that study indicated downstream conditions were good to excellent.

Offsite contaminant migration, is anticipated to be minimal for three reasons. First, site conditions – slope, soil type, plant cover – are only slightly conducive to erosion. Second, there is no indication that organic compounds in soil are presently leaching to surface water and sediment in the stream, and this may apply to inorganics as well. Most importantly, site conditions are unlikely to change in a way that would lead to increases in surface water or sediment concentrations as a result of erosion or leaching from

the soil. Thus, it is expected that future conditions are unlikely to pose an increase in exposure and risk to aquatic ecological receptors.

3.4.2.5 Mitigation Trade-offs of Reducing Chemical Risk but Harming Environment

There is a trade-off of two kinds of risk: physical alterations and residual contamination. That is, the localized ecosystem either can have clean soil because of removal and replacement but have a highly disturbed habitat as a result, or it can have exposure to contaminants in the soil in a habitat that is minimally disturbed. In some cases, it can be appropriate to allow plants and animals low in the food chain to be exposed to potentially toxic concentrations, sparing important habitat, if animals higher in the food chain (especially top carnivores) are not receiving toxic exposures.

There may be little benefit to removing contaminated soil because COPEC concentrations are not necessarily at harmful levels as described previously.

3.5 Fate and Transport Assessment of COCs in Soils

Impacted soils at ODA2 also were evaluated to assess their potential to impact groundwater both at the AOC (unrestricted land use exposure scenario) and at an exposure point downgradient of the AOC (restricted land use exposure scenario) to ensure residual concentrations in soils are protective of groundwater under both potential land use exposure scenarios. The process for identifying soil constituents potentially impacting groundwater is detailed in Appendix 3A and summarized below:

- Assessment started with the soils CMCOPCs and CMCOCs identified in the conservative fate and transport evaluation conducted in the RI.

- Constituents were assessed across media using AOC-specific analytical data and background information to refine the list of soils CMCOPCs and CMCOCs.

- Constituents were evaluated further if necessary using a refined version of the modeling performed in RIs. The refinements include updated source areas, updated source concentrations, and an updated depth to the water table (averaged over the new source areas) to further define potential for impacted soils to leach to groundwater.

3.5.1 Refined Chemical Impacts to Groundwater Assessment

Based on the results of the Phase II RI for ODA2, ten constituents are evaluated for potential impacts in groundwater beneath the source and all ten constituents also are evaluated for potential impacts to groundwater at downgradient receptors. Upon further analysis, nine of these constituents were not predicted or identified to impact groundwater as summarized below.

- Antimony is removed from further consideration for future groundwater impacts because there were only two detections of antimony in soil above background (only slightly greater than twice

background and clustered near Sand Creek), and there were no detections above background in surface water or groundwater. Due to its conservative nature, modeling results using concentrations near background predict impacts to groundwater; however, no impacts to groundwater are observed.

- Arsenic is removed from further consideration of future groundwater impacts because concentrations detected in soils are consistent with background concentrations. Modeling results indicate background levels of arsenic in soils may result in groundwater impacts in excess of the MCL.

- Barium is removed from further consideration of future groundwater impacts because there were few elevated detects clustered near one location (DA2-045); the EPC in soils is less than background; and concentrations in surface water/groundwater generally did not exceed background.

- All detections of chromium (total) in soil samples were below subsurface background; therefore chromium (total) is removed from further consideration of future groundwater impacts.

- Chromium (hexavalent) is not naturally occurring. Conservative modeling predicted impact to groundwater within a few hundred years in the areas north and south of Sand Creek. The highest detection of hexavalent chromium occurred in a well upgradient of ODA2. Hexavalent chromium also was detected in monitoring wells located near Sand Creek at ODA2; however hexavalent chromium was not detected in surface water samples collected in Sand Creek (2003). The ODA2 upgradient well, DA2mw-104, is downgradient of Winklepeck Burning Grounds (where hexavalent chromium also detected in surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soils) and also downgradient of former munitions storage facilities. Chromium (hexavalent) in soils is retained for further consideration of future impacts to groundwater; however, impacts are not limited to ODA2 soils contributions – impacts also appear to be migrating from offsite contributors in groundwater.

- Copper concentrations in soils exceeded background both north and south of Sand Creek. The highest concentrations were detected in surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soils south of Sand Creek. Groundwater south of Sand Creek contacts copper in soils directly. Copper also was detected above background in sediment in Sand Creek. Copper concentrations detected in groundwater did not exceed the MCL despite the fact that the water table is in direct contact with copper in soil nor did copper exceed background concentrations in surface water, therefore copper detected in soils north and south of Sand Creek are removed from further consideration of future groundwater impacts.

- Manganese is removed from further consideration of future groundwater impacts because there is only a single exceedance of background; both the source concentration and the EPC are less than subsurface soil (1-3 ft bgs) background; and observed groundwater results are at or below background.

- All detections of selenium in soils were below background values; therefore selenium is removed from further consideration of future groundwater impacts.

- RDX: RI SESOIL source load modeling in area south of Sand Creek predicted maximum impact in 3 years. Given AOC history, the maximum impact likely occurred in the past. RDX is removed from further consideration of future groundwater impacts at ODA2 because there are few detections in soils, the predicted time of maximum impact to groundwater is 3 years (so maximum impact has likely passed), and RDX has not been detected in surface water nor was it detected in groundwater samples above the PRG (6.1E-04 mg/l).

- Tetryl: RI SESOIL source load modeling in the area south of Sand Creek predicted maximum impact in 6 years. Given AOC history, the maximum impact likely occurred in the past. Tetryl is removed from further consideration of future groundwater impacts at ODA2 because there are limited detections in soils, the predicted time of maximum impact to groundwater is 6 years (so maximum impact has likely passed), and tetryl has not been detected in surface water or groundwater samples at ODA2.

3.5.2 Refined AOC-Specific Modeling Results

Based on analyses of the conservative fate and transport assessment performed in support of the RI for ODA2, no COCs were identified for further analysis using the SESOIL/AT123D models previously developed with refined input parameters.

Groundwater impacts in excess of MCLs are predicted for impacted soils at ODA2:

- Hexavalent Chromium in soils at ODA2 – North and South of Sand Creek.

The predicted impacts in groundwater beneath ODA2 are not predicted to reach downgradient receptor locations. No remediation of soils is required at ODA2 for groundwater under restricted land use. In addition, observed impacts to groundwater may not be entirely attributable to ODA2 soils contributions – observed impacts also appear to be migrating from offsite contributors to groundwater.

3.6 COCs FOR REMEDIAL ALTERNATIVE EVALUATION AT ODA2

The final list of COCs for evaluation of remedial alternatives in this FS was in the previous sections (Sections 3.3, 3.4, and 3.5) based on risk management considerations including:

- Comparison of EPC to preliminary cleanup goal concentrations (including background concentrations);

- Consideration of soil as the primary source of contamination (i.e., if soil concentrations are below background at an AOC, that AOC is not contributing to contamination in other media); and

- Other site-specific and receptor-specific considerations.

No COCs are identified for the representative receptor at ODA2, unrestricted land use was not evaluated at ODA2. The presence of MEC and the active RCRA unit is anticipated to preclude future unrestricted land use of this AOC.

4.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Agencies responsible for remedial actions under CERCLA must ensure selected remedies meet ARARs. The following sections describe proposed ARARs for ODA2.

4.1 INTRODUCTION

CERCLA Sections 121(d)(1) and (2) provide that remedial actions selected for a site must attain a degree of cleanup of hazardous substances, pollutants, and contaminants that: (1) assures protection of human health and the environment; and (2) complies with ARARs. ARARs are developed in accordance with the statutory and regulatory provisions set forth in CERCLA and the National Contingency Plan (NCP).

A remedial action will comply with ARARs if the remedial action attains the standard established in the ARAR for a particular hazardous substance. When a hazardous substance, pollutant, or contaminant will remain onsite at the completion of a remedial action, then that substance must meet any limit or standard set forth in any legally ARAR, criteria, or limitation under a federal environmental law. These standards apply unless such standard, requirement, criteria, or limitation is waived in accordance with CERCLA Section 121(d)(4). Any promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation, and that has been identified by the state in a timely manner, can be an ARAR as well.

Regulatory language interpreting and implementing the statutory directive is found in the NCP. One provision, 40 Code of Federal Regulation (CFR) § 300.400(g), provides that the lead agency (US Department of the Army) and support agency (Ohio EPA) shall identify applicable requirements based upon an objective determination of whether the requirement specifically addresses a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Under 40 CFR § 300.430(e), the lead agency has the ultimate authority to decide what requirements are ARARs for the potential remedial activities.

Identifying ARARs involves determining whether a requirement is legally applicable, and if it is not legally applicable, then whether a requirement is relevant and appropriate. Individual ARARs for each site must be identified on a site-specific basis. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site (40 CFR § 300.5).

If it is determined that a requirement is not legally applicable to a specific release, the requirement may still be relevant and appropriate to the circumstances of the release. Determining whether a rule is relevant and appropriate is a two-step process that involves determining whether the rule is relevant, and, if so, whether it is appropriate. A requirement is relevant if it addresses problems or situations

sufficiently similar to the circumstances of the remedial action contemplated. It is appropriate if its use is well suited to the site.

In addition to ARARs, the lead and support agencies may identify other advisories, criteria, or guidance to be considered for a particular release. The "to be considered" (TBC) category consists of advisories, criteria, or guidance that were developed by USEPA, other federal agencies, or states that may be useful in developing CERCLA remedies. TBCs will be considered as guidance or justification for a standard used in the remediation if no other standard is available for a situation to help determine the necessary level of cleanup for protection of health or the environment. This may occur if no ARAR is available for a particular contaminant or concern, or if there are multiple contaminants and/or multiple pathways not considered when establishing the standards in the ARAR so that use of the ARAR does not allow the remedial action to be protective of human health or the environment.

While onsite actions must comply with both applicable and relevant and appropriate requirements, offsite actions must comply with only applicable requirements. Also, a determination of relevance and appropriateness may be applied to only portions of a requirement, so that only parts of a requirement need be complied with, whereas a determination of applicability is made for the requirement as a whole, so that the entire requirement must be complied with.

CERCLA provides for a permit waiver for remedial actions that are conducted onsite and in accordance with the NCP. Although the administrative requirement of permits has been waived by the statute, substantive requirements of rules that would otherwise be enforced through permits are still applicable. The Ohio EPA Division of Emergency and Remedial Response (DERR) has addressed this issue in two policies, one in final form and one in draft form. The policy in final form, Final Policy Number DERR-00-RR-001, ARARs, 7/30/1998, states that: "…cleanup projects will not be subject to the administrative requirements of permits, including permit applications, public notice, etc.", particularly when the cleanup project is governed by an enforcement order. The policy in draft form, Draft Policy Number DERR-00-RR-034, Use of ARARs in the Ohio EPA Remedial Response Program, 9/2/03, states that: "It has been DERR's policy to require responsible parties to acquire and comply with all necessary permits, including all substantive and administrative requirements." Permit waivers are specifically addressed in Section VII. General Provisions (Paragraph No. 12) of the DFFO:

"e. It is Ohio EPA's position that if state law related to a remedial or removal action requires a permit, then a permit must be acquired in accordance with CERCLA Section 120(a)(4). It is Respondent's position that these Orders implement a CERCLA-based remediation program and that a permit is not required in accordance with CERCLA Section 121(e). The Parties agree that the remedial or removal actions anticipated at the RVAAP are not of the type that routinely require a permit under state law. If Ohio EPA determines that a permit is required for a particular remedial or removal action at the RVAAP, the Parties will meet and attempt in good faith to resolve to [sic] this issue."

Any remedial response action at RVAAP must be conducted in accordance with the DFFOs, which provide that, irrespective of ARARs, "all activities undertaken … pursuant to these Orders shall be

performed in accordance with the requirements of CERCLA, the NCP, and all other applicable federal and state laws and regulations."

4.2 POTENTIAL ARARS FOR ODA2

USEPA classifies ARARs as chemical-specific, action-specific, and location-specific in order to provide guidance for identifying and complying with ARARs (USEPA 1988):

- Chemical-specific ARARs are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, allow numerical values to be established. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment (USEPA 1988).

- Action-specific ARARs are rules, such as performance or design or other activity-based rules, which place requirements or limitations on actions.

- Location-specific ARARs are rules that place restrictions on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations (USEPA 1988).

As explained in the following paragraph, rules from each of these categories are ARARs only to the extent that they relate to the degree of cleanup.

CERCLA Section 121 governs cleanup standards at CERCLA sites. ARARs originate in the subsection of CERCLA that specifies the degree of cleanup at each site, CERCLA Section 121(d). In Section 121(d)(2), CERCLA expressly directs that ARARs are to address specific contaminants of concern at each site, specifying the level of protection to be attained by any chemicals remaining at the site. CERCLA Section 121(d)(2) provides that with respect to hazardous substances, pollutants, or contaminants remaining onsite at the completion of a remedial action, an ARAR is:

> "any standard, requirement, criteria, or limitation under any Federal environmental law … or any promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any Federal standard, requirement, criteria, or limitation"

CERCLA Section 121(d)(2) further provides that the remedial action attain a level of control established in rules determined to be ARARs.

As such, most ARARs will be chemical-specific. Action- or location-specific requirements will be ARARs to the extent that they establish standards addressing contaminants of concern that will remain at the site. In addition, CERCLA Section 121(d)(1) directs that remedial actions taken to achieve a degree of cleanup that is protective of human health and the environment are to be relevant and appropriate under the circumstances presented by the release. Accordingly, any chemical-, action-, or location-

specific requirements will be ARARs to the extent that they ensure that the degree of cleanup will be protective of human health and the environment under the circumstances presented by the release.

In summary, chemical-, action-, or location-specific requirements will be ARARs to the extent that they establish standards protective of human health and the environment for chemicals that will remain onsite after the remedial action, and to the extent that they ensure a degree of cleanup which is protective of human health and the environment under the circumstances presented by the release.

4.2.1 Potential Soil ARARs for RCRA Hazardous Waste

If soil contamination at ODA2 is determined to be RCRA hazardous material, certain hazardous waste requirements are triggered. Some RCRA requirements prescribe standards for treatment of hazardous materials. These requirements are generally not ARARs because they do not relate directly to the degree of cleanup or to specific chemicals but rather to the method used to obtain the degree of cleanup. Some RCRA requirements prescribe standards for disposal of hazardous materials. Standards that directly address land disposal may be potential ARARs at ODA2. These are: (1) land disposal requirements (LDRs) prohibiting disposal of specific chemicals until they are treated to a protective level, and (2) minimum technical requirements (MTRs) for land disposal units.

USEPA cautions that LDRs should not be used to determine site-specific cleanup levels for soils (USEPA 2002). The purpose of LDRs is to require appropriate treatment of RCRA hazardous wastes that are to be land disposed in order to minimize short and long-term threats to human health or the environment. Performing treatment to meet certain standards is different from the CERCLA approach to remediation, which is analyzing risk and then developing soil cleanup standards based on the risk present, and may result in soil cleanup levels that are different from those of a risk-based approach. Nevertheless, if RCRA hazardous materials are managed in a way that generates RCRA hazardous waste, and if that waste is land disposed onsite, then the material must meet the standards established in the LDRs.

In order for LDRs to be triggered as potential ARARs, RCRA hazardous waste must be present. This requires: (1) that soil contain contaminants that either derive from RCRA listed wastes or that exhibit a characteristic of RCRA hazardous waste; and (2) that soils are managed in a way that "generates" hazardous waste. Several methods of soil management that do not "generate" hazardous waste and so do not trigger LDRs are available for use. These methods are: the AOC approach, use of a staging pile, use of a storage or treatment corrective action management unit (CAMU), or use of a temporary unit (TU).

If soils are managed in a manner that generates hazardous waste, such as removing soil to an above-ground container, then redepositing the soil within the land unit for disposal, then LDRs become potential ARARs. LDRs attach to the waste at the time that it is removed from the unit under an AOC approach, or at the time that the soil is excavated and lifted out of the unit. Potential LDR ARARs in Ohio are variances from treatment standards at OAC § 3745-700-44, LDR standards for contaminated debris at OAC § 3745-47, Universal Treatment Standards (UTS) at OAC § 3745-270-48, and Alternative Standards for Contaminated Soil at OAC § 3745-270-49.

Ohio has adopted the alternative soil treatment standards as promulgated by USEPA in its Phase IV LDR rule, effective August 1998. Basically, the rules provide that if RCRA hazardous wastes are present, then the material must meet either one of two sets of LDRs before being disposed in a land unit: (1) the UTS; or (2) the contaminated soil (technology-based treatment) standards promulgated in Phase IV of the LDRs, whichever is greater. Or, if a generator so chooses, he may use the generic treatment standards at OAC § 3745-270-40 which apply to all hazardous wastes. Only the alternative soil treatment standards are explained in this document. Under the alternative soil treatment standards, all soils subject to treatment must be treated as follows:

1. For non-metals, treatment must achieve 90% reduction in total constituent concentration (primary constituent for which the waste is characteristically hazardous as well as for any organic or metal underlying hazardous constituent [UHC]), subject to item 3 below.

2. For metals and carbon disulfide, cyclohexanone, and methanol, treatment must achieve 90% reduction in constituent concentrations as measured in leachate from the treated media (tested according to the toxicity characteristic leaching procedure (TCLP) or 90% reduction in total constituent concentrations (when a metal removal treatment technology is used), subject to item 3 below.

3. When treatment of any constituent subject to treatment to a 90% reduction standard would result in a concentration less than 10 times the UTS for that constituent, treatment to achieve constituent concentrations less than 10 times the UTS is not required. This is commonly referred to as "90% capped by 10xUTS."

4. USEPA and Ohio EPA have established a site-specific variance from the soil treatment standards, which can be used when treatment to concentrations of hazardous constituents greater (i.e., higher) than those specified in the soil treatment standards minimizes short- and long-term threats to human health and the environment. In this way, on a case-by-case basis, risk-based LDR treatment standards approved through a variance process could supersede the soil treatment standards. Any variance granted cannot rely on capping, containment, or other physical or institutional controls.

If CAMUs are used as disposal units at ODA2, then the design and treatment standards established at OAC §3745-57-72 will be potentially relevant and appropriate to the response action. Only CAMU-eligible waste can be disposed in a CAMU. CAMU-eligible waste includes hazardous and non-hazardous waste that are managed for implementing cleanup, depending on the Director's approval or prohibition of specific wastes or waste streams. Use of a CAMU for disposal does not trigger LDRs or MTRs as long as the standards specified in the rule are observed. The Director will incorporate design and treatment standards into a permit or order. Design standards include a composite liner and a leachate collection system that is designed and constructed to maintain less than a thirty centimeter depth of leachate over the liner. A composite liner means a system consisting of two components; each component has detailed specifications and installation requirements. The Director may approve alternate requirements if he can make the findings specified in the rule. Treatment standards are similar to LDR standards for

contaminated soil, although alternative and adjusted standards may be approved or required by the Director, as long as the adjusted standard is protective of human health and the environment.

Table 4-1. Potential Action ARARs for Disposal of RCRA Hazardous Waste

Media and Citation	Description of Requirement	Potential ARAR Status	Standard
Soil Contaminated with RCRA Hazardous Waste OAC § 3745-400-49 OAC § 3745-400-48 UTS	These rules prohibit land disposal of RCRA hazardous wastes subject to them, unless the waste is treated to meet certain standards that are protective of human health and the environment. Standards for treatment of hazardous contaminated soil prior to disposal are set forth in the two cited rules. Use of the greater of either technology-based standards or universal treatment standards (UTS) is prescribed.	Land Disposal Restrictions (LDRs) apply only to RCRA hazardous waste. This rule is considered for ARAR status only upon generation of a RCRA hazardous waste. If any soils are determined to be RCRA hazardous, and if they will be disposed onsite, then this rule is potentially Applicable to disposal of the soils.	All soils subject to treatment must be treated as follows: For non-metals, treatment must achieve 90% reduction in total constituent concentration (primary constituent for which the waste is characteristically hazardous as well as for any organic or metal UHC), subject to 3) below; For metals and carbon disulfide, cyclohexanone, and methanol, treatment must achieve 90% reduction in constituent concentrations as measured in leachate from the treated media (tested according to the TCLP or 90% reduction in total constituent concentrations (when a metal removal treatment technology is used), subject to 3) below: When treatment of any constituent subject to treatment to a 90% reduction standard would result in a concentration less than 10 times the UTS for that constituent, treatment to achieve constituent concentrations less than 10 times the UTS is not required. This is commonly referred to as "90% capped by 10xUTS."

Table 4-1. Potential Action ARARs for Disposal of RCRA Hazardous Waste (continued)

Media and Citation	Description of Requirement	Potential ARAR Status	Standard
Debris Contaminated with RCRA Hazardous Waste OAC § 3745-400-49 OAC § 3745-400-47	These rules prescribe conditions and standards for land disposal of debris contaminated with RCRA hazardous waste. Debris subject to this requirement for characteristic RCRA contamination that no longer exhibits the hazardous characteristic after treatment does not need to be disposed as a hazardous waste. Debris contaminated with listed RCRA contamination remains subject to hazardous waste disposal requirements.	If RCRA hazardous debris is disposed onsite, then these rules are potentially Applicable to disposal of the debris.	Standards are extraction or destruction methods prescribed in OAC § 3745-400-47. Treatment residues continue to be subject to RCRA hazardous waste requirements.
Soils/Debris Contaminated with RCRA Hazardous Waste – Variance OAC § 3745-400-44	The Director will recognize a variance approved by the USEPA from the alternative treatment standards for hazardous contaminated soil or for hazardous debris.	Potentially applicable to RCRA hazardous soil or debris that is generated and placed back into a unit and that will be land disposed onsite.	A site-specific variance from the soil treatment standards can be used when treatment to concentrations of hazardous constituents greater (i.e., higher) than those specified in the soil treatment standards minimizes short- and long-term threats to human health and the environment. In this way, on a case-by-case basis, risk-based LDR treatment standards approved through a variance process could supersede the soil treatment standards.
Soils Disposed in a Corrective Action Management Unit (CAMU) OAC § 3745-57-53	Only CAMU-eligible waste can be disposed in a CAMU. CAMU-eligible waste includes hazardous and non-hazardous waste that are managed for implementing cleanup, depending on the Director's approval or prohibition of specific wastes or waste streams. Use of a CAMU for disposal does not trigger LDRs or MTRs as long as the standards specified in the rule are observed. The Director will incorporate design and treatment standards into a permit or order.	Potentially applicable to RCRA hazardous waste that is disposed in a CAMU.	Design standards include a composite liner and a leachate collection system that is designed and constructed to maintain less than a thirty centimeter depth of leachate over the liner. A composite liner means a system consisting of two components; each of which has detailed specifications and installation requirements. The Director may approve alternate requirements if he can make the findings specified in the rule. Treatment standards are similar to LDR standards for contaminated soil, although alternative and adjusted standards may be approved or required by the Director, as long as the adjusted standard is protective of human health and the environment. Treatment standards are de facto cleanup standards for wastes disposed in a CAMU.

CAMU = Corrective Action Management Unit
LDR = Land Disposal Restrictions
OAC = Ohio Administrative Code
RCRA = Resource Conservation and Recovery Act
UHC = Underlying Hazardous Constituent
UTS = Universal Treatment Standard
ARAR = Applicable and relevant or appropriate requirements

4.2.2 Potential Location ARARs for Solid Wastes, RCRA Hazardous Wastes, Construction & Demolition Debris Wastes or Clean Fill

Location requirements include those established for potential remedial activities conducted within wetlands or within a floodplain area, or with respect to threatened and endangered species. Generally, for wetlands and floodplains, rules require that alternatives to remedial activity within the sensitive area be pursued, and if that is not feasible, then adverse effects from any actions taken within the sensitive area be mitigated to the extent possible. These requirements do not relate to specific chemicals, nor do they further the degree of cleanup in the sense of protecting human health or the environment from the effects of harmful substances. Rather, their purpose is to protect the sensitive areas to the extent possible. Under CERCLA Section 121(d), relevance and appropriateness are related to the circumstances presented by the release of hazardous substance, with the goal of attaining a degree of cleanup and control of further releases that ensures protection of human health and the environment.

Rules ensuring protection of sensitive resources do not represent requirements that are relevant and appropriate to circumstances presented by the release of hazardous substance, with a goal of attaining a degree of cleanup and control of further releases that ensure protection of human health and the environment. Location requirements for wetlands and floodplains do not relate to the degree of cleanup as much as they relate to protection of these sensitive areas from the effects of remedial activities. This purpose of the rule requirements does not address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site as an ARAR; that is, the rule requirements are not sufficiently relevant and appropriate under CERCLA Section 121(d) as related to the circumstances of the release, degree of cleanup, or protectiveness of remedial action, to include these requirements as ARARs.

The Endangered Species Act (ESA) exists to protect the habitat or body of flora and fauna that are threatened or endangered. Once again, these rules do not relate to specific chemicals, nor do they further the degree of cleanup in the sense of protecting human health or the environment from the effects of harmful substances. The purpose of these rules is to protect sensitive areas and plant and animal life to the degree possible. This purpose does not address problems or situations sufficiently similar to those encountered at the CERCLA site that its use is well suited to the particular site as an ARAR; that is, the rule requirements are not sufficiently relevant and appropriate under CERCLA Section 121(d) as related to the circumstances of the release, degree of cleanup, or protectiveness of the remedial action, to include these requirements as ARARs.

Having determined that these requirements are not ARARs, it bears repeating that any action taken by the Federal Government must be conducted in accordance with requirements established under the National Environmental Policy Act (NEPA), ESA, and federal and state wetlands and floodplains construction and placement of materials considerations, even though these laws and rules do not establish standards, requirements, limitations, or criteria relating to the degree of cleanup for chemicals remaining onsite at the close of the response action.

5.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

The United States Department of the Army is the lead agency under the Defense Environmental Restoration Program responsible for achieving interim closure of the six high priority AOCs at RVAAP, including ODA2. This section reviews actions that have been conducted and that are planned in the future to ensure regulatory agencies and the public have been provided with appropriate opportunities to stay informed of progress of the six high priority environmental AOCs site remediation and to provide meaningful input on the planning effort as well as the final selection of an interim remedy.

5.1 STATE ACCEPTANCE

State Acceptance considers comments received from agencies of the State of Ohio on the actions being considered. For the process supporting closure (or interim remedy) of the six high priority AOCs, including ODA2, Ohio EPA is the lead regulatory agency and this FS has been prepared in consultation with Ohio EPA. Ohio EPA has provided input during the ongoing investigation and report development process to ensure the action ultimately selected for the six high priority AOCs, including ODA2, meets the needs of the State of Ohio and fulfills the requirements of the Director's Final Findings and Orders (Ohio EPA 2004). Comments will be solicited from Ohio EPA on the FS and on the PP. The Army will obtain Ohio EPA concurrence prior to the final selection of the interim remedy for ODA2.

5.2 COMMUNITY ACCEPTANCE

Community acceptance considers comments provided by the community on the actions being considered. CERCLA 42 U.S.C. 9617(a) emphasizes early, constant, and responsive community relations. The Army has prepared a Community Relations Plan (USACE 2003b) for this project to ensure the public has convenient access to information regarding project progress. The community relations program interacts with the public through news releases, public meetings, public workshops, and Restoration Advisory Board (RAB) meetings with local officials, interest groups, and the general public. The public also is provided the opportunity to comment on draft documents submitted to the Administrative Record that support interim remedy of ODA2, including the previously completed RI Report and this FS Report.

CERCLA 42 U.S.C. 9617(a) requires that an Administrative Record be established "at or near the facility at issue." Relevant documents regarding the RVAAP/RTLS site have been made available to the public for review and comment. The ***Administrative Record*** for this project is available at the following location:

Ravenna Army Ammunition Plant
Building 1037 Conference Room
8451 St. Route 5
Ravenna, Ohio 44266-9297

Access to RVAAP/RTLS is restricted but can be obtained by contacting facility management at (330) 358-7311. In addition, an Information Repository of current information and final documents is available to any interested reader at the following libraries:

Reed Memorial Library
167 East Main Street
Ravenna, Ohio 44266

Newton Falls Public Library
204 South Canals
Newton Falls, Ohio 44444-1694

Also, RVAAP has an online resource for site restoration news and information. This website can be viewed at www.rvaap.org.

Similar to state agencies, comments will be received from the community upon issuance of the FS and the PP. The Army will request public comments on the PP for ODA2, as required by the CERCLA regulatory process and the RVAAP Community Relations Plan. These comments will be considered in the final selection of an interim remedy for ODA2. Responses to these comments will be addressed in the responsiveness summary of the ROD.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This FS establishes RAOs and evaluates the need for remedial action to reduce risks to the environment to obtain interim remedy of ODA2 for soils/dry sediments. ODA2 will be transferred to OHARNG and is not a candidate for unrestricted release. The extensive presence of MEC prevents most activity at ODA2, including most OHARNG training activities. The current future likely land use for a portion of ODA2 is as an emergency munitions demolition area. No COCs are identified for the restricted land use receptor at ODA2. Therefore, it is the recommendation of this FS that ODA2 undergoes no further action with respect to chemical contamination in soils/dry sediment. MEC issues at ODA2 will be addressed under the MMRP program. Any land use controls required with respect to MEC issues will be developed and implemented by the Army and OHARNG.

The next step in the CERCLA process is to prepare a PP to solicit public input with respect to no further action at ODA2. The PP will present the RAO analysis performed in the FS supporting no further action at ODA2 with respect to impacted soils/dry sediments.

The ROD will document the final interim remedy for ODA2. Comments on the PP received from state and federal agencies and the public will be considered in drafting the ROD for ODA2. The ROD will provide a brief summary of the history, characteristics, risks, and the basis for no further action at ODA2 under restricted land use. The ROD also will include a responsiveness summary, addressing comments received on the PP.

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Appendix 2A
Supplemental Phase II
RI Sampling Results

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2A.0 SUPPLEMENTAL PHASE II RI FOR ODA2

2A.1 INTRODUCTION

This report addresses the results of the Phase II Supplemental RI of ODA2 at RVAAP, Ravenna, Ohio. This Supplemental Phase II RI investigation was conducted under the United States Department of Defense (DoD) IRP by SAIC, under contract number GS-10F-0076J, Delivery Order No. W912QR-05-F-003, with USACE, Louisville District. The Phase II RI, completed in 2005 (USACE 2005), and the supplemental investigation presented in this report, were conducted in compliance with CERCLA following work plans reviewed and commented on by Ohio EPA.

This document summarizes the results of the Supplemental Phase II RI field activities conducted in November 2005 at ODA2. These activities were conducted in accordance with the *Final Sampling and Analysis Plan Addendum No. 1 Supplemental Phase II Remedial Investigations for Open Demolition Area #2 (RVAAP-02), Fuze and Booster Quarry Landfill/Ponds (RVAAP-16), and Central Burn Pits (RVAAP-49)* (Supplemental Phase II RI Sampling and Analysis Plan [SAP]) issued November 10, 2005 and approved by Ohio EPA (SAIC 2005). This Supplemental Phase II RI Report addresses only the findings of the investigation at ODA2. Supplemental Phase II RI reports for FBQ and CBP are issued separately.

2A.1.1 Purpose and Objectives

The purpose of the field investigation performed in the Supplemental RI is to fill additional data needs regarding the extent of contamination in affected soil media following the Phase II RI. The objectives of the Supplemental Phase II sampling at ODA2 are to define the nature and extent of explosive compounds detected at ODA and to evaluate potential risks to receptors in support of the FS.

2A.1.2 Phase II RI Summary

Phase II field activities were conducted in July, August, and September 2002. These activities and subsequent findings and data are presented in the *Final Open Demolition Area #2 Phase II Remedial Investigation Report* (USACE 2005).

The Phase II RI report concluded that explosives detected in the northwestern portion of the site require further delineation. Inorganics detected at ODA2 were compared to EPA Region 9 Preliminary Remediation Goals (PRGs) (residential). Only aluminum, iron, arsenic, and manganese exceeded the Region 9 PRGs. Detected concentrations of aluminum, iron, arsenic, and manganese at ODA2 are similar to naturally occurring concentrations. Average results for aluminum, arsenic, and manganese are at or below background.

2A.1.3 Report Organization

This Supplemental RI Report is organized to meet Ohio EPA requirements in accordance with EPA CERCLA Superfund and USACE guidance. This Supplemental Phase II RI Report consists of Sections 2A.1 through 2A.6, and supporting appendices.

- Section 2A.2 presents the study area field investigation and the methodologies used for data collection;
- Section 2A.3 describes the updated nature and extent of soil contamination at ODA2;
- Section 2A.4 presents the qualitative risk evaluation; and
- Section 2A.5 lists the summary and conclusions of the report.

Appendices (A through G) contain supporting data collected during the Supplemental Phase II RI field activities. These appendices consist of:

- Attachment A: Soil Sampling Logs;
- Attachment B: IDW Summary Report;
- Attachment C: Project Quality Assurance Summary Report;
- Attachment D: Data Quality Control Summary Report;
- Attachment E: Laboratory Analytical Results and chain-of-custody records;
- Attachment F: Topographic Survey Report; and
- Attachment G: MEC Avoidance Survey Report.

2A.2 STUDY AREA INVESTIGATION

The scope of the Supplemental Phase II RI field investigation at ODA2 includes sampling of surface (0-1 ft below ground surface [bgs]) and subsurface soils (1-3 ft bgs). This section presents information on locations of and rationale for samples collected during the field effort and provides a synopsis of the sampling methods employed during the investigation. Information regarding standard field decontamination procedures, sample container types, preservation techniques, sample labeling, chain-of-custody, and packaging and shipping requirements implemented during the field investigation may be found in the Facility-Wide SAP (USACE 2001) and the Supplemental Phase II RI SAP (SAIC 2005).

2A.2.1 Surface and Subsurface Soil Characterization

Soil samples for chemical analyses were collected from a total of six stations located throughout the ODA2 AOC. Figure 2A-1 illustrates the locations for surface soil (0-1 ft bgs) and subsurface soil (1-3 ft bgs) sampling. Table 2A-1 provides a detailed listing of the soil samples collected during the Supplemental Phase II RI field effort. Both surface and subsurface samples were collected at all of the stations. Soil sampling logs are presented in Attachment A.

2A.2.1.1 Rationale

Soil samples were collected primarily from outside of the area previously sampled to further define the nature and extent of explosive and inorganic compounds detected during the previous Phase II RI. Sample locations were selected on the basis of analytical results from the Phase II RI to characterize contaminant nature and extent (i.e., where explosives were detected or inorganic contamination was not defined).

Six discrete surface and subsurface soil samples were collected at ODA2 (Figure 2A-1). The final sample locations were determined in the field based on site conditions, access considerations, visual survey of the area, and MEC considerations. The six discrete surface and subsurface soil locations are as follows:

- Three surface and subsurface soil samples were located along the northwestern limit of ODA2. These samples were collected to define extent of explosives detections at Phase II sample locations DA2-114, DA2-035, DA2-037, and DA2-040.

- One surface and subsurface soil sample was located southwest of Phase II sample location DA2-MW111.

- One surface and subsurface soil sample was located northeast of Phase II sample location DA2-MW108.

- One surface and subsurface soil sample was located northeast of Phase II sample location DA2-093 to define the extent of explosives detections from DA2-093.

Table 2A-1 describes the rationale for the final placement of individual sampling locations for soil within ODA2. Surface soil and co-located subsurface soil samples were collected from six sampling stations at ODA2 as planned in the Supplemental Phase II RI SAP (SAIC 2005).

2A.2.1.2 Surface and Subsurface Soil Field Sampling Methods

Surface Soil and Dry Sediment

A decontaminated bucket hand auger was used to collect surface soil samples at each station. The target depth interval for surface soil samples was 0 to 0.3 m (0 to 1 foot) bgs. Composite samples were collected for all surface soil samples. Because of the physical characteristics of explosive compounds (e.g., flakes, particles, and pellets) and the nature of demolition operations, the distribution of these types of compounds can be erratic and highly variable. Composite sampling has been shown to reduce statistical sampling error in surface soil at sites with a history of explosives contamination in surface soil (Jenkins et al. 1996) and to increase the likelihood of capturing detectable levels of explosives compounds over a given area. Composite sampling data are considered acceptable to the Ohio EPA for use in a risk assessment where concentrations are expected to vary spatially.

To collect composite samples for surface soil, three borings were hand augured in an equilateral triangle pattern measuring approximately 0.9 meter (3 ft) per side. Equal portions of soil from the three subsamples were placed into a large, decontaminated stainless steel bowl and labeled with the Sample ID. Field descriptions and classifications for the soil samples were performed and the results recorded in the project logbooks in accordance with Section 4.4.2.3 of the Facility-Wide SAP, as specified in the Supplemental Phase II RI SAP, with the exception that headspace gases were not screened in the field for organic vapors. Organic vapor measurements were made in the breathing zone during sampling and the results recorded on the field sample logs.

The samples were homogenized by MKM Engineers using the Ohio EPA approved procedure utilized during the 14 Sites AOC field effort. The combined sub-samples collected in the field were brought back to Building 1036 and logged for processing to ensure chain-of-custody was maintained. The soil was spread and allowed to air dry overnight or up to two days. The air-dried soil was prepared for sieving by crushing and removing rocks and organic materials. The soil was then sieved using a #10 and #4 stainless steel sieve. Any materials not passing through the sieve was considered IDW. The remaining air-dried, sieved materials were then ground using a decontaminated coffee grinder. The ground soil was incrementally placed into sample jars and submitted to the fixed-base laboratory for analysis.

Following preparation of the sample, excess soil was designated as IDW and placed in lined 55-gallon open top drums staged at Building 1036. IDW is discussed in Attachment B. Hand-auger borings were backfilled to the ground surface with dry bentonite chips.

Subsurface Soil Sampling Methods

To collect subsurface samples for chemical analyses, a decontaminated auger bucket was used to deepen one of the three surface soil borings at each sample location over the required depth interval.

Soil from the subsurface interval was placed into a stainless steel pan or bowl and labeled with the Sample ID. Field descriptions and classification of the soils were performed and the results recorded in the project logbooks in accordance with Section 4.4.2.3 of the Facility-Wide SAP, as specified in the Phase II RI Work Plan and SAP Addenda, with the exception that headspace gases were not screened in the field for organic vapors. Organic vapor measurements were made in the breathing zone during sampling and at the top of the boring and recorded on the field sample logs.

The samples were homogenized by MKM Engineers using the EPA approved procedure utilized during the 14 Sites AOC field effort. The combined sub-samples collected in the field were brought back to Building 1036 and logged for processing to ensure chain-of-custody was maintained. The soil was spread and allowed to air dry overnight or up to two days. The air-dried soil was prepared for sieving by crushing and removing rocks and organic materials. The soil was then sieved using a #10 and #4 stainless steel sieve. Any materials not passing through the sieve was considered IDW. The remaining air-dried, sieved materials were then ground using a decontaminated coffee grinder.

The ground soil was incrementally placed into sample jars and submitted to the fixed-base laboratory for analysis.

Following processing of the samples, excess soil was designated as IDW and placed in a lined, labeled roll-off container that was staged at Building 1502. IDW practices for all media are discussed in Attachment B. Hand-auger borings were backfilled to the ground surface with dry bentonite chips.

2A.2.2 Analytical Program Overview

2A.2.2.1 Laboratory Analyses

All analytical procedures were completed in accordance with applicable professional standards, USEPA requirements, government regulations and guidelines, USACE Louisville District analytical quality assurance (QA) guidelines, and specific project goals and requirements. The sampling and analysis program conducted during the Supplemental Phase II RI for ODA2 involved the collection and analysis of surface soil and subsurface soil. Specified samples were analyzed by an independent quality control (QC) split analytical laboratory under contract with the USACE Louisville District. Samples were collected and analyzed according to the Facility-Wide SAP and the Supplemental Phase II RI SAP.

Samples collected during the investigation were analyzed by GPL Laboratories, Gaithersburg, Maryland, a USACE Center of Excellence certified laboratory. The specified QC split samples collected for soil were analyzed by USACE-contracted laboratory, Severn Trent Laboratories, located in North Canton, Ohio. Laboratories supporting this work have statements of qualifications including organizational structures, QA manuals, and standard operating procedures, which are available upon request.

Attachment C presents an assessment of analytical precision, accuracy, representativeness, completeness, comparability, and sensitivity for the measurement data as they apply to the analytical program.

QA/QC samples for this project included field blanks, QA field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, matrix spike/matrix spike duplicate (MS/MSD) samples, and QC field split samples (submitted to the independent USACE-contracted laboratory). Field blanks, consisting of potable and de-ioinized (DI) water used in the decontamination process and equipment rinsate blanks, were submitted for analysis along with field duplicate samples to provide a means to assess the quality of the data resulting from the field sampling program. The QC field split samples provide independent verification of the accuracy and precision of the principal analytical laboratory. Evaluation of these QC measures and of their contribution to documenting the project data quality is provided in Attachment D, Data Quality Summary Report (DQSR).

SAIC is the custodian of the project file and will maintain the contents of the file for this investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, and chain-of-custody forms. These files will remain in a secure area under

the custody of the SAIC Program Manager until they are transferred to the USACE Louisville District and RVAAP. Analytical data reports from GPL Laboratories have been forwarded to the USACE Louisville District laboratory data validation contractor (Lab Data Consultants, Inc.) for validation review and QA comparison. GPL will retain all original raw data information (both hard copy and electronic) in a secure area under the custody of the laboratory project manager.

2A.2.2.2 Data Review, Validation, and Quality Assessment

Samples were properly packaged for shipment and dispatched to GPL Laboratories for analysis. A separate signed custody record with sample numbers and locations listed was enclosed with each shipment. When transferring the possession of samples, the individuals who relinquished and received the samples signed, dated, and noted the time on the record. All shipments were in compliance with applicable Department of Transportation regulations for environmental samples.

Data were produced, reviewed, and reported by the laboratory in accordance with specifications outlined in the Supplemental Phase II RI Quality Assurance Project Plan (QAPP) Addendum, the USACE Louisville District analytical QA guidelines, and the laboratory's QA manual. Laboratory reports included documentation verifying analytical holding time compliance.

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

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

Data were then delivered to SAIC for data verification. GPL Laboratories prepared and retained full analytical and QC documentation for the project in both paper copy and electronic storage media (e.g., magnetic tape), as directed by the analytical methodologies employed. GPL Laboratories provided the following information to SAIC in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;

- Tabulated results of inorganic and organic compounds identified and quantified; and

- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, method blanks, and laboratory control sample information.

A systematic process for data verification was performed by SAIC to ensure the precision and accuracy of the analytical data were adequate for their intended use. This verification also attempted to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach was consistent with data quality objectives (DQOs) for the project and with the analytical methods, and was appropriate for determining contaminants of concern and calculating risk. Analytical data were verified through the review process outlined in the SAP and are presented in Attachment E. Following data verification, all data packages were forwarded to the USACE independent data validation contractor.

Independent data validation was performed by Lab Data Consultants, Inc. under a separate task with the USACE Louisville District. This review constitutes comprehensive validation of 10 percent of the primary data set, comprehensive validation of the QA split sample data set, and a comparison of primary sample, field duplicate sample, and field QA split sample information.

2A.2.3 Munitions and Explosives of Concern Avoidance

MEC avoidance subcontractor support staff was present during all field operations. The OE Team Leader led an initial safety briefing on OE to train all field personnel to recognize and avoid MEC. Daily tailgate safety briefings included reminders regarding OE avoidance. Site visitors were briefed on OE avoidance before they were allowed access to the AOC. Prior to beginning sampling activities, access routes into areas from which samples were to be collected were assessed for potential OE using visual surveys and hand-held magnetometers. The OE Team Leader, Ohio EPA technical representative, and SAIC project manager located proposed sampling stations within the AOC using pin flags or wooden stakes marked with the sample station identification number. The pin flag or stake was placed at a point approved by the OE technician. An OE technician remained with the sampling crews as work progressed. Prior to collection of subsurface soil samples (1 to 3 ft bgs), a magnetometer was lowered into the borehole to screen for subsurface magnetic anomalies at the top of the subsurface interval. Attachment G presents the MEC Survey Report.

Table2A-1 Soil Sample List and Rationales, ODA2 Supplemental Phase II RI

Area Description	Station ID	Sample Location Rationale	Sample ID	Depth (ft)	Sample Collected (Yes/No)	Comments
ODA2	DA2-125	Site Boundary	DA2ss-125-0900-SO	0 to 1	Yes	
	DA2-125	Site Boundary	DA2so-125-0901-SO	1 to 3	Yes	
	DA2-126	Site Boundary	DA2ss-126-0902-SO	0 to 1	Yes	
	DA2-126	Site Boundary	DA2so-126-0903-SO	1 to 3	Yes	
	DA2-127	Site Boundary	DA2ss-127-0904-SO	0 to 1	Yes	
	DA2-127	Site Boundary	DA2so-127-0905-SO	1 to 3	Yes	
	DA2-128	Site Boundary	DA2ss-128-0906-SO	0 to 1	Yes	
	DA2-128	Site Boundary	DA2so-128-0907-SO	1 to 3	Yes	
	DA2-129	Site Boundary	DA2ss-129-0908-SO	0 to 1	Yes	
	DA2-129	Site Boundary	DA2so-129-0909-SO	1 to 3	Yes	
	DA2-130	Site Boundary	DA2so-130-0910-SO	0 to 1	Yes	
	DA2-130	Site Boundary	DA2so-130-0911-SO	1 to 3	Yes	Auger refusal at 1.9 ft

2A.3 UPDATED NATURE AND EXTENT

This section presents results of the Supplemental Phase II RI. Constituents that are deemed to be related to AOC operations are classified as SRCs. These SRCs are then evaluated to determine their occurrence and distribution in surface and subsurface soil at ODA2. Section 2A.3.1 presents the statistical methods and screening criteria used to reduce and display data and to distinguish naturally occurring constituents from SRCs indicative of historical site operations. Section 2A.3.2 presents the nature and extent of identified SRCs in surface and subsurface soil.

2A.3.1 Data Evaluation Methods

For the purposes of this Supplemental Phase II RI Report, the evaluation and screening of data were performed using the established RVAAP processes employed in the ODA2 Phase II RI Report (USACE 2005e) and other RIs for the facility, including: (1) defining data aggregates, (2) data reduction and screening, and (3) data presentation.

2A.3.1.1 Data Aggregates

The ODA2 Supplemental Phase II RI data were grouped (aggregated) by environmental media as a single aggregate (soil) and then further aggregated on the basis of depth: surface soil (0 to 1 ft) and subsurface soil (1-3 ft). For the nature and extent section, only the Supplemental Phase II data are discussed. For the qualitative risk evaluation, Phase II RI and Supplemental Phase II RI data were evaluated together, as well as evaluating the Phase II RI data separately.

2A.3.1.2 Data Reduction and Screening

Data reduction and screening steps to identify SRCs included the following: screening of inorganics against facility-wide background values and screening of essential human nutrients. A frequency of

detection screen is not applicable because only six samples were collected. Detailed descriptions of these screening processes may be found in Section 4.1.3 of the Phase II RI Report (USACE, 2005). The screening steps are summarized below.

- Facility-wide background values for inorganic constituents in soil, sediment, surface water, and groundwater (bedrock and unconsolidated zones) were developed as part of a previous Phase II RI at the Winklepeck Burning Grounds at RVAAP (USACE 2001). Any inorganic chemical exceeding its facility-wide background criterion for soil was considered to be an SRC. For inorganics not detected in the background data set, the background value is considered to be zero; thus, any detected value for these inorganics is considered to be above background.

- Chemicals considered to be essential nutrients (calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium) are not generally addressed as SRCs in the contaminant nature and extent evaluation and the HHRA (EPA 1989 and 1996) unless they are grossly elevated relative to background values. For the ODA2 investigation, analyses were conducted for calcium, iron, magnesium, potassium, and sodium. These five constituents were eliminated as SRCs for the nature and extent evaluation and HHRA.

2A.3.1.3 Data Presentation

Data summary statistics and screening results for soil data are presented in Tables 2A-2 and 2A-3. Analytical results for selected SRCs are presented on maps to depict spatial distribution. Analytical results by sample location for classes of SRCs (e.g., explosive compounds or inorganics) are presented in Tables 2A-4 through 2A-7. Complete analytical results are contained in Attachment E.

2A.3.2 Results of Soil Sampling and Analysis

Surface (0-1 ft) and subsurface (1-3 ft) samples were collected from six discrete locations during the Supplemental Phase II RI to further define the nature and extent of explosive and inorganic contamination. All discrete samples were analyzed for TAL metals and explosives. Data summary statistics and screening results to identify SRCs are presented in Tables 2A-2 and 2A-3.

2A.3.2.1 Surface Soil (0-1 ft)

Explosives

Four explosives compounds were detected in the ODA2 discrete surface soil samples (Table 2A-2). One of the five (nitrobenzene) had not been detected previously in surface soil samples. Explosives were detected at sample locations DA2-126, -127, and -129 (Table 2A-4 and Figure 2A-2).

The concentrations of explosives at the Supplemental Phase II sample locations were all below reporting limits with the exception of tetryl at DA2-129. DA2-129 is bounded by previous sample locations (Figure 2A-2) in which no explosives were detected. All explosives detected during the Supplemental Phase II sampling were below the maximum detected concentrations of the previous

data with the exception of nitrobenzene, which is below the reporting limit. The extent of explosive compounds at ODA2 has been defined to below reporting limits with the additional Supplemental Phase II data collected.

1 **Table 2A-2. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Surface Soil (0-1 ft bgs)**

Analyte	CAS Number	Units	Results >Detection Limit	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background	Max. > Bkg.?	Site Related?
Inorganics											
Aluminum	7429905	mg/kg	6/ 6	12300	8100	18400	16700	16700	17700	Yes	Yes
Antimony	7440360	mg/kg	4/ 6	0.387	0.33	0.71	0.564	0.564	0.96	No	No
Arsenic	7440382	mg/kg	6/ 6	12.1	8.2	19.4	18	18	15.4	Yes	Yes
Barium	7440393	mg/kg	6/ 6	77.3	46.1	132	120	120	88.4	Yes	Yes
Beryllium	7440417	mg/kg	6/ 6	0.61	0.42	1	0.868	0.868	0.88	Yes	Yes
Cadmium	7440439	mg/kg	5/ 6	0.368	0.05	0.91	137	0.91	0	Yes	Yes
Calcium	7440702	mg/kg	6/ 6	917	266	2160	3290	2160	15800	No	No
Chromium	7440473	mg/kg	6/ 6	19.9	14	28.7	26.8	26.8	17.4	Yes	Yes
Cobalt	7440484	mg/kg	6/ 6	11.3	8	18.3	15.1	15.1	10.4	Yes	Yes
Copper	7440508	mg/kg	6/ 6	48.4	13.5	175	99.6	99.6	17.7	Yes	Yes
Iron	7439896	mg/kg	6/ 6	20500	14700	29200	25700	25700	23100	Yes	No
Lead	7439921	mg/kg	6/ 6	26.2	15.6	36.8	33.7	33.7	26.1	Yes	Yes
Magnesium	7439954	mg/kg	6/ 6	2080	1620	2610	2420	2420	3030	No	No
Manganese	7439965	mg/kg	6/ 6	1010	311	2890	3380	2890	1450	Yes	Yes
Mercury	7439976	mg/kg	6/ 6	0.45	0.04	2.4	1.24	1.24	0.036	Yes	Yes
Nickel	7440020	mg/kg	6/ 6	17.2	14.1	22.9	20.5	20.5	21.1	Yes	Yes
Potassium	7440097	mg/kg	6/ 6	979	704	1650	1360	1360	927	Yes	No
Selenium	7782492	mg/kg	4/ 6	0.475	0.35	0.94	1.21	0.94	1.4	No	No
Sodium	7440235	mg/kg	3/ 6	56.9	70	78.1	73.3	73.3	123	No	No
Thallium	7440280	mg/kg	1/ 6	0.288	0.36	0.36	0.385	0.36	0	Yes	Yes
Vanadium	7440622	mg/kg	6/ 6	23.5	15.6	40.1	33.8	33.8	31.1	Yes	Yes
Zinc	7440666	mg/kg	6/ 6	97.6	61.3	199	164	164	61.8	Yes	Yes
Organics-Explosives											
2-Amino-4,6-dinitrotoluene	35572782	mg/kg	1/ 6	0.0483	0.04	0.04	0.0517	0.04	--	--	Yes
4-Amino-2,6-dinitrotoluene	19406510	mg/kg	1/ 6	0.0467	0.03	0.03	0.0534	0.03	--	--	Yes
Nitrobenzene	98953	mg/kg	3/ 6	0.0367	0.02	0.03	0.0491	0.03	--	--	Yes
Tetryl	479458	mg/kg	2/ 6	0.107	0.01	0.23	0.165	0.165	--	--	Yes

Table 2A-3. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Subsurface Soil (1-3 ft bgs)

Analyte	CAS Number	Units	Results >Detection Limit	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background	Max. > Bkg.?	Site Related?
Inorganics											
Aluminum	7429905	mg/kg	6/ 6	15200	9570	20500	21300	20500	19500	Yes	Yes
Antimony	7440360	mg/kg	5/ 6	0.38	0.32	0.55	0.493	0.493	0.96	No	No
Arsenic	7440382	mg/kg	6/ 6	14.7	11	20.4	18.6	18.6	19.8	Yes	Yes
Barium	7440393	mg/kg	6/ 6	68.6	37.5	102	123	102	124	No	No
Beryllium	7440417	mg/kg	6/ 6	0.713	0.38	1.2	1.2	1.2	0.88	Yes	Yes
Cadmium	7440439	mg/kg	3/ 6	0.0333	0.05	0.07	0.058	0.058	0	Yes	Yes
Calcium	7440702	mg/kg	6/ 6	1160	205	3690	12900	3690	35500	No	No
Chromium	7440473	mg/kg	6/ 6	22.3	13.5	29.1	27.2	27.2	27.2	Yes	Yes
Cobalt	7440484	mg/kg	6/ 6	12.6	7.6	18.1	16.8	16.8	23.2	No	No
Copper	7440508	mg/kg	6/ 6	21.4	9.5	31.4	27.6	27.6	32.3	No	No
Iron	7439896	mg/kg	6/ 6	26700	17500	36000	35500	35500	35200	Yes	No
Lead	7439921	mg/kg	6/ 6	16.5	10.5	28.4	24.3	24.3	19.1	Yes	Yes
Magnesium	7439954	mg/kg	6/ 6	3170	1690	4930	4810	4810	8790	No	No
Manganese	7439965	mg/kg	6/ 6	391	222	587	604	587	3030	No	No
Mercury	7439976	mg/kg	6/ 6	0.05	0.02	0.13	0.157	0.13	0.044	Yes	Yes
Nickel	7440020	mg/kg	6/ 6	23	12.2	37	35.2	35.2	60.7	No	No
Potassium	7440097	mg/kg	6/ 6	1690	959	2830	2940	2830	3350	No	No
Selenium	7782492	mg/kg	5/ 6	0.513	0.39	0.87	0.697	0.697	1.5	No	No
Sodium	7440235	mg/kg	5/ 6	72	64.2	101	88.4	88.4	145	No	No
Thallium	7440280	mg/kg	4/ 6	0.516	0.47	1	0.781	0.781	0.91	Yes	Yes
Vanadium	7440622	mg/kg	6/ 6	26.6	18.9	36.4	34.3	34.3	37.6	No	No
Zinc	7440666	mg/kg	6/ 6	66.8	40.3	82.7	80.2	80.2	93.3	No	No
Organics-Explosives											
Nitrobenzene	98953	mg/kg	1/ 6	0.0467	0.03	0.03	0.0534	0.03	--	--	Yes
Tetryl	479458	mg/kg	1/ 6	0.0883	0.03	0.03	0.112	0.03	--	--	Yes

Table 2A-4. Explosive SRCs Detected in Surface Soil (0-1 ft bgs) at ODA2

Analyte (mg/kg)	Station					
	DA2-125	DA2-126	DA2-127	DA2-128	DA2-129	DA2-130
2-Amino-4,6-Dinitrotoluene	0.1 U	0.1 U	0.1 U	0.1 U	0.04 J	0.1 U
4-Amino-2,6-Dinitrotoluene	0.1 U	0.1 U	0.1 U	0.1 U	0.03 J	0.1 U
Nitrobenzene	0.1 UJ	0.03 J	0.02 J	0.1 UJ	0.02 J	0.1 U
Tetryl	0.2 U	0.2 U	0.01 J	0.2 U	0.23 J	0.2 U

J - estimated value less than reporting limits.
U - Not detected

Inorganics

Twenty-two inorganic constituents were detected in surface soil samples collected during the Supplemental Phase II RI (Table 2A-2). Fourteen of these constituents were identified as SRCs (Table 2A-5). Calcium, iron, magnesium, potassium, and sodium were eliminated as these constituents are essential nutrients. Antimony and selenium were not detected above their respective background concentrations. Cadmium and thallium are considered SRCs because background criteria are zero.

Table 2A-5. Inorganic SRCs Detected in Surface Soil (0-1 ft bgs) at ODA2

Analyte (mg/kg)	Station					
	DA2-125	DA2-126	DA2-127	DA2-128	DA2-129	DA2-130
Aluminum	14600=	12700 =	9400 =	18400 =#	8100 =	10800 =
Arsenic	8.5 J	8.7 =	11.4 =	19.4 J#	16.1 =#	8.2 J
Barium	61.3 J	80.8 J	92.1 J#	132 J#	51.7 J	46.1 J
Cadmium	0.05 J#	0.02 U	0.33 =#	0.73 =#	0.91 =#	0.18 =#
Chromium	21.9 =#	16.6 =	14.5 =	23.9 =#	14 =	28.7 =#
Cobalt	10.4 =	12.1 =#	9 =	18.3 =#	9.7 =	8 =
Copper	13.5 =	22.1 J#	31.2 J#	25.3 =#	175 J#	23.2 =#
Lead	15.6 =	15.7 =	24.5 =	32.3 =#	32.3 =#	36.8 =#
Manganese	702 =	971 D=	760 =	2890 =#	454 =	311 =
Mercury	0.04 =#	0.04 =#	0.07 =#	0.08 =#	2.4 =#	0.07 =#
Nickel	15.2 =	14.1 =	14.8 =	22.9 =#	16.8 =	19.5 =
Thallium	0.36 J#	0.98 U	0.48 U	0.49 U	0.47 U	0.31 U
Vanadium	23.7 J	24.3 =	17.7 =	40.1 J#	15.6 =	19.5 J
Zinc	61.3 =	63.9 =#	87.9 =#	101 =#	199 =#	72.6 =#

J - estimated value less than reporting limits.
U - Not detected
= - analyte present and concentration accurate
- value above Facility-Wide background

Aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, vanadium, and zinc were detected at all Supplemental Phase II locations. DA2-128 had the most detections of inorganics above background (13). The other sample locations ranged from 6 to 4 constituents above background. The most pervasive inorganic constituents in Supplemental Phase II samples were mercury, cadmium, copper, and zinc. Figure 2A-3 illustrates results for SRCs in supplemental Phase II RI surface soil samples. It is noted that miscellaneous inorganics are present

above background concentrations in the Supplemental Phase II RI samples collected; however, no substantial data gaps have been identified.

2A.3.2.2 Subsurface Soil (1-3 ft)

Explosives

Two explosives compounds were detected in the Supplemental Phase II ODA2 discrete subsurface soil samples (nitrobenzene at DA2-126 and tetryl at DA2-129) (Table 2A-6). Both detections of nitrobenzene and tetryl were blow reporting limits. The extent of explosive compounds at ODA2 has been defined to below reporting limits with the additional Supplemental Phase II RI data collected.

Table 2A-6. Explosive SRCs Detected in Subsurface Soil (1-3 ft bgs) at ODA2

Analyte (mg/kg)	Station					
	DA2-125	DA2-126	DA2-127	DA2-128	DA2-129	DA2-130
Nitrobenzene	0.1 UJ	0.03 J	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ
Tetryl	0.2U	0.2U	0.2 U	0.2 U	0.03 J	0.2 U

J - estimated value less than reporting limits.
U - Not detected

Inorganics

Twenty-two inorganic constituents were detected in subsurface soil samples collected during the Supplemental Phase II RI (Table 2A-3). Eight of these constituents were identified as SRCs (Table 2A-7). DA2-128 had the most detections of inorganics above background (5). The most pervasive inorganic constituent in the subsurface Supplemental Phase II samples was cadmium. Figure 2A-4 illustrates the results for inorganic SRCs in Supplemental Phase II RI subsurface soil samples.

Table 2A-7. Inorganic SRCs Detected in Subsurface Soil (1-3 ft bgs) at ODA2

Analyte (mg/kg)	Station					
	DA2-125	DA2-126	DA2-127	DA2-128	DA2-129	DA2-130
Aluminum	20500 =#	11700 =	9570 =	20000 =#	16500 =	12700 =
Arsenic	15.1 J	13.5 =	11 J	20.4 J#	16.6 J	11.8 J
Beryllium	1.2 =#	0.68 =	0.38 =	0.93 =#	0.64 =	0.45 =
Cadmium	0.02 U	0.07 J#	0.01 U	0.01 U	0.06 =#	0.05 =#
Chromium	29.1 =#	19.3 =	13.5 =	27.8 =#	25 =	18.9 =
Lead	15 =	28.4 =#	10.5 =	18.9 =	14 =	12.4 =
Mercury	0.02 J	0.06 =#	0.03 J	0.02 J	0.13 =#	0.04 =
Thallium	0.76 J	0.48 U	0.27 U	1 J#	0.49 J	0.47 J

J - estimated value less than reporting limits.
U - Not detected
= - analyte present and concentration accurate
- value above Facility-Wide background

2A.4 QUALITATIVE RISK EVALUATION

This qualitative risk evaluation provides an analysis of the impact of the Supplemental Phase II soil data on the conclusions of the HHRA and SERA presented in the *Final Open Demolition Area #2 Phase II Remedial Investigation Report* (RIR) (USACE 2005).

Tables 2A-8 and 2A-9 provide summary statistics and identification of SRCs and chemicals of potential concern (COPCs) for (1) the soil data sets used in the RIR and (2) revised soil data sets including both the original RIR data and the Supplemental Phase II data collected in November 2005. The impact of including the supplemental data on the conclusions of the HHRA and SERA are summarized below. The impact of inclusion of the supplemental data falls into three categories:

1. Chemicals that are essentially unchanged by the addition of the new data;

2. SRCs/COPCs that differ between the original RIR data set and the combined RIR and supplemental data set; and

3. New chemicals detected in the supplemental data but not detected in the RIR data set.

Chemicals in each of these three categories are summarized below for shallow surface soil (0-1 ft bgs) and subsurface soil (1-3 ft bgs). No deep surface soil (0-3 ft bgs) aggregate was evaluated for ODA2 because the National Guard Trainee was not evaluated at ODA2 and the deep surface soil aggregate is not evaluated for ecological receptors.

2A.4.1 Shallow Surface Soil (0-1 ft bgs)

Summary statistics for shallow surface soil (0-1 ft bgs) data are provided in Table 2A-8. The impact of inclusion of the supplemental data on the conclusions of the HHRA and SERA is summarized in the following sections.

2A.4.1.1 Chemicals that are Essentially Unchanged

Forty-one chemicals were detected in shallow surface soil (0-1 ft bgs) data in the RIR. For 39 of these 41 chemicals the identification of SRCs and COPCs does not change as a result of adding the supplemental data. For these 39 chemicals the exposure point concentration (EPC; 95% UCL or maximum detected concentration [MDC]) reported in the RIR is very similar the EPC calculated with the supplemental data included (i.e., using two significant figures, the ratios of the revised EPC/original EPC range from 0.92 to 1.1). Chemicals with EPCs that decrease, increase, and stay the same are listed below:

- The EPCs for 5 chemicals (cadmium, calcium, copper, mercury, and silver) are slightly lower with the supplemental data included (revised EPC/original EPC range from 0.92 to 0.93). Neither calcium (an essential nutrient) nor silver were identified as COPCs in the original or supplemental data. The maximum hazard quotient (HQ; 0.0016) and maximum incremental

lifetime cancer risk (ILCR; 3.1E-11) for the other three of these metals were well below acceptable levels using the old (higher) EPC; therefore, this reduction in the EPC does not change the conclusions of the HHRA.

- The EPC for 1 chemical (manganese) is slightly larger with the supplemental data included (revised EPC/original EPC = 1.1). The maximum HQ (0.0082) was well below acceptable levels using the old (lower) EPC; therefore, this slight increase in EPC does not change the conclusions of the HHRA. Manganese was retained as a chemical of potential ecological concern (COPEC) in the RIR; therefore, inclusion of the supplemental data would not change the conclusions of the SERA.

- The EPCs for the remaining 33 chemicals are unchanged (revised EPC/original EPC = 1.0).

The conclusions of the HHRA and SERA are unchanged for these 39 chemicals.

2A.4.1.2 SRCs/COPCs that Differ

Results for two chemicals differ between the shallow surface soil (0-1 ft bgs) data included in the RIR and the supplemental data.

Antimony: The MDC of antimony reported in the RIR (2.2 mg/kg) was above the background criterion (0.96 mg/kg); however, antimony was detected in only 3 of 63 samples and was not identified as an SRC due to low frequency of detection. The MDC of antimony reported in the supplemental data remains 2.2 mg/kg and the frequency of detection increases to 7 of 68; therefore, inclusion of the supplemental data results in antimony being identified as an SRC. The MDC is less than $1/10^{th}$ the Region 9 residential (3.1 mg/kg); therefore, antimony is considered an SRC but not a COPC and its inclusion does not change the conclusions of the HHRA. The MDC of antimony is also less than the ESV (5 mg/kg from Efroymson et al. 1997); therefore, antimony is not identified as a COPEC and inclusion of the supplemental data does not change the conclusions of the SERA.

Vanadium: The MDC of vanadium reported in the RIR (38 mg/kg) was just above the background criterion (31 mg/kg) but below $1/10^{th}$ the Region 9 PRG (55 mg/kg); therefore, vanadium was considered an SRC but not a COPC. The HHRA for ODA2 was completed in July 2004. The Region 9 residential PRG changed in October 2004. The MDC of vanadium reported in the supplemental data (40.1 mg/kg) is above the background criterion and above $1/10^{th}$ the revised Region 9 PRG (7.8 mg/kg); therefore, vanadium is identified as a COPC due to the change in the PRG value rather than as a result of inclusion of the supplemental data. The EPC for vanadium (20.4 mg/kg) including the supplemental data is less than background. Both the EPC and the MDC for vanadium are less than $1/10^{th}$ the Region 9 PRG for an industrial worker (100 mg/kg). The cleanup goal for vanadium would not be less than the background concentration and the EPC is less than background; therefore, inclusion of vanadium as a COPC would not change the conclusions of the HHRA (i.e., vanadium would not be a chemical of

concern [COC] for evaluation of alternatives). Vanadium was previously retained as a COPEC in the RIR; therefore, inclusion of the supplemental data would not change the conclusions of the SERA.

The conclusions of the HHRA and SERA are unchanged for antimony and vanadium.

2A.4.1.3 New chemicals detected in the Supplemental Data Only

Two chemicals were detected in the supplemental data but not in the original RIR data.

Thallium: This metal was not detected in the RIR data but was detected in 1 of 6 supplemental surface soil samples. No background concentration is available for thallium in surface soil. The MDC (0.36 mg/kg) is less than $1/10^{th}$ the Region 9 residential PRG (0.52 mg/kg); therefore, thallium is identified as an SRC but not a COPC. The MDC is also less than the ecological screening value (ESV; 1 mg/kg from Efroymson et al. 1997); therefore, thallium is not identified as a COPEC. A background criterion is available for thallium in subsurface soil (0.91 mg/kg). Because (1) the soil is highly disturbed at ODA2 and the surface soil MDC is well below this subsurface background concentration for thallium, (2) thallium was detected in only 1 of 69 surface soil samples at ODA2, and (3) it is present below both human health and ecological screening values, it is unlikely to be site related and the conclusions of the HHRA and SERA are not affected.

Nitrobenzene: This high explosive (HE) was not detected in the original RIR data but was detected in 3 of 6 supplemental shallow surface soil samples. The MDC (0.03 mg/kg) is less than $1/10^{th}$ the Region 9 residential PRG (2.0 mg/kg); therefore, nitrobenzene is identified as an SRC but not a COPC. The MDC is also less than the ESV (40 mg/kg from Efroymson et al. 1997); therefore, nitrobenzene is not identified as a COPEC. Because nitrobenzene was detected below both human health and ecological screening values inclusion of the supplemental data does not change the conclusions of the HHRA or the SERA.

The conclusions of the HHRA and SERA are unchanged by inclusion of thallium and nitrobenzene.

2A.4.1.4 Risk Assessment Conclusions for Supplemental Shallow Surface Soil Data

Based on evaluation of the original and revised data sets, inclusion of the supplemental data would not change the conclusions of the HHRA or SERA for shallow surface soil (0-1 ft bgs) at ODA2.

2A.4.2 Subsurface Soil (1-3 ft bgs)

Summary statistics for subsurface soil (1-3 ft bgs) data are provided in Table 2A-9. Subsurface soil was not evaluated in the HHRA because the one receptor evaluated at ODA2 (Security Guard/Maintenance Worker) is only exposed to shallow surface soil (0-1 ft bgs). The impact of inclusion of the supplemental data on the conclusions of the SERA is summarized in the following sections.

2A.4.2.1 Chemicals that are Essentially Unchanged

Thirty-eight chemicals were detected in subsurface (1-3 ft bgs) soil data in the RIR. For 34 of these chemicals the identification of SRCs does not change as a result of adding the supplemental data. For these 34 chemicals the EPC (95% UCL or MDC) reported in the RIR is very similar to the EPC calculated with the supplemental data included in the data set (i.e., using two significant figures, the ratio of the revised EPC/original EPC range from 0.90 to 1.2). Chemicals with EPCs that increase, decrease, and stay the same are listed below:

- The EPCs for 5 chemicals (cadmium; copper; mercury; zinc; and tetryl) are slightly lower with the supplemental data included (revised EPC/original EPC range from 0.91 to 0.94).

- The EPCs for 3 chemicals (potassium, sodium, and vanadium) are slightly larger with the supplemental data included (revised EPC/original EPC range from 1.1 to 1.2): however, the MDCs for all three of these metals are below background so they are not SRCs.

- The EPCs for the remaining 26 chemicals are unchanged (revised EPC/original EPC = 1.0).

The conclusions of the SERA would be unchanged for these 34 chemicals.

2A.4.2.2 SRCs/COPCs that Differ

Results for four chemicals differ between the subsurface soil (1-3 ft bgs) data included in the RIR and the supplemental data.

Aluminum: The MDC of aluminum reported in the RIR (18,900 mg/kg) was just below the background criterion (19,500 mg/kg); therefore, aluminum was not an SRC. The MDC of aluminum reported in the supplemental data (20,500 mg/kg) is just above the background criterion; therefore, inclusion of the supplemental data results in aluminum being identified as an SRC. The USEPA recommends that aluminum not be considered an ecological COC for soils with a pH > 5.5. Measured soil pH at ODA2 ranges from 7.0 to 8.7 (USACE, 2005, Appendix A); therefore, inclusion of the supplemental data would not change the conclusions of the SERA.

Antimony: The MDC of antimony reported in the RIR (2.2 mg/kg) was above the background criterion (0.96 mg/kg); however, antimony was detected in only 1 of 62 samples and was not identified as an SRC due to low frequency of detection. The MDC of antimony reported in the supplemental data remains 2.2 mg/kg and the frequency of detection increases to 6 of 68; therefore, inclusion of the supplemental data results in antimony being identified as an SRC. The MDC is lower than the ESV (5 mg/kg from Efroymson et al. 1997); therefore, antimony is not identified as a COPEC and inclusion of the supplemental data does not change the conclusions of the SERA.

Beryllium: The MDC of beryllium reported in the RIR (0.87 mg/kg) was just below the background criterion (0.88 mg/kg); therefore, beryllium was not considered an SRC. The MDC of beryllium reported in the supplemental data (1.2 mg/kg) is above the background criterion; therefore, inclusion of the supplemental data results in beryllium being identified as an SRC. The MDC is lower than the ESV (10 mg/kg from Efroymson et al. 1997); therefore, beryllium is not identified as a COPEC and inclusion of the supplemental data does not change the conclusions of the SERA.

Chromium: The MDC of chromium reported in the RIR (25 mg/kg) was just below the background criterion (27 mg/kg); therefore, chromium was not considered an SRC. The MDC of chromium reported in the supplemental data (29.1 mg/kg) is above the background criterion; therefore, inclusion of the supplemental data results in chromium being identified as an SRC. The MDC exceeds the ESV (0.4 mg/kg from Efroymson et al. 1997); therefore, chromium is identified as a COPEC. Because hexavalent chromium (which has the same ESV) was previously retained as COPEC, inclusion of the supplemental data does not change the conclusions of the SERA.

The conclusions of the SERA are unchanged for these four metals as discussed above. The EPCs for these 4 metals, including the supplemental data, are less than background. The cleanup goals for these metals would not be less than the background concentration; therefore, inclusion of these metals as SRCs would not change the conclusions of the feasibility study (FS).

2A.4.2.3 New Chemicals Detected in the Supplemental Data Only

Two chemicals were detected in the supplemental data but not in the original RI data.

Thallium: This metal was not detected in the RIR data but was detected in 4 of 6 supplemental subsurface soil samples. The MDC (1 mg/kg) is slightly above the background criterion (0.91 mg/kg); therefore, thallium is identified as an SRC. Because the MDC is equal to the ESV (1 mg/kg), thallium is not identified as a COPEC and inclusion of the supplemental data does not change the conclusions of the SERA.

Nitrobenzene: This HE was not detected in the RIR data but was detected in 1 of 6 supplemental samples. The MDC (0.03 mg/kg) is less than the ESV (40 mg/kg); therefore, nitrobenzene is not identified as a COPEC and inclusion of the supplemental data does not change the conclusions of the SERA.

The conclusions of the HHRA and SERA are unchanged by inclusion of thallium and nitrobenzene.

2A.4.2.4 Risk Assessment Conclusions for Supplemental Subsurface Soil Data

Based on evaluation of the original and revised data sets, inclusion of the supplemental data would not change the conclusions of the SERA for subsurface soil (1-3 ft bgs) at ODA2. Subsurface soil was not evaluated in the HHRA for ODA2.

1 **Table 2A-8. Summary of RIR and Supplemental Phase II Shallow Surface Soil (0-1 ft bgs) Data: Open Demolition Area2**

Chemical	CAS Number	Site Background Criteria[a]	Region 9 Res PRG[b]	Data included in Phase II RI Report (USACE 2005)							
				Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[c]?	COPC[d]?
					Min	Ave	Max				
Inorganics											
Aluminum	7429905	18000	7600	63/63	4000	11000	23000	12000	12000	Yes	Yes
Antimony	7440360	0.96	3.1	3/63	1.4	0.28	2.2	0.36	0.36	No	No
Arsenic	7440382	15	0.39	63/63	3.5	13	20	14	14	Yes	Yes
Barium	7440393	88	540	63/63	31	79	180	85	85	Yes	No
Beryllium	7440417	0.88	15	63/63	0.27	0.59	1.5	0.63	0.63	Yes	No
Cadmium	7440439	0	3.7	61/63	0.12	1.2	9.5	1.5	1.5	Yes	Yes
Calcium	7440702	16000	NA	63/63	230	2400	34000	3500	3500	No	No
Chromium	7440473	17	210	63/63	6.8	16	61	18	18	Yes	No
Chromium, Hexavalent	18540299	0	22	2/6	8.0	7.6	28	16	16	Yes	Yes
Cobalt	7440484	10	140	63/63	4.1	8.5	25	9.1	9.1	Yes	No
Copper	7440508	18	310	63/63	8.3	110	1200	150	150	Yes	Yes
Iron	7439896	23000	2300	63/63	10000	24000	39000	25000	25000	No	No
Lead	7439921	26	400	63/63	12	33	220	40	40	Yes	No
Magnesium	7439954	3000	None	63/63	1200	2600	5300	2700	2700	No	No
Manganese	7439965	1500	180	63/63	120	520	2100	600	600	Yes	Yes
Mercury	7439976	0.036	2.3	51/63	0.060	0.68	9.9	1.3	1.3	Yes	Yes
Nickel	7440020	21	160	63/63	7.6	18	31	20	20	Yes	No
Nitrate/Nitrite	N599	0	NA	2/6	4.0	2.1	5.1	3.7	3.7	Yes	Yes
Potassium	7440097	930	NA	63/63	400	1100	2500	1100	1100	No	No
Selenium	7782492	1.4	39	6/63	0.86	0.36	1.9	0.44	0.44	Yes	No
Silver	7440224	0	39	1/63	0.32	0.050	0.32	0.061	0.061	No	No
Sodium	7440235	120	NA	6/63	68	35	220	42	42	No	No
Sulfide	18496258	0	NA	6/6	52	530	2200	23000	2200	Yes	Yes
Thallium	7440280	0	0.52	0/63	NA	NA	NA	NA	NA	No	No
Vanadium	7440622	31	55/7.8[c]	63/63	7.8	19	38	20	20	Yes	No[e]
Zinc	7440666	62	2300	63/63	49	140	560	160	160	Yes	No

Table 2A-8. Summary of RIR and Supplemental Phase II Shallow Surface Soil (0-1 ft bgs) Data: Open Demolition Area2 (continued)

Chemical	CAS Number	Site Background Criteria[a]	Region 9 Res PRG[b]	Data included in Phase II RI Report (USACE 2005)							
				Freq of Detect	Measured Concentration			95% UCL	EPC	SRC[c]?	COPC[d]?
					Min	Ave	Max				
Organic Explosives											
1,3,5-Trinitrobenzene	99354	NA	180	1/63	0.086	0.051	0.086	0.052	0.052	Yes	No
2,4,6-Trinitrotoluene	118967	NA	3.1	6/63	0.068	0.14	3.2	0.23	0.23	Yes	Yes
2,4-Dinitrotoluene	121142	NA	0.72	2/63	0.13	0.054	0.21	0.059	0.059	Yes	No
2-Amino-4,6-Dinitrotoluene	35572782	NA	NA	4/63	0.065	0.060	0.39	0.070	0.070	Yes	Yes
4-Amino-2,6-Dinitrotoluene	19406510	NA	NA	4/63	0.056	0.057	0.25	0.063	0.063	Yes	Yes
HMX	2691410	NA	310	2/63	0.12	0.11	0.58	0.12	0.12	Yes	No
Nitrobenzene	98953	NA	2.0	0/63	NA	NA	NA	NA	NA	No	No
Nitroglycerine	55630	NA	35	2/63	7.2	5.4	31	6.1	6.1	Yes	No
RDX	121824	NA	4.4	1/63	0.15	0.10	0.15	0.10	0.10	Yes	No
Tetryl	479458	NA	61	16/63	0.12	0.65	18	1.1	1.1	Yes	No
Organic Pesticides											
4,4-DDD	72548	NA	2.4	1/6	0.026	0.0051	0.026	0.014	0.014	Yes	No
Organic Semivolatiles											
Bis(2-ethylhexyl)phthalate	117817	NA	35	2/6	0.022	0.15	0.10	0.21	0.10	Yes	No
di-n-Butyl Phthalate	84742	NA	610	2/6	0.15	0.30	0.86	0.52	0.52	Yes	No
n-Nitrosodiphenylamine	86306	NA	99	1/6	0.10	0.18	0.10	0.21	0.10	Yes	No
Organic Volatiles											
2-Butanone	78933	NA	730	1/6	0.0089	0.0063	0.0089	0.0074	0.0074	Yes	No
Acetone	67641	NA	160	1/6	0.019	0.018	0.019	0.026	0.019	Yes	No
Tetrachloroethylene	127184	NA	1.5	3/6	0.0037	0.0035	0.0048	0.0043	0.0043	Yes	No

Table 2A-8. Summary of RIR and Supplemental Phase II Shallow Surface Soil (0-1 ft bgs) Data: Open Demolition Area2 (continued)

Chemical	CAS Number	Site Background Criteria[a]	Region 9 Res PRG[b]	Data included in RI report plus Supplemental Data collected Nov 2005								Revised EPC/ RIR EPC
				Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[c]?	COPC[d]?	
					Min	Ave	Max					
Inorganics												
Aluminum	7429905	18000	7600	69/ 69	4020	11200	23400	11900	11900	Yes	Yes	1.0
Antimony	7440360	0.96	3.1	7/ 68	0.33	0.291	2.2	0.371	0.371	Yes	No	1.0
Arsenic	7440382	15	0.39	69/ 69	3.5	13	20	13.6	13.6	Yes	Yes	1.0
Barium	7440393	88	540	69/ 69	31	78	175	84.6	84.6	Yes	No	1.0
Beryllium	7440417	0.88	15	69/ 69	0.27	0.59	1.5	0.632	0.632	Yes	No	1.0
Cadmium	7440439	0	3.7	66/ 69	0.05	1.1	9.5	1.38	1.38	Yes	Yes	0.92
Calcium	7440702	16000	NA	69/ 69	234	2300	34100	3250	3250	No	No	0.93
Chromium	7440473	17	210	69/ 69	6.8	17	61	18	18	Yes	No	1.0
Chromium, Hexavalent	18540299	0	22	2/ 6	8	7.6	28	16	16	Yes	Yes	1.0
Cobalt	7440484	10	140	69/ 69	4.1	8.8	25	9.34	9.34	Yes	No	1.0
Copper	7440508	18	310	69/ 69	8.3	101	1210	139	139	Yes	Yes	0.93
Iron	7439896	23000	2300	69/ 69	10200	23600	39300	24700	24700	No	No	1.0
Lead	7439921	26	400	69/ 69	12.1	33	218	39.1	39.1	Yes	No	1.0
Magnesium	7439954	3000	None	69/ 69	1150	2520	5340	2690	2690	No	No	1.0
Manganese	7439965	1500	180	69/ 69	115	562	2890	654	654	Yes	Yes	1.1
Mercury	7439976	0.036	2.3	57/ 69	0.04	0.66	9.9	1.19	1.19	Yes	Yes	0.92
Nickel	7440020	21	160	69/ 69	7.6	18	31	19.4	19.4	Yes	No	1.0
Nitrate/Nitrite	N599	0	NA	2/ 6	4	2.1	5.1	3.7	3.7	Yes	Yes	1.0
Potassium	7440097	930	NA	69/ 69	399	1050	2510	1120	1120	No	No	1.0
Selenium	7782492	1.4	39	10/ 69	0.35	0.37	1.9	0.446	0.446	Yes	No	1.0
Silver	7440224	0	39	1/ 67	0.32	0.047	0.32	0.0568	0.0568	No	No	0.93
Sodium	7440235	120	NA	9/ 69	67.7	37	223	43.1	43.1	No	No	1.0
Sulfide	18496258	0	NA	6/ 6	52	529	2200	22700	2200	Yes	Yes	1.0
Thallium	7440280	0	0.52	1/ 69	0.36	0.46	0.36	0.528	0.36	Yes	No	NA
Vanadium	7440622	31	55/7.8[c]	67/ 67	7.8	19	40	20.4	20.4	Yes	Yes[e]	1.0
Zinc	7440666	62	2300	69/ 69	49.2	134	557	155	155	Yes	No	1.0

1 **Table 2A-8. Summary of RIR and Supplemental Phase II Shallow Surface Soil (0-1 ft bgs) Data: Open Demolition Area2 (continued)**

Chemical	CAS Number	Site Background Criteria[a]	Region 9 Res PRG[b]	Data included in RI report plus Supplemental Data collected Nov 2005								Revised EPC/ RIR EPC
				Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[c]?	COPC[d]?	
					Min	Ave	Max					
Organic Explosives												
1,3,5-Trinitrobenzene	99354	NA	180	1/ 69	0.086	0.051	0.086	0.051	0.051	Yes	No	1.0
2,4,6-Trinitrotoluene	118967	NA	3.1	6/ 69	0.068	0.13	3.2	0.22	0.22	Yes	Yes	1.0
2,4-Dinitrotoluene	121142	NA	0.72	2/ 69	0.13	0.054	0.21	0.058	0.058	Yes	No	1.0
2-Amino-4,6-Dinitrotoluene	35572782	NA	NA	5/ 69	0.040	0.059	0.39	0.068	0.068	Yes	Yes	1.0
4-Amino-2,6-Dinitrotoluene	19406510	NA	NA	5/ 69	0.030	0.056	0.25	0.062	0.062	Yes	Yes	1.0
HMX	2691410	NA	310	2/ 69	0.12	0.11	0.58	0.12	0.12	Yes	No	1.0
Nitrobenzene	98953	NA	2.0	3/ 69	0.02	0.049	0.03	0.05	0.03	Yes	No	NA
Nitroglycerine	55630	NA	35	2/ 63	7.2	5.5	31	6.1	6.1	Yes	No	1.0
RDX	121824	NA	4.4	1/ 69	0.15	0.10	0.15	0.10	0.10	Yes	No	1.0
Tetryl	479458	NA	61	18/ 69	0.01	0.61	18	1.1	1.1	Yes	No	1.0
Organic Pesticides												
4,4-DDD	72548	NA	2.4	1/ 6	0.026	0.0051	0.026	0.014	0.014	Yes	No	1.0
Organic Semivolatiles												
Bis(2-ethylhexyl)phthalate	117817	NA	35	2/ 6	0.022	0.15	0.1	0.21	0.1	Yes	No	1.0
di-n-Butyl Phthalate	84742	NA	610	2/ 6	0.15	0.30	0.86	0.53	0.53	Yes	No	1.0
n-Nitrosodiphenylamine	86306	NA	99	1/ 6	0.1	0.18	0.1	0.209	0.1	Yes	No	1.0

Table 2A-8. Summary of RIR and Supplemental Phase II Shallow Surface Soil (0-1 ft bgs) Data: Open Demolition Area2 (continued)

Chemical	CAS Number	Site Background Criteria[a]	Region 9 Res PRG[b]	Data included in RI report plus Supplemental Data collected Nov 2005								Revised EPC/ RIR EPC
				Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[c]?	COPC[d]?	
					Min	Ave	Max					
Organic Volatiles												
2-Butanone	78933	NA	730	1/ 6	0.0089	0.0063	0.0089	0.0074	0.0074	Yes	No	1.0
Acetone	67641	NA	160	1/ 6	0.019	0.018	0.019	0.026	0.019	Yes	No	1.0
Tetrachloroethylene	127184	NA	1.5	3/ 6	0.0037	0.0035	0.0048	0.0043	0.0043	Yes	No	1.0

Chemical was not an SRC or COPC in the original RIR data set but is identified as an SRC and/or COPC with the Supplemental Phase II data included.

Chemical was not detected in the original RIR data set but was detected with the Supplemental Phase II data.

EPC for this chemical was larger in the original RIR data set and is reduced by the inclusion of the Supplemental Phase II data.

EPC for this chemical was smaller in the original RIR data set and is increased by the inclusion of the Supplemental Phase II data.

All units are mg/kg. COPC = Chemical of potential concern. EPC = Exposure point concentration.
PRG = Preliminary remediation goal. RIR = Remedial investigation report. SRC = Site-related contaminant.
UCL = Upper confidence limit on the mean. NA = not applicable or no data available.

[a]Background criteria for surface soil from USACE 2001. *Final Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

[b]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to a carcinogenic risk of 1E-06 or hazard index of 0.1.

[c]Chemicals are identified as SRCs if (1) they are detected in any sample (high explosives) or they are detected in at least 5% of samples (all other chemical classes), and (2) they are not essential nutrients, and (3) the maximum detected concentration (MDC) is greater than background (inorganics).

[d]Chemicals are identified as COPCs if (1) they are SRCs and (2) the MDC is greater than the Region 9 residential PRG.

[e]The MDC of vanadium reported in the HHRA completed in July 2004 was below the Region 9 PRG (55 mg/kg); therefore, vanadium was not a COPC. The Region 9 PRG changed in October 2004. The MDC of vanadium reported in the supplemental data is above the revised Region 9 PRG (7.8 mg/kg); therefore, vanadium is identified as a COPC due to the change in the PRG value rather than as a result of inclusion of the supplemental data.

1 **Table 2A-9. Summary of RIR (USACE 2005) and Supplemental Subsurface Soil (1-3 ft bgs) Data: Open Demolition Area 2**

Chemical	CAS Number	Site Background Criteria[a]	Data included in Phase II RI Report (USACE 2005)						
			Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[b]?
				Min	Ave	Max			
Inorganics									
Aluminum	7429905	19500	62/ 62	3840	10090	18900	11000	11000	No
Antimony	7440360	0.96	1/ 62	2.2	0.22	2.2	0.29	0.29	No
Arsenic	7440382	20	62/ 62	4.5	13	33	15	15	Yes
Barium	7440393	124	62/ 62	17	78	700	96	96	Yes
Beryllium	7440417	0.88	62/ 62	0.24	0.56	0.87	0.60	0.60	No
Cadmium	7440439	0	60/ 62	0.11	0.78	4.7	0.99	0.99	Yes
Calcium	7440702	35500	62/ 62	117	1860	19300	2506	2506	No
Chromium	7440473	27	62/ 62	5.1	14	25	15	15	No
Chromium, Hexavalent	18540299	0	1/ 6	16	4.6	16	9.2	9.2	Yes
Cobalt	7440484	23	62/ 62	3.6	8.2	15	8.9	8.9	No
Copper	7440508	32	62/ 62	5.2	49	445	64	64	Yes
Iron	7439896	35200	62/ 62	9550	23740	45800	25360	25360	No
Lead	7439921	19	62/ 62	5.3	21	147	25	25	Yes
Magnesium	7439954	8790	62/ 62	825	2555	11000	2832	2832	No
Manganese	7439965	3030	62/ 62	101	454	2620	555	555	No
Mercury	7439976	0.044	28/ 62	0.060	0.79	18	1.4	1.4	Yes
Nickel	7440020	61	62/ 62	6.0	18	32	20	20	No
Nitrate/Nitrite	N599	0	2/ 6	2.0	1.5	3.7	2.5	2.5	Yes
Potassium	7440097	3350	62/ 62	290	978	1990	1103	1103	No
Selenium	7782492	1.5	6/ 62	0.88	0.34	1.7	0.42	0.42	Yes
Sodium	7440235	145	2/ 62	72	27	78	30	30	No
Sulfide	18496258	0	6/ 6	50	451	1900	1054	1054	Yes
Thallium	7440280	0.91	0/ 62	NA	NA	NA	NA	NA	No
Vanadium	7440622	38	62/ 62	7.1	17	30	18	18	No
Zinc	7440666	93	62/ 62	24	144	2770	220	220	Yes

Table 2A-9. Summary of RIR (USACE 2005) and Supplemental Subsurface Soil (1-3 ft bgs) Data: Open Demolition Area 2 (continued)

Chemical	CAS Number	Site Background Criteria[a]	Data included in Phase II RI Report (USACE 2005)						
			Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[b]?
				Min	Ave	Max			
Organic Explosives									
2,4,6-Trinitrotoluene	118967	NA	9/ 62	0.040	0.075	1.3	0.11	0.11	Yes
2,4-Dinitrotoluene	121142	NA	3/ 62	0.058	0.050	0.062	0.051	0.051	Yes
2-Amino-4,6-Dinitrotoluene	35572782	NA	4/ 62	0.083	0.062	0.57	0.077	0.077	Yes
4-Amino-2,6-Dinitrotoluene	19406510	NA	5/ 62	0.070	0.064	0.43	0.077	0.077	Yes
HMX	2691410	NA	2/ 62	0.10	0.11	0.46	0.12	0.12	Yes
Nitrobenzene	98953	NA	0/ 62	NA	NA	NA	NA	NA	No
Nitroglycerine	55630	NA	1/ 62	26	5.3	26	5.9	5.9	Yes
RDX	121824	NA	3/ 62	0.10	0.11	0.52	0.13	0.13	Yes
Tetryl	479458	NA	8/ 62	0.26	0.63	22	1.2	1.2	Yes
o-Nitrotoluene	88722	NA	1/ 62	0.43	0.11	0.43	0.11	0.11	Yes
Organic Semivolatiles									
bis(2-ethylhexyl) phthalate	117817	NA	4/ 6	0.021	0.11	0.13	0.17	0.13	Yes
di-n-Butyl Phthalate	84742	NA	3/ 6	0.16	0.21	0.34	0.26	0.26	Yes
Organic Volatiles									
2-Butanone	78933	NA	1/ 6	0.012	0.0069	0.012	0.0090	0.0090	Yes
Tetrachloroethylene	127184	NA	1/ 6	0.0024	0.0028	0.0024	0.0030	0.0024	Yes
Toluene	108883	NA	1/ 6	0.0070	0.0036	0.0070	0.0050	0.0050	Yes

Table 2A-9. Summary of RIR (USACE 2005) and Supplemental Subsurface Soil (1-3 ft bgs) Data: Open Demolition Area 2 (continued)

Chemical	CAS Number	Site Backgroud Criteria[a]	Data included in RI report Plus Supplemental Data collected Nov 2005							Revised EPC/ RIR EPC
			Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[b]?	
				Min	Ave	Max				
Inorganics										
Aluminum	7429905	19500	68/ 68	3840	10500	20500	11500	11500	Yes	1.0
Antimony	7440360	0.96	6/ 67	0.32	0.236	2.2	0.3	0.3	Yes	1.0
Arsenic	7440382	20	68/ 68	4.5	13.4	32.6	14.8	14.8	Yes	1.0
Barium	7440393	124	68/ 68	16.6	76.8	700	93.8	93.8	Yes	1.0
Beryllium	7440417	0.88	68/ 68	0.24	0.575	1.2	0.616	0.616	Yes	1.0
Cadmium	7440439	0	63/ 68	0.05	0.712	4.7	0.909	0.909	Yes	0.92
Calcium	7440702	35500	68/ 68	117	1800	19300	2390	2390	No	1.0
Chromium	7440473	27	68/ 68	5.1	14.6	29.1	15.9	15.9	Yes	1.1
Chromium, Hexavalent	18540299	0	1/ 6	16	4.6	16	9.19	9.19	Yes	1.0
Cobalt	7440484	23	68/ 68	3.6	8.58	18.1	9.3	9.3	No	1.0
Copper	7440508	32	68/ 68	5.2	46.7	445	60.6	60.6	Yes	0.94
Iron	7439896	35200	68/ 68	9550	24000	45800	25500	25500	No	1.0
Lead	7439921	19	68/ 68	5.3	20.4	147	24.3	24.3	Yes	1.0
Magnesium	7439954	8790	68/ 68	825	2610	11000	2880	2880	No	1.0
Manganese	7439965	3030	68/ 68	101	448	2620	541	541	No	1.0
Mercury	7439976	0.044	34/ 68	0.02	0.728	18.1	1.3	1.3	Yes	0.91
Nickel	7440020	61	68/ 68	6	18.3	37	20	20	No	1.0
Nitrate/Nitrite	N599	0	2/ 6	2	1.52	3.7	2.47	2.47	Yes	1.0
Potassium	7440097	3350	68/ 68	290	1040	2830	1170	1170	No	1.1
Selenium	7782492	1.5	11/ 68	0.39	0.356	1.7	0.429	0.429	Yes	1.0
Sodium	7440235	145	7/ 68	64.2	31.2	101	35.1	35.1	No	1.2
Sulfide	18496258	0	6/ 6	50	451	1900	1050	1050	Yes	1.0
Thallium	7440280	0.91	4/ 68	0.47	0.439	1	0.512	0.512	Yes	NA
Vanadium	7440622	38	66/ 66	7.1	18	36.4	19.4	19.4	No	1.1
Zinc	7440666	93	68/ 68	24.3	138	2770	206	206	Yes	0.94

Table 2A-9. Summary of RIR (USACE 2005) and Supplemental Subsurface Soil (1-3 ft bgs) Data: Open Demolition Area 2 (continued)

Chemical	CAS Number	Site Backgroud Criteria[a]	Data included in RI report Plus Supplemental Data collected Nov 2005							Revised EPC/ RIR EPC
			Frequency of Detect	Measured Concentration			95% UCL	EPC	SRC[b]?	
				Min	Ave	Max				
Organic Explosives										
2,4,6-Trinitrotoluene	118967	NA	9/ 68	0.04	0.0728	1.3	0.104	0.104	Yes	1.0
2,4-Dinitrotoluene	121142	NA	3/ 68	0.058	0.0504	0.062	0.0509	0.0509	Yes	1.0
2-Amino-4,6-Dinitrotoluene	35572782	NA	4/ 68	0.083	0.0613	0.57	0.0748	0.0748	Yes	1.0
4-Amino-2,6-Dinitrotoluene	19406510	NA	5/ 68	0.07	0.0625	0.43	0.0749	0.0749	Yes	1.0
HMX	2691410	NA	2/ 68	0.1	0.105	0.46	0.114	0.114	Yes	1.0
Nitrobenzene	98953	NA	1/ 68	0.03	0.0497	0.03	0.0502	0.03	Yes	NA
Nitroglycerine	55630	NA	1/ 62	26	5.34	26	5.9	5.9	Yes	1.0
RDX	121824	NA	3/ 68	0.1	0.111	0.52	0.123	0.123	Yes	1.0
Tetryl	479458	NA	9/ 68	0.03	0.58	22	1.13	1.13	Yes	0.92
o-Nitrotoluene	88722	NA	1/ 68	0.43	0.105	0.43	0.113	0.113	Yes	1.0
Organic Semivolatiles										
bis(2-ethylhexyl) phthalate	117817	NA	4/ 6	0.021	0.107	0.13	0.171	0.13	Yes	1.0
di-n-Butyl Phthalate	84742	NA	3/ 6	0.16	0.205	0.34	0.261	0.261	Yes	1.0
Organic Volatiles										
2-Butanone	78933	NA	1/ 6	0.012	0.00692	0.012	0.00897	0.00897	Yes	1.0
Tetrachloroethylene	127184	NA	1/ 6	0.0024	0.00279	0.0024	0.00296	0.0024	Yes	1.0
Toluene	108883	NA	1/ 6	0.007	0.00361	0.007	0.00498	0.00498	Yes	1.0

Chemical was not an SRC or COPC in the original RIR data set but is identified as an SRC and/or COPC with the Supplemental Phase II data included.

Chemical was not detected in the original RIR data set but was detected with the Supplemental Phase II data.

EPC for this chemical was larger in the original RIR data set and is reduced by the inclusion of the Supplemental Phase II data.

EPC for this chemical was smaller in the original RIR data set and is increased by the inclusion of the Supplemental Phase II data.

All units are mg/kg. COPC = Chemical of potential concern. EPC = Exposure point concentration.
PRG = Preliminary remediation goal. RIR = Remedial investigation report. SRC = Site-related contaminant.
UCL = Upper confidence limit on the mean. NA = not applicable or no data available.
[a]Background criteria for subsurface soil from USACE 2001. Final Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio.
[b]Chemicals are identified as SRCs if (1) they are detected in any sample (high explosives) or they are detected in at least 5% of samples (all other chemical classes), and (2) they are not essential nutrients, and (3) the maximum detected concentration (MDC) is greater than background (inorganics).

2A.5 SUMMARY AND CONCLUSIONS

2A.5.1 Summary of Contaminant Nature and Extent

The results of the Supplemental Phase II RI identified one explosive (nitrobenzene) not previously detected. Sample DA2-129 has the most detections of explosives; however, this sample location is bounded by previous samples in which no explosives were detected. The detected concentrations of explosives at locations DA2-127 and DA2-126 (nitrobenzene and tetryl) are below the laboratory reporting limit. The extent of explosives in surface soil at ODA2 has been defined to reporting limits with the additional data collected. The extent of inorganic constituents was previously defined in the Phase II RI. It is noted inorganics are present above background; however, no substantial data gaps have been identified following completion of the Supplemental Phase II RI.

The areas exhibiting the greatest numbers and concentrations of explosives and inorganics have been identified and delineated. Adequate data has been collected and the uncertainties of the Phase II RI have been addressed.

2A.5.2 Summary of the Supplemental Human Health and Ecological Risk Assessments

Based on evaluation of the original (as used in the RIR [USACE 2005]) and revised (including supplemental Phase II samples) data sets, inclusion of the supplemental data would not change the conclusions of the HHRA or SERA for shallow surface soil (0-1 ft bgs) or subsurface soil (1-3 ft bgs) at ODA2.

2A.5.3 Conclusions and Recommendations

Adequate data have been collected to proceed with the Feasibility Study for ODA2.

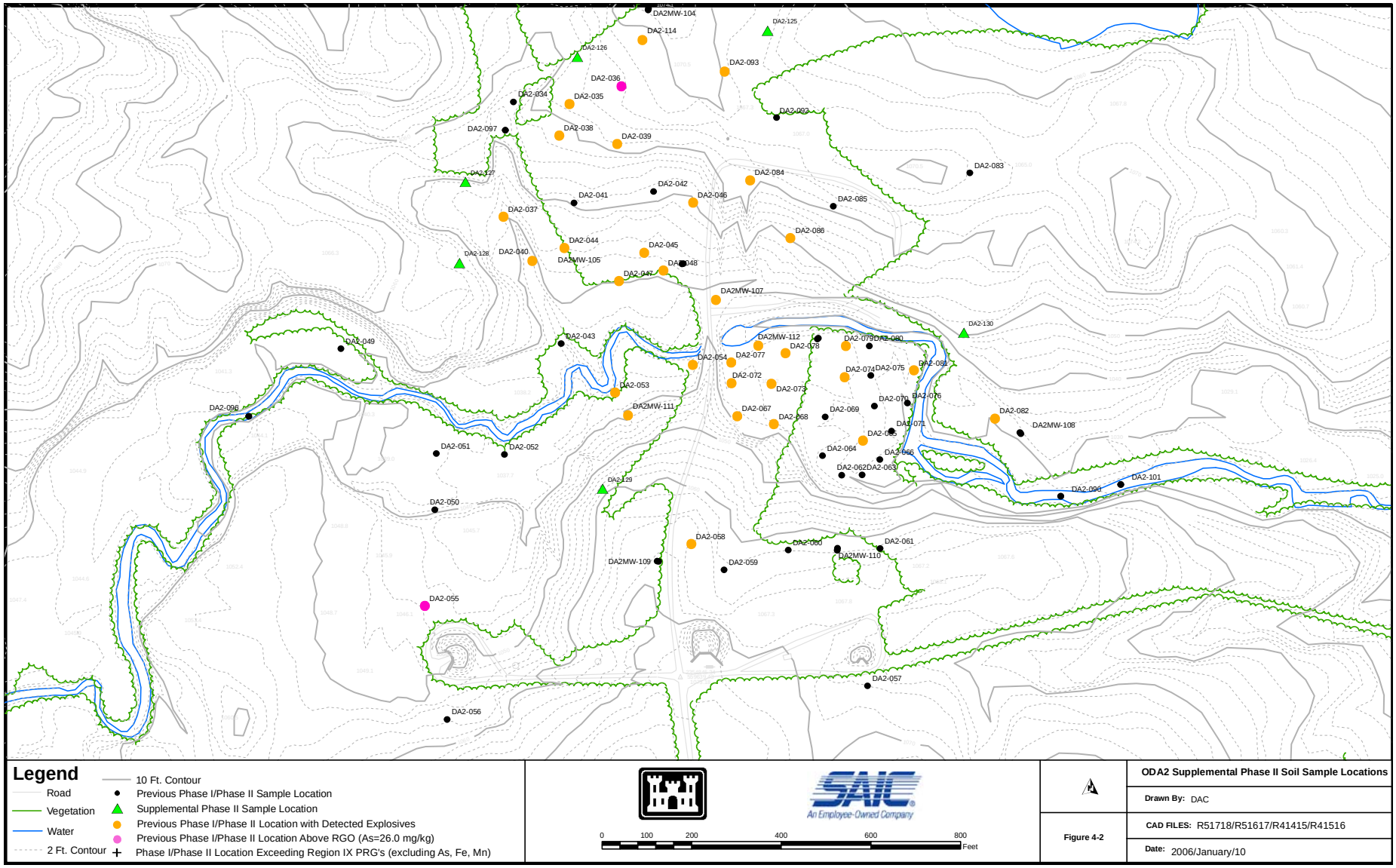
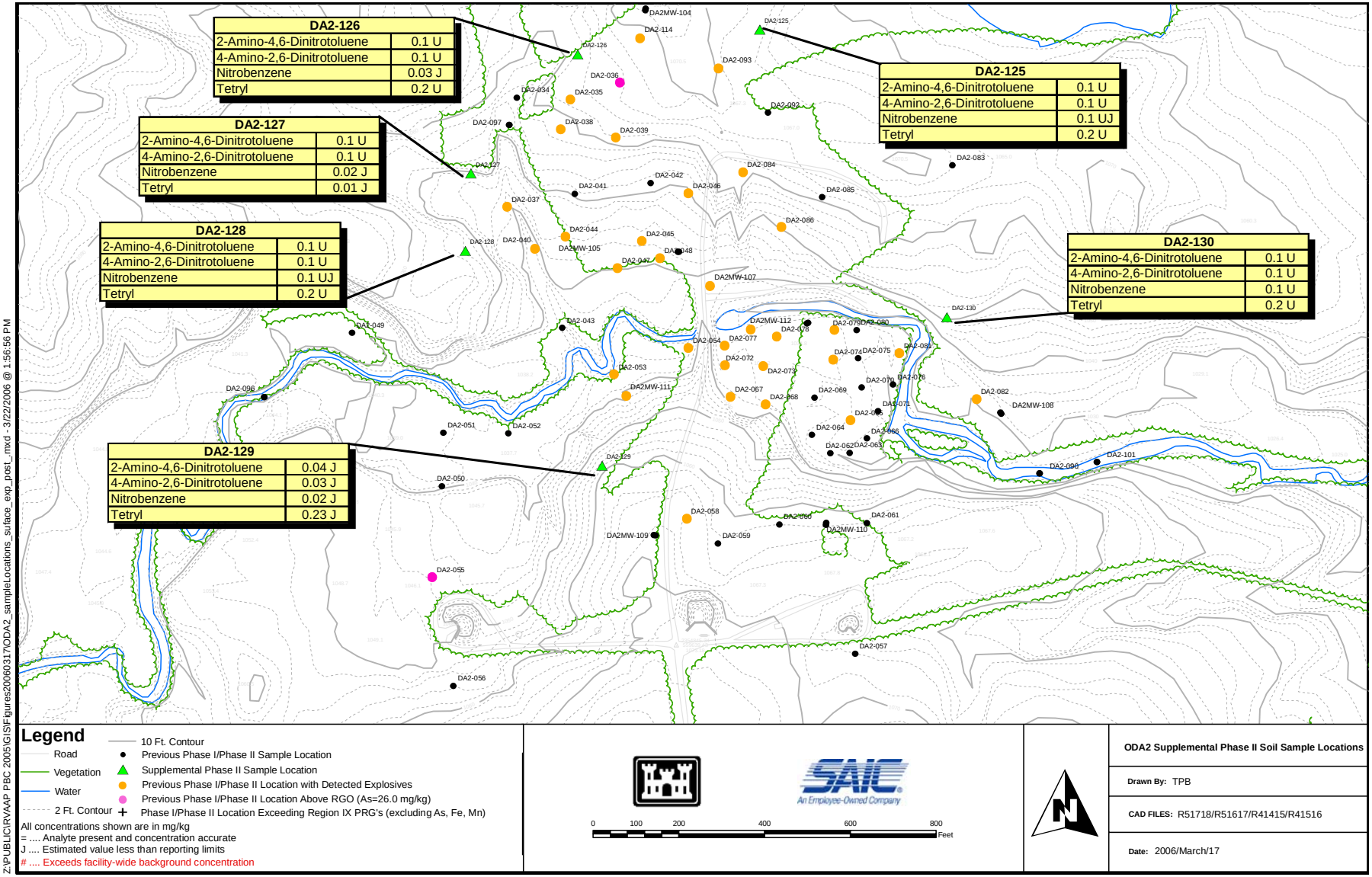
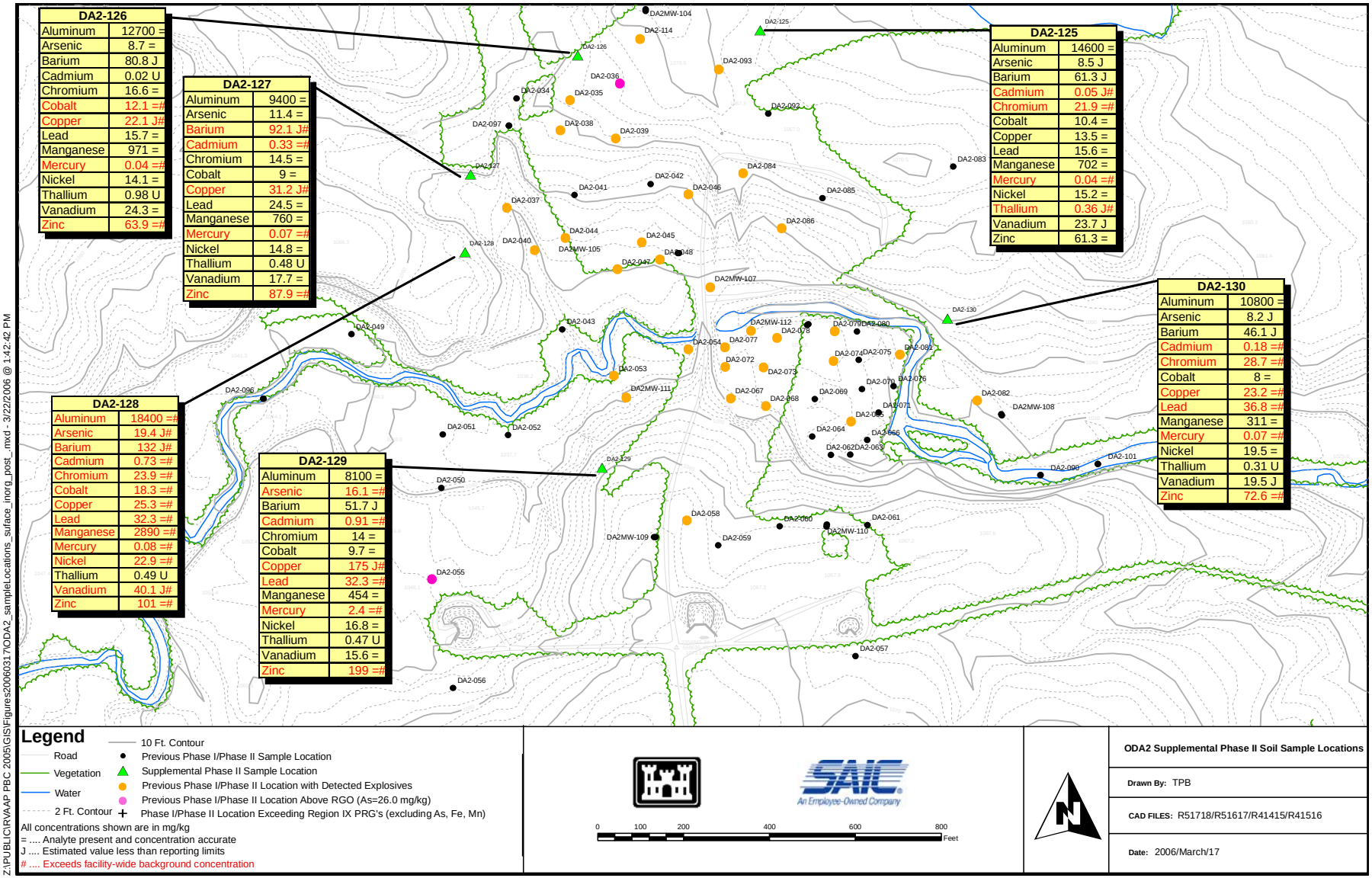


Figure 2A-1. Sample Locations at ODA2



1 **Figure 2A-2. Occurrences of Detected Explosives in Surface Soil (0-1 ft), ODA2 Supplemental Phase II RI**



1 **Figure 2A-3. Occurrences of Detected Inorganic SRCs in Surface Soil (0-1 ft), ODA2 Supplemental Phase II RI**

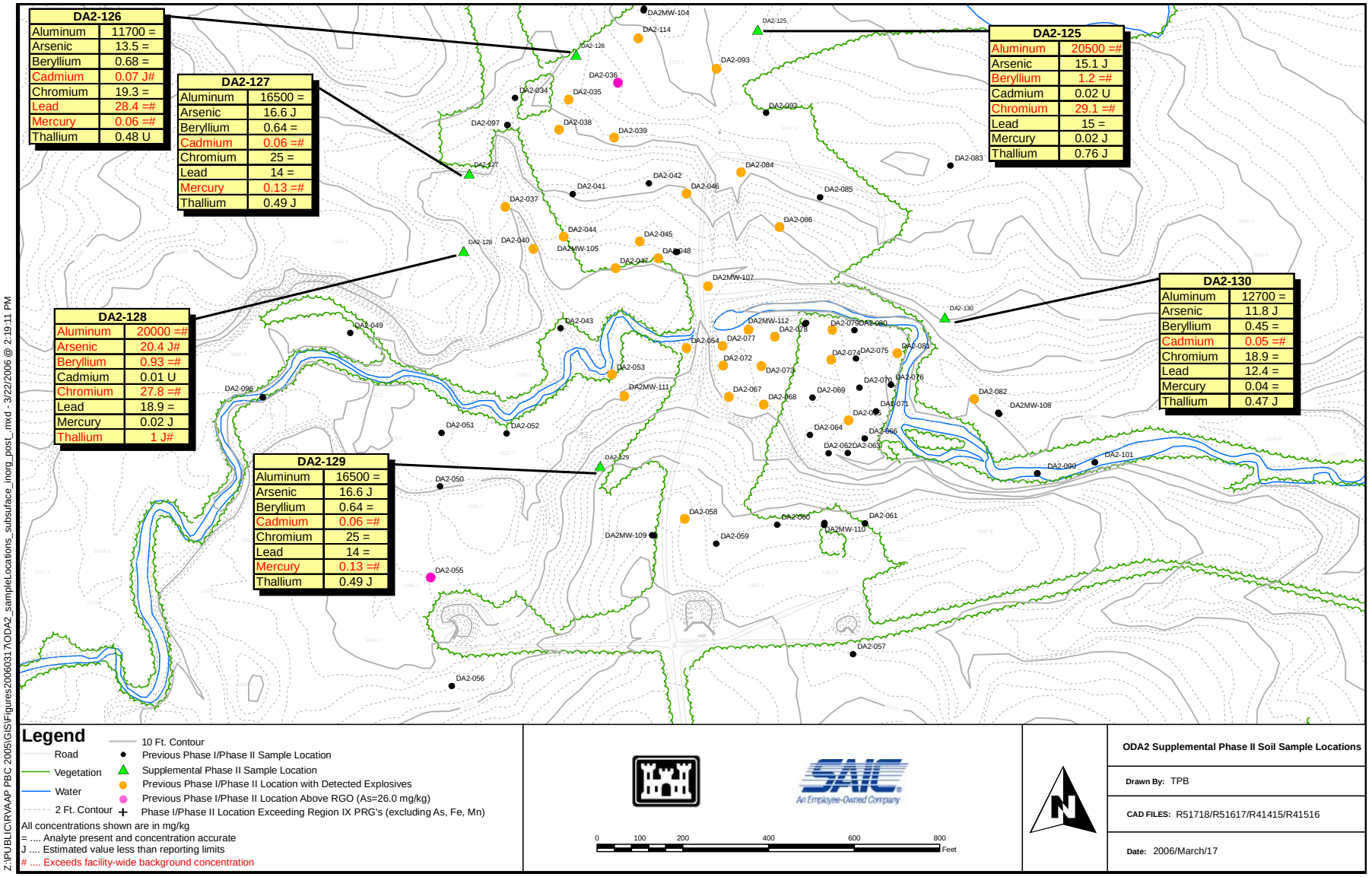


Figure 2A-4. Occurrences of Detected Inorganic SRCs in Subsurface Soil (1-3 ft), ODA2 Supplemental Phase II RI

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ATTACHMENT A

SOIL SAMPLING LOGS

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ATTACHMENT A
SOIL SAMPLING LOGS

DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

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DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

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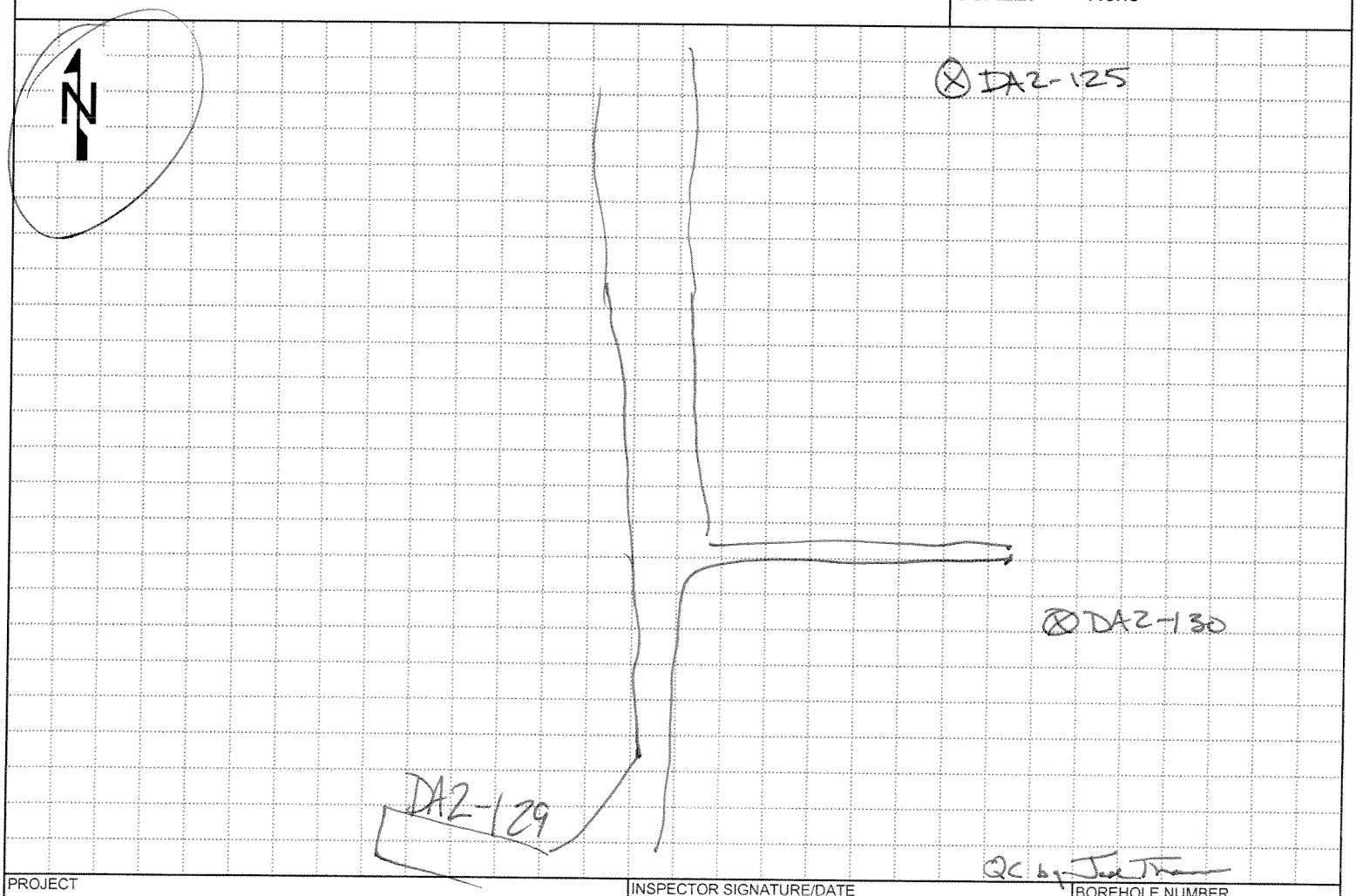
HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: DA2-125
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC-Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3-in) S.S. Bowl & Spoon BW	8. BOREHOLE LOCATION: Demolition Area 2	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1315 COMPLETED:	
	15. DEPTH GROUNDWATER ENCOUNTERED	
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
12. OVERBURDEN THICKNESS: N/A		
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3 ft.		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/15/05	DATE COMPLETED/ABANDONED: 11/15/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams	BOREHOLE NUMBER: DA2-125

HTRW DRILLING LOG (continued)

DISTRICT	BOREHOLE NUMBER
USACE - Louisville	DA2-125

1. COMPANY NAME	2. DRILL SUBCONTRACTOR	
SAIC	N/A	SHEET 2 OF 2

3. PROJECT	4. LOCATION	
Supplemental Phase II at CBP, FBQ, and ODA2	RVAAP	

5. NAME OF DRILLER	6. DIRECTION OF BOREHOLE		
SAIC - Martha Clough & Jed Thomas	X VERTICAL	INCLINED	DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED KP 3003

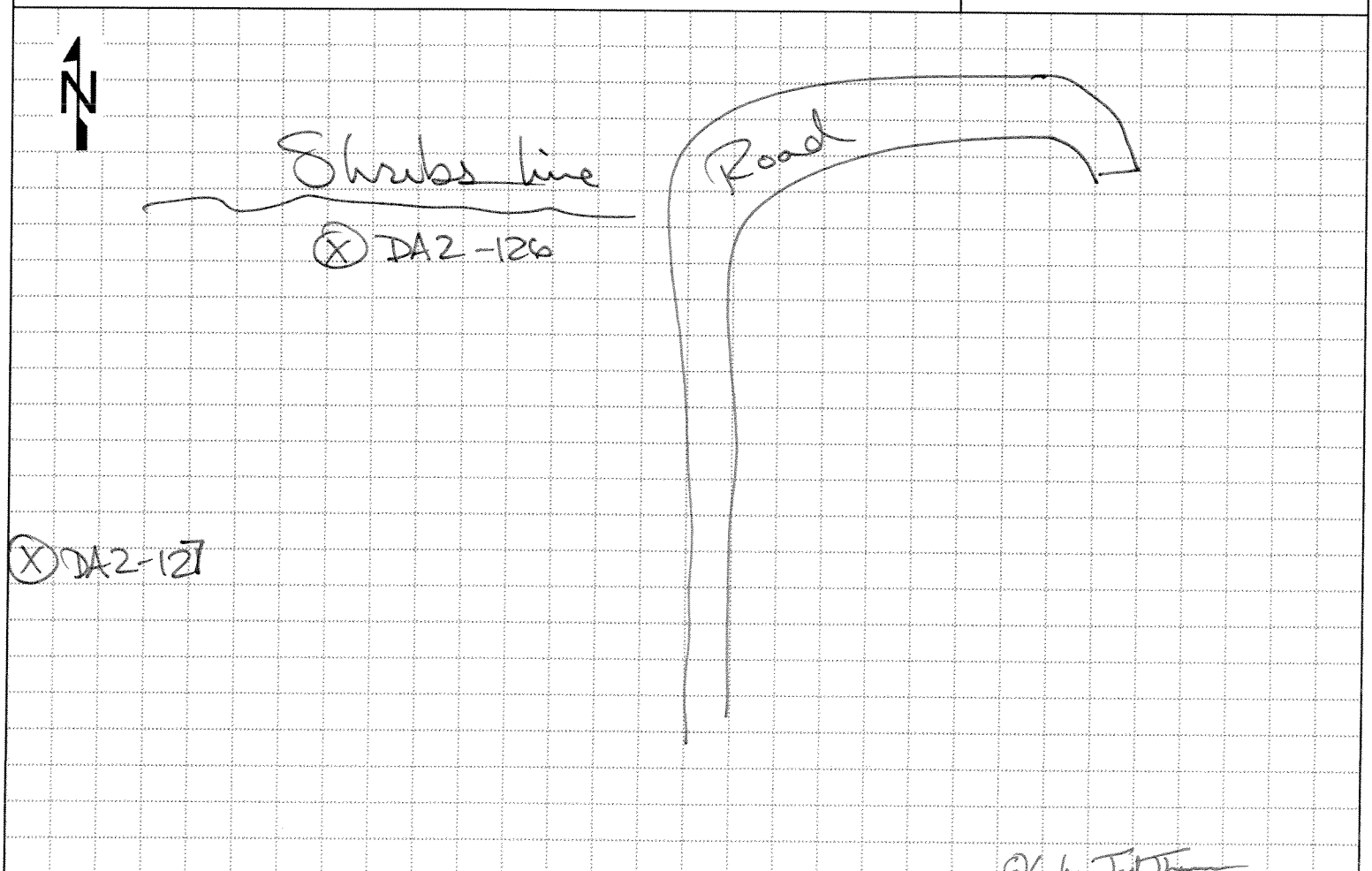
ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	0.3		2.5 Y 3/2 Very dark grayish brown silt with medium sand moist; roots.	DA2-SS-125-0900-SO 1.0 ft	0.1	Martha Clough
	1.3	CL	2.5Y 6/4 light yellowish brown with 10% mottling: 7.5YR 5/8 Strong brown; clay (lean) BW with medium sand; +0% subangular gravel 0%	DA2-SO-125-0901-SO	0.1	Jed Thomas
		CL	very fine stones. BW			
			2.5Y 5/3 light olive brown stiff lean clay with fine sand damp to dry BW	3.0 ft		
			Bottom of borehole			
			BW 11/15/05			
						QC by JT

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams	DA2-125

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: DA2 - 126
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS. Bowl & Spoon (AW)	8. BOREHOLE LOCATION: Demolition Area 2	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1515 COMPLETED: 1535	
	15. DEPTH GROUNDWATER ENCOUNTERED: 1 ft BGS	
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
12. OVERBURDEN THICKNESS: N/A		
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3 ft.		
18. GEOTECHNICAL SAMPLES: Qty N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/15/05	DATE COMPLETED/ABANDONED: 11/15/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



QC by JT

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams	DA2 - 126

HTRW DRILLING LOG (continued)

DISTRICT	BOREHOLE NUMBER
USACE - Louisville	DA2-126

1. COMPANY NAME	2. DRILL SUBCONTRACTOR	SHEET
SAIC	N/A	2 OF 2

3. PROJECT	4. LOCATION	
Supplemental Phase II at CBP, FBQ, and ODA2	RVAAP	

5. NAME OF DRILLER	6. DIRECTION OF BOREHOLE		
SAIC - Martha Clough & Jed Thomas	X VERTICAL	☐ INCLINED	DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED KR 303

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1		2.5Y 5/4 light olive brown Silt with medium sand and BW very fine subangular Stone (3%) Roots in top 0.1 foot, ~~wet~~ BW moist 0-1 foot, wet 1-3 feet; ~~Stiff~~ BW	DA2ss-126-0902-SO 1.0 ft.	0.1	Martha Clough
	2			DA2so-126-0903-SO	0.0	Jed Thomas
	3		3.0 ft Bottom of Borehole			
	4					
	5		BW			
	6					
	7					
	8					
	9					
	10					

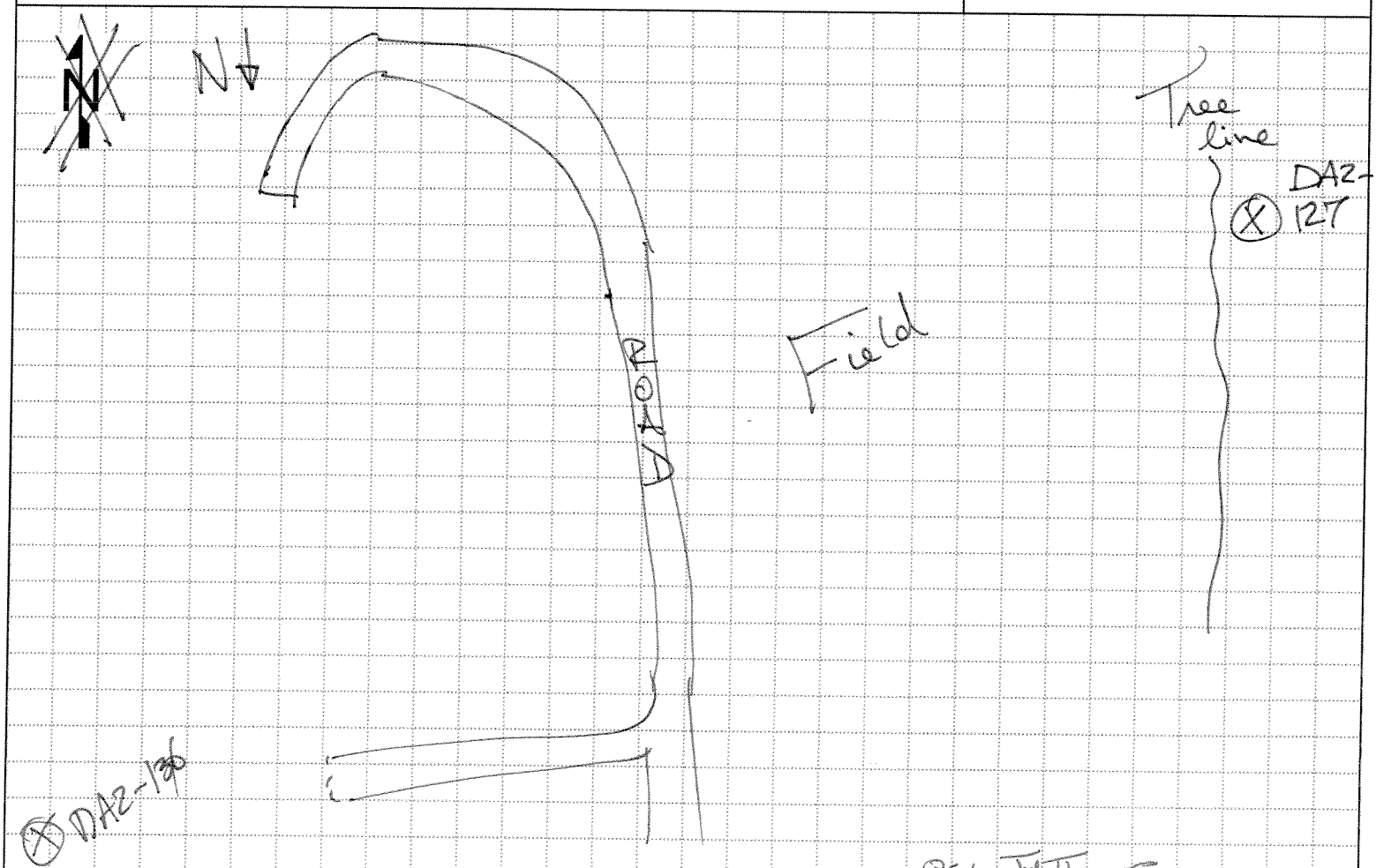
QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/15/05	DA2-126

HTRW DRILLING LOG

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: DA2-127
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS. Bowl & Spoon BW	8. BOREHOLE LOCATION: Demolition Area 2	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME: STARTED: BW 1405 11/15/05 COMPLETED: 1435	
	15. DEPTH GROUNDWATER ENCOUNTERED: BW N/A 2 ft BGS	
	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
12. OVERBURDEN THICKNESS: N/A		
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/15/05	DATE COMPLETED/ABANDONED: 11/15/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: 11/15/05 (QC by Jed Thomas)	BOREHOLE NUMBER: DA2-127

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: DA2-127
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Jed Thomas & Martha Clough	6. DIRECTION OF BOREHOLE: [X] VERTICAL [ ] INCLINED DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR. 303	

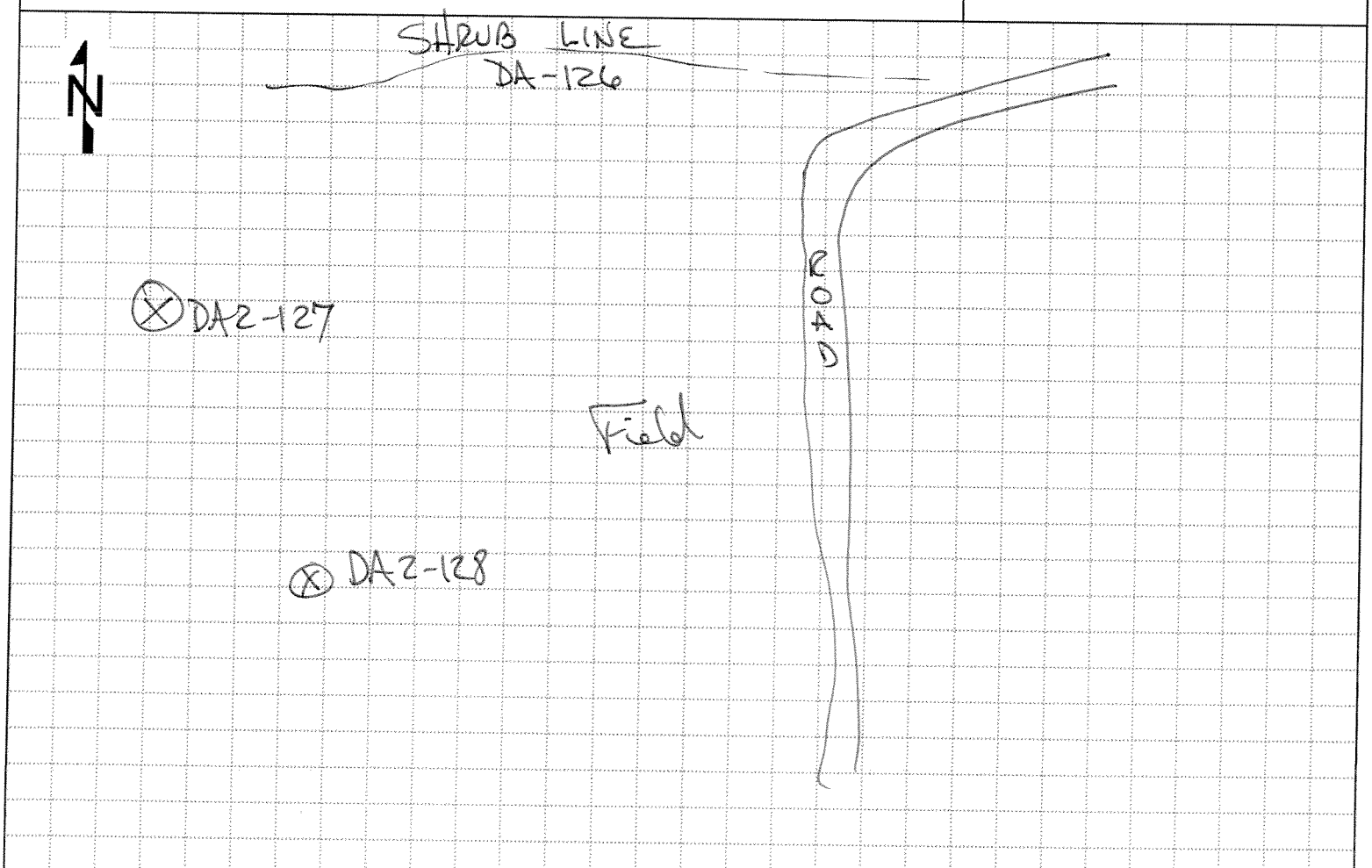
ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1		2.5Y 4/2 Dark grayish brown with 5% mottling: 10YR 5/8 yellow brown silt with medium to course sand; very fine subangular stone; moist; roots.	DA2-SS-127-0004-SO	0.1	Martha Clough
	2		2.5Y 5/6 light olive brown sand with silt (medium sand); very fine to medium subangular stones; (moist to wet)	DA2-SO-127-0005-SO	0.0	Jed Thomas - Water in hole: soil at 2-3 ft. interval. - faint septic odor
	3		2.5Y 5/6 light olive brown sand with silt (medium sand); very fine to medium subangular stones; wet (more so than 2-3 ft bw) 1-2 ft. bore); water in soil 3.0 ft			
	4		Bottom of borehole			
	5					
	6					
	7		BW 11/15/05			
	8					
	9					
	10					QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Will 11/15/05	DA2-127

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: DA2-128
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC-Martha Clough & Bo Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: S.S. Hand Auger (3-in) S.S. Bowl & Spoon BW	8. BOREHOLE LOCATION: Demolition Area 2	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1440 COMPLETED: 1505	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3 ft.		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A.	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/15/05	DATE COMPLETED/ABANDONED: 11/15/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams QC by Jed Thomas 11/15/05	DA2-128

HTRW DRILLING LOG (continued)

DISTRICT	BOREHOLE NUMBER
USACE - Louisville	DA2-128

1. COMPANY NAME	2. DRILL SUBCONTRACTOR	SHEET
SAIC	N/A	2 OF 2

3. PROJECT	4. LOCATION	
Supplemental Phase II at CBP, FBQ, and ODA2	RVAAP	

5. NAME OF DRILLER	6. DIRECTION OF BOREHOLE		
SAIC - Martha Clough & Jed Thomas	☒ VERTICAL	☐ INCLINED	DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED KR 303

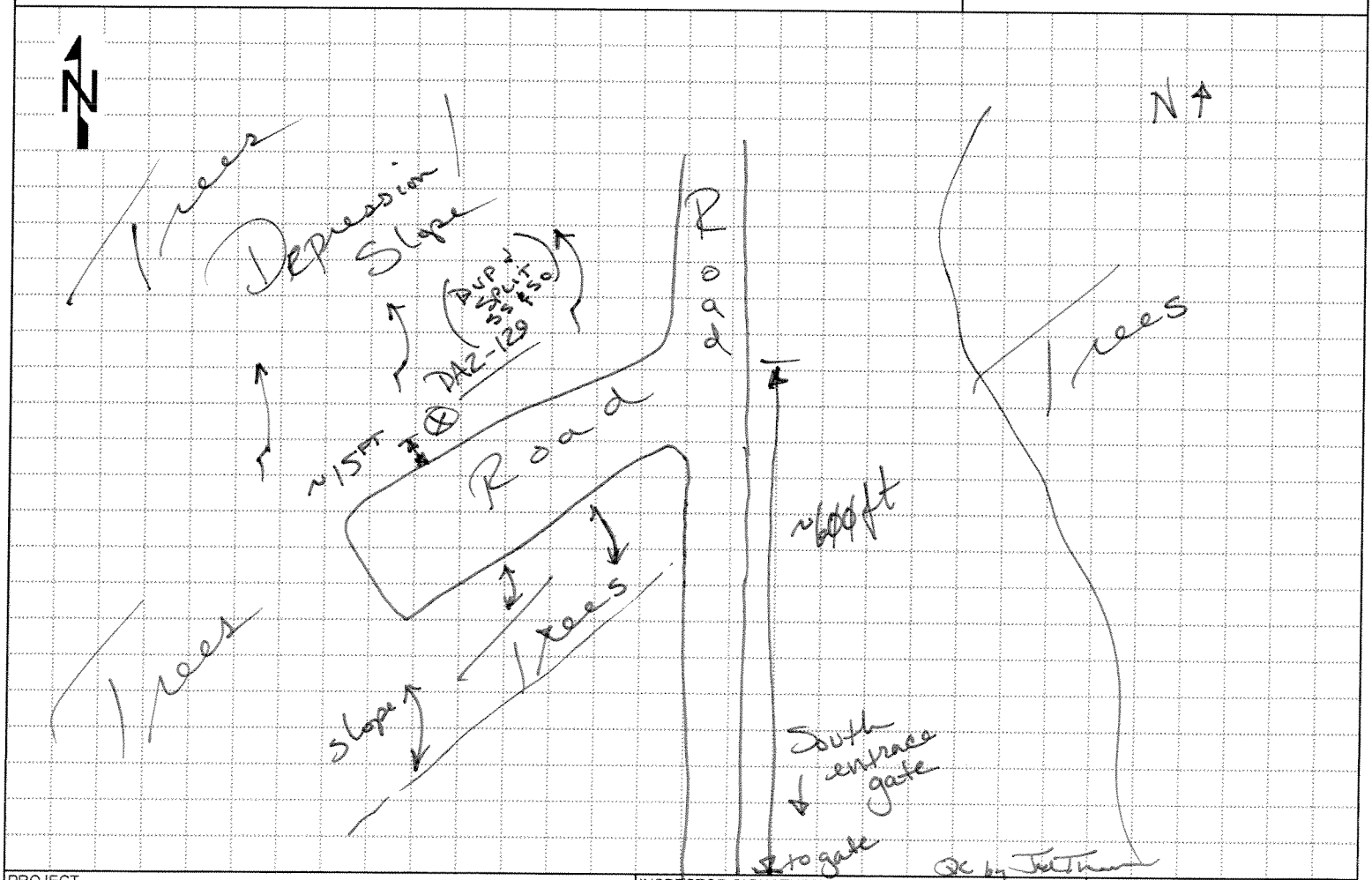
ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	1		2.5Y 3/2 Very dark grayish brown silt with ~~coarse~~ fine sand; medium moist, roots.	~~DA2-128-~~ DA2SS-128-0906-SO	0.0	Martha Clough
	2	CL	2.5Y 5/6 light olive brown with 5% mottling: 2.5Y 7/1 light gray and 10% mottling: 10YR 5/8 yellow brown. Stiff lean clay with fine sand and 1% very fine subangular stones 3.8 ft	DA2SO-128-0907-SO	0.0	Jed Thomas
	3		Bottom of borehole			
	4					
	5					
	6		BW 11/15/05			
	7					
	8					
	9					
	10					

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams QC by Jed Thomas	DA2-128

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: DA2-129
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: Jack Thomas & Martha Clough	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS. Bowl & Spoon (BW)	8. BOREHOLE LOCATION: BW N/A Demolition Area 2.	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1155 COMPLETED: 1220	
	15. DEPTH GROUNDWATER ENCOUNTERED: NA	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE: 3ft		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/15/05 DATE COMPLETED/ABANDONED:		
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams BW 11/15/05	DA2-129

HTRW DRILLING LOG (continued)

DISTRICT	BOREHOLE NUMBER
USACE - Louisville	DA2-129

1. COMPANY NAME	2. DRILL SUBCONTRACTOR	SHEET
SAIC	N/A	2 OF 2

3. PROJECT	4. LOCATION
Supplemental Phase II at CBP, FBQ, and ODA2	RVAAP

5. NAME OF DRILLER	6. DIRECTION OF BOREHOLE
SAIC - Martha Clough & Jed Thomas	[X] VERTICAL [ ] INCLINED DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020 PID SERIAL#: ED KR 303

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	0.2		2.5Y 3/2 very dark grayish brown silt with fine sand, roots, moist.	DA2ss-125-0908-SO	0.1	DA2ss-125-0912-SO (DUPLICATE) DA2ss-125-0913-SO (SPLIT)
	1		2.5Y 5/4 light olive brown silt with course sand, fine roots, moist, medium to course subangular stones (poorly sorted - variety of sizes)	1.0 ft		Martha Clough
	2	CL		DA2so-125-0909-SO	0.1	DA2so-125-0914-SO (DUPLICATE) DA2so-125-0915-SO (SPLIT)
	3		2.5Y 5/6 light olive brown with 1% 2.5Y 5/1 gray mottling. lean clay with course sand; moist; subangular medium to course stone	3.0 ft		Jed Thomas
	4		Bottom of Borehole			
	5					
	6					
	7					
	8					
	9					
	10					

BW 11/15/05

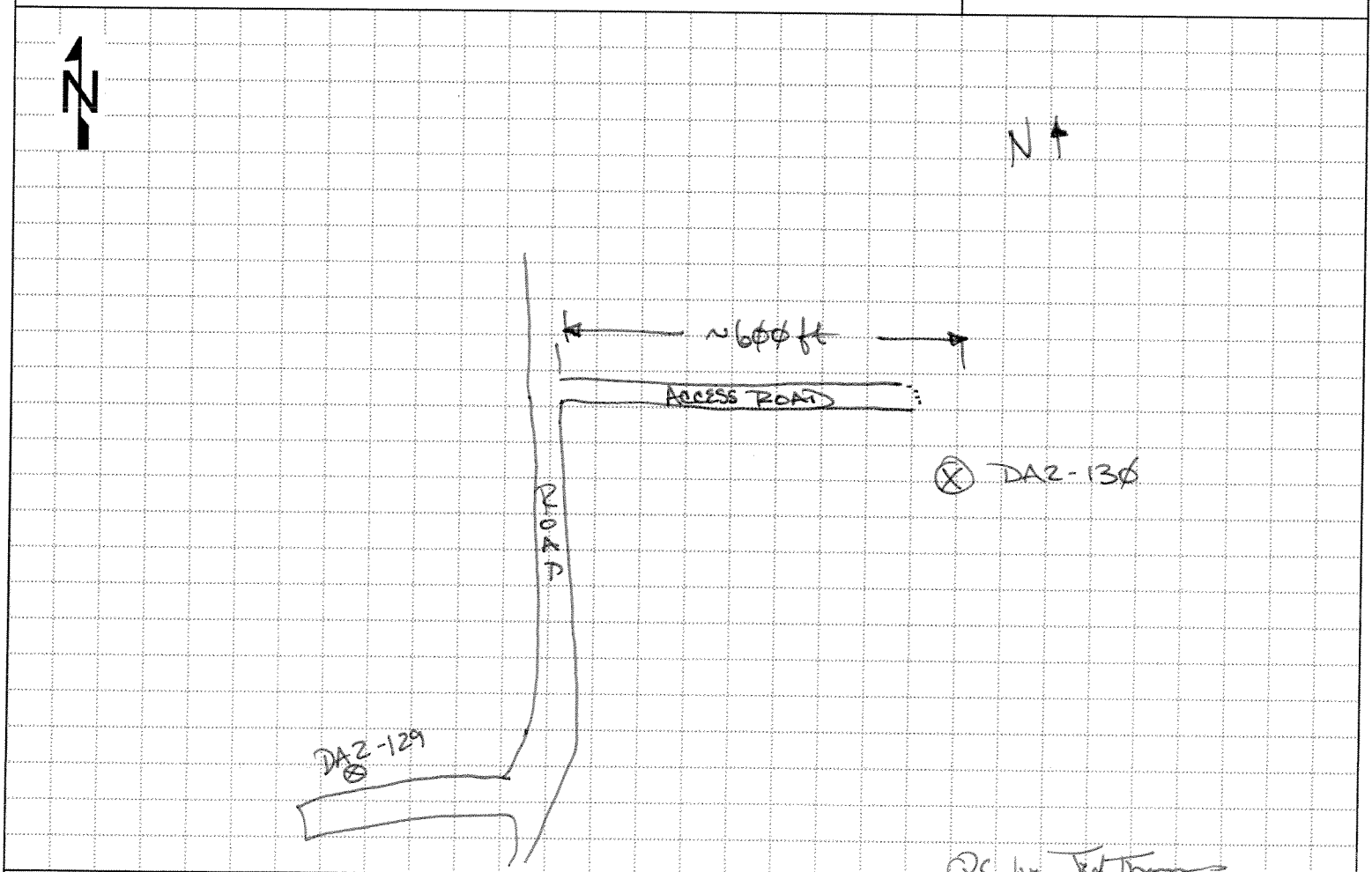
QC by JT

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/15/05	DA2-129

HTRW DRILLING LOG

	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: DA2-130
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: NA	SHEET 1 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC - Martha Clough & Jed Thomas	6. MAKE/MODEL OF DRILL: na	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT: SS. Hand Auger (3-in) SS. Bowl & Spoon GW	8. BOREHOLE LOCATION: Demolition Area 2	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1230 COMPLETED: 1300	
	15. DEPTH GROUNDWATER ENCOUNTERED: N/A	
12. OVERBURDEN THICKNESS: N/A	16. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION: NA	
13. DEPTH DRILLED INTO BEDROCK: N/A	17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA	
14. TOTAL DEPTH OF BOREHOLE		
18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: — DISTURBED: —	19. TOTAL NUMBER OF CORE BOXES: N/A	
20. CHEMICAL SAMPLES: (METALS) (EXPL) OTHER: —	21. TOTAL CORE RECOVERY %: N/A	
22. DISPOSITION OF BOREHOLE: DATE STARTED/INSTALLED: 11/15/05	DATE COMPLETED/ABANDONED: 11/15/05	
BACKFILL TYPE: ☐ GROUT ☒ BENTONITE ☐ TEMPORARY WELL POINT ☐ MONITORING WELL		

LOCATION SKETCH/COMMENTS — **SCALE:** None



PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams 11/15/05	DA2-130

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: DA2-130
1. COMPANY NAME: SAIC	2. DRILL SUBCONTRACTOR: N/A	SHEET 2 OF 2
3. PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	4. LOCATION: RVAAP	
5. NAME OF DRILLER: SAIC-Martha Clough & Jed Thomas	6. DIRECTION OF BOREHOLE: [X] VERTICAL [ ] INCLINED DEGREES	
7. NOTES PID MAKE/MODEL: Perkins Elmer Photovac 2020	PID SERIAL#: ED KR 303	

ELEVATION	DEPTH (0.1 Feet)	USCS	CLASSIFICATION OF MATERIALS	ANALYTICAL SAMPLE NUMBER	MONITORING (PPM)	REMARKS
	0.3		2.5Y 3/2 very dark grayish brown Silt with medium sand; Moist, roots	DA2ss-130-0910-SO	0.0	Martha Clough
	1.0		2.5Y 5/4 light olive brown Silt with medium sand; fine to medium subangular poorly sorted (variety of size & type) Stones; damp; fine roots	1.0 ft DA2so-130-0911-SO	0.0	Jed Thomas 1.9 ft refusal
	1.9		2.5Y 5/6 light olive brown Silt with medium to course Sand; very fine to fine subangular poorly sorted Stones; damp	1.9 ft.		
	2					
	3					
	4		Bottom of borehole			
	5					
	6		BW 11/15/05			
	7					
	8					
	9					
	10					QC by Jed Thomas

PROJECT	INSPECTOR SIGNATURE/DATE	BOREHOLE NUMBER
Supplemental Phase II at CBP, FBQ, and ODA2	B. Williams	DA2-130

ATTACHMENT B

IDW LETTER REPORT

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ONYX

ENVIRONMENTAL SERVICES

Please type or print in block letters. (Form designed for use on elite (12-pitch) typewriter.)

NH040

NON-HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. OH5214088265 Manifest Document No. 0001

2. Page 1 of 1

3. Generator's Name and Mailing Address
RAVENNA ARMY AMMO PLANT
8451 SATE RT 5
RAVENNA, OH 44266

4. Generator's Phone (330) 405-5804

A. Non-hazardous Manifest Document Number Z 178520

B. State Generator's ID SAME

5. Transporter 1 Company Name: HAZMAT ENVIRONMENTAL GROUP INC

6. US EPA ID Number: MYD988079495

C. State Trans. ID 124187MY

7. Transporter 2 Company Name

8. US EPA ID Number

D. Transporter's Phone ( )

E. State Trans. ID 716 827-7200

9. Designated Facility Name and Site Address
ONYX ENVIRONMENTAL SVCS,L.L.C.
4301 INFIRMARY ROAD
WEST CARROLLTON, OH 45449

10. US EPA ID Number: OHD980145293

F. Transporter's Phone ( )

G. State Facility's ID

H. Facility's Phone (937) 859-5101

	11. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number) HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	L Waste No.
a.	NON RCRA AND DOT NON REGULATED LIQUID, NONE, NONE	004	DM	01600	P	NONE
b.	NON RCRA AND DOT NON REGULATED SOLID, NONE, NONE	002	DM	00800	P	NONE
c.						
d.						

J. Additional Descriptions for Materials Listed Above

a. L/- 236022//NON HAZ WATER

b. S/- 236023//NON HAZ SOIL

c.

d.

K. Handling Codes for Wastes Listed Above

a.

b.

c.

d.

15. Special Handling Instructions and Additional Information
PACKING SLIPS ATTACHED FOR CLARIFICATION - EMERGENCY NUMBER INFOTRAC: 1-800-535-5053

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

I hereby certify that the above-named material is not hazardous waste as defined by 40 CFR Part 261 or any applicable state law.

GENERATOR

Printed/Typed Name: Irv Venger | Signature: Irv Venger | Month Day Year: 10 23 06

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name: Darrell Ferguson | Signature: Darrell Ferguson | Month Day Year: 10 23 06

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of non-hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month Day Year

1-GENERATOR COPY

SIGNATURE AND INFORMATION *MUST* BE LEGIBLE ON ALL COPIES

ATTACHMENT C

PROJECT QUALITY ASSURANCE SUMMARY

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CONTENTS

ACRONYMS

CQC	contractor quality control
EPA	U. S. Environmental Protection Agency
FCO	field change order
GPL	GPL Laboratories, Inc.
M&TE	materials and testing equipment
NCR	Nonconformance Report
QA	quality assurance
QC	quality control
RI	remedial investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SOW	Statement of Work
USACE	U. S. Army Corps of Engineers

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C. PROJECT QUALITY CONTROL SUMMARY REPORT

This attachment presents the actions and methodologies undertaken to meet the quality assurance/quality control (QA/QC) goals for the Supplemental Phase II remedial investigation (RI) at Open Demolition Area #2 (ODA2) at the Ravenna Army Ammunition Plant (RVAAP). These goals were established in the *Facility-wide Sampling and Analysis Plan (SAP) for the Ravenna Army Ammunition Plant* (USACE 2001a) and the *Sampling and Analysis Plan Addendum No. 1 for the Supplemental Phase II Remedial Investigation* (USACE 2005). The field investigation was conducted under one mobilization; this attachment addresses QA/QC goals for the entire project. These goals were implemented through project-specific procedures and requirements, the Science Applications International Corporation (SAIC) QA Program, and the U. S. Army Corps of Engineers (USACE), Louisville District QA requirements. A large portion of project QA was focused on field and analytical laboratory activities and project administration.

C.1 FIELD QUALITY ASSURANCE

C.1.1 Readiness Review

Field QA was initiated for the Supplemental Phase II RI in the readiness review held at the SAIC Twinsburg, OH office on November 10, 2005. The purpose of the readiness review was to ensure that

- project documents and procedures were approved, controlled, and properly distributed;
- assigned personnel were trained or a schedule was established to conduct training;
- mobilization and site logistics were established;
- laboratories were ready to accept samples;
- subcontractors were ready to begin work; and
- QA systems were implemented.

All elements of the readiness review were completed prior to initiating field activities and were approved by the SAIC QA/QC Officer. Readiness review and project kickoff checklists provide documentation of this QA element and are maintained in the project file.

C.1.2 Procedures

Standard operating methods for field activities performed during the Supplemental Phase II RI are incorporated into the governing documents for the project. The facility-wide sampling and analysis plan (SAP) (USACE 2001a) describes the overall approach and methodologies to be used for projects at RVAAP, and the *Supplemental Phase II RI SAP Addendum* (USACE 2005) details project-specific requirements for field implementation. These documents were reviewed by USACE, Louisville District and by the Ohio Environmental Protection Agency prior to implementation. Clarifications and/or planned deviations from these methods were documented as field change orders (FCOs), and variances were documented as Nonconformance Reports (NCRs). Copies of the FCOs issued during the Phase I RI are attached to this attachment.

C.1.3 Training

Field team personnel were trained in all procedures applicable to their assigned tasks. Training was accomplished through a combination of classroom lectures, reading assignments, and on-the-job training.

Surveillance performed by the project SAIC contractor quality control (CQC) representative provided assessments of worker proficiency and training effectiveness.

Copies of training records and surveillance reports were maintained in the project file. Copies of training records required for Occupational Safety and Health Administration and U. S. Department of Transportation compliance also were maintained in the field.

C.1.4 Equipment Calibration

Various types of measuring and testing equipment (M&TE) were used during the field investigation. All M&TE was categorized, assigned unique identifiers, and listed in an inventory in the M&TE logbook. Last and next calibration recall dates were also recorded. As appropriate, instruments were calibrated daily according to the manufacturer's instructions. Only equipment and standards having verifiable traceability to nationally recognized standards were used for calibration. Daily calibration activities and results were recorded in the M&TE logbook, as well as source information for all calibration standards and reagents.

C.1.5 Quality Control Samples

Field QC samples collected included equipment rinsate blanks, source water, and field duplicates. Field QA splits were collected as specified in the *Supplemental Phase II RI SAP Addendum* (USACE 2005) pertaining to CQC. Implementation of the CQC program in the field was done by the SAIC CQC representative. Attachment D presents an evaluation of data quality and analytical performance with respect to field QC results. Field QC data and analyses of QC samples are presented in Attachment E.

C.1.6 Field Records

Field data, observations, activities, and information were recorded on standardized field sheets and in bound field logbooks. The use of standardized field sheets ensured that all necessary data were entered consistently. Logbook entries were checked for accuracy and completeness by independent reviewers. Other field records, which were collected and likewise maintained, included equipment/material certifications, boring logs, and air-bill forms.

C.2 ANALYTICAL LABORATORY QUALITY ASSURANCE

SAIC subcontracted GPL Laboratories, Inc. (GPL) to perform chemical analysis of samples collected during the Supplemental Phase II RI. The selected laboratory is certified by the USACE, Missouri River Division, Mandatory Center of Expertise in Omaha, Nebraska. In addition, this laboratory was technically audited by SAIC prior to contract award. QA split samples were collected and submitted to an independent USACE QA laboratory, Severn Trent Laboratories, Inc., located in North Canton, Ohio.

C.2.1 Readiness Review

Laboratory QA/QC activities were initiated during the readiness review. The readiness review ensured that (1) governing documents and approved analytical methods were controlled and properly distributed, (2) the laboratory was scheduled and ready to conduct the analysis, (3) logistical coordination was established between the laboratory and the field team, and (4) laboratory QA programs were consistent and compatible with the project requirements.

C.2.2 Procedures

Prior to initiation of analytical support for the Supplemental Phase II RI, GPL and SAIC reviewed and negotiated a contract based on a comprehensive laboratory Statement of Work (SOW). The laboratory SOW detailed project-specific requirements, including the parameters to be measured, analytical methods, adherence to U. S. Environmental Protection Agency (EPA) SW-846 protocols, project quantitation goals (sensitivity), and data deliverables requirements. All laboratory comments and questions were resolved before analytical work proceeded.

C.2.3 Laboratory Quality Control

To document laboratory data quality and to measure the quality of the analytical process, laboratory QC samples and data verification/validation were employed. The results of laboratory QC are discussed in the project QC Summary Report (Attachment D). Analytical results of laboratory QC samples are included in the project file and form the basis of the data verification and evaluation process (Section C.2.5).

C.2.4 Laboratory Documentation

GPL maintains comprehensive information regarding the entire analytical process. The laboratory delivered summary data packages and electronic deliverables consistent with those identified in the EPA SW-846 protocol to SAIC for validation and verification. Laboratory QC sample analyses were cross-referenced to the appropriate environmental field sample analyses in the laboratory deliverables.

C.2.5 Data Verification/Validation

Analytical data generated during this project were subjected to a rigorous process of data verification by SAIC. For verification of data, criteria were established against which the analytical results were compared and from which a judgment was rendered regarding the acceptability and qualification of the data (Attachment D). Upon receipt of data packages from each laboratory, the information was subjected to a systematic examination following standardized checklists and procedures to ensure content, presentation, administrative validity, and technical validity. Routine data changes were documented through data change forms. Data deficiencies or formal laboratory-related nonconformances were documented through an NCR process, as required.

C.3 QUALITY ASSURANCE DOCUMENTATION

Primary methods for documenting QA during the Supplemental Phase II RI include the completion of FCOs requiring USACE concurrence and NCRs generated in accordance with SAIC QA procedures. Copies of FCOs completed during the investigation are included in this attachment. Copies of NCRs are on record in the SAIC RVAAP project file.

C.3.1 Field Change Control

The FCOs are completed during the RI to request and document the rationale and approval for any departures from protocols specified in the approved Facility-wide SAP and the Supplemental Phase II RI SAP Addendum. Field changes provide clarification to the scope or refinement in the procedural approach to a specific field activity. All FCOs are reviewed and approved by designated technical representatives of USACE, Louisville District prior to implementation. No FCOs were implemented during the Supplemental Phase I RI activities for ODA2.

C.3.2 Nonconformance Reports

To identify and correct conditions adverse to quality, as described in the field and laboratory QA plans, NCRs and associated corrective action reports were completed, as necessary. No NCRs were identified throughout the duration of the project.

C.4 REFERENCES

USACE (U. S. Army Corps of Engineers) 2001a. *Facility-wide Sampling and Analysis Plan (SAP) for the Ravenna Army Ammunition Plant, Ravenna, Ohio,* DACA62-00-D-0001, DO CY 02, March.

USACE (U. S. Army Corps of Engineers) 2005. *Sampling and Analysis Plan Addendum No. 1 for Supplemental Phase II Remedial Investigation of ODA2, FBQ, and CBP.* November.

ATTACHMENT D

DATA QUALITY CONTROL SUMMARY REPORT

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CONTENTS

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TABLES

ACRONYMS

AOC	area of concern
DQA	data quality assessment
DQCR	Data Quality Control Report
DQO	data quality objective
EPA	U. S. Environmental Protection Agency
GPL	GPL Laboratories, Inc.
IDW	investigation-derived waste
LCS	laboratory control standard
MDL	method detection level
MPR	monthly progress report
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	remedial investigation
RPD	relative percent difference
RQL	Ramsdell Quarry Landfill
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SDG	sample delivery group
SVOC	semivolatile organic compound
USACE	U. S. Army Corps of Engineers
VOC	volatile organic compound

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D1.0 PURPOSE OF THIS REPORT

Environmental data must always be interpreted relative to its known limitations and its intended use. As can be expected in environmental media of this type, there are areas and data points where the user needs to be cautioned relative to the quality of the project information presented. The data verification process and this data quality assessment (DQA) are intended to provide current and future data users assistance throughout the interpretation of these data.

The purpose of this DQA report is (1) to describe the quality control (QC) procedures followed to ensure data generated by Science Applications International Corporation (SAIC) during these investigations at the Ravenna Army Ammunition Plant (RVAAP) would meet project requirements; (2) to describe the quality of the data collected; and (3) to describe problems encountered during the course of the study and their solutions. A separate Chemical Quality Assessment Report will be completed by the U. S. Army Corp of Engineers (USACE) quality assurance (QA) representative and will cover data generated from QA split samples remanded to their custody.

This report provides an assessment of the analytical information gathered during the course of the RVAAP Supplemental Phase II Remedial Investigation (RI) for the Demolition Area 2 (DA2), area performed during November 2005. It documents that the quality of the data employed for the RI report and evaluation met their objectives. Evaluation of field and laboratory QC measures will constitute the majority of this assessment; however, references will also be directed toward those QA procedures that establish data credibility. The primary intent of this assessment is to illustrate that data generated for these studies can withstand scientific scrutiny, are appropriate for their intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy.

Multiple activities were performed to achieve the desired data quality for this project. As discussed in the report, decisions were made during the initial scoping of the RI to define the quality and quantity of data required. Data quality objectives (DQOs) were established to guide the implementation of the field sampling and laboratory analysis [refer to the RVAAP Sampling and Analysis Plan (SAP) Addendum August (USACE 2005)]. A QA program was established to standardize procedures and to document activities [refer to the RVAAP Facility-wide Quality Assurance Project Plan (QAPP) March 2001]. This program provided a means to detect and correct any deficiencies in the process. Upon receipt by the project team, data were subjected to verification and validation review to identify and qualify problems related to the analysis. These review steps contributed to this final DQA where data used in the investigation are identified as having met the criteria and are being employed appropriately.

D2.0 QUALITY ASSUARNACE PROGRAM

A Facility-wide QAPP and a Supplemental Phase II RI QAPP Addendum were developed to guide the investigation. These plans are found in Part II of the Facility-wide SAP for RVAAP (USACE 2001) and the Supplemental Phase II RI SAP Addendum No. 1 (USACE 2005). The purpose of these documents was to enumerate the quantity and type of samples to be taken to inspect the area of concern (AOC), and to define the quantity and type of QA/QC samples to be used to evaluate the quality of the data obtained.

The QAPP established requirements for both field and laboratory QC procedures. In general, field QC duplicates and QA split samples were required for each environmental sample matrix collected in the area being investigated; volatile organic compound (VOC) trip blanks were to accompany each cooler containing

water samples for VOC determinations; and analytical laboratory QC duplicates, matrix spikes (MSs), laboratory control samples (LCSs), and method blanks were required for every 20 samples or less of each matrix and analyte.

A primary goal of the RVAAP QA Program was to ensure that the quality of results for all environmental measurements were appropriate for their intended use. To this end, the QAPP and standardized field procedures were compiled to guide the investigation. Through the process of readiness review, training, equipment calibration, QC implementation, and detailed documentation, the project has successfully accomplished the goals set for the QA Program. Surveillances were conducted to determine the adequacy of field performance as evaluated against the QA plan and procedures.

D2.1 MONTHLY PROGRESS REPORTS

Monthly Progress Reports (MPRs) were completed by the SAIC Project Manager for the duration of the project. The MPRs contained the following information: work completed, problems encountered, corrective actions/solutions, summary of findings, and upcoming work. These reports were issued to the USACE, Louisville District Project Manager. Access to these reports can be obtained through the USACE, Louisville District Project Manager.

D2.2 DAILY QUALITY CONTROL REPORTS

The Field Team Leader produced all Daily Quality Control Reports (DQCRs). These include information such as, but not limited to, sub-tier contractors on-site, equipment on-site, work performed summaries, QC activities, Health and Safety activities, problems encountered, and corrective actions. The DQCRs were submitted to the USACE, Louisville District Project Manager and may be obtained through his office.

D2.3 LABORATORY "DEFINITIVE" LEVEL DATA REPORTING

The QAPP for this project identified requirements for laboratory data reporting and identified GPL Laboratory (GPL), Gaithersburg, Maryland as the laboratory for the project. During the execution of the project, the GPL facility performed all of the analyses. Environmental Protection Agency (EPA) "definitive" data have been reported, including the following basic information:

a. laboratory case narratives

b. sample results (soils/sediments reported per dry weight)

c. laboratory method blank results

d. LCS results

e. laboratory sample MS recoveries

f. laboratory duplicate results

g. surrogate recoveries [VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and explosives]

h. sample extraction dates

i. sample analysis dates

This information from the laboratory, along with field information, provides the basis for subsequent data evaluation relative to sensitivity, precision, accuracy, representativeness, and completeness. These have been presented in Chapter 4.0.

D3.0 DATA VERIFICATION

The objective when evaluating the project data quality is to determine its usability. The evaluation is based on the interpretation of laboratory QC measures, field QC measures, and the project DQOs. This project implemented the Automated Data Review (ADR) electronic review process in combination with technical oversight to facilitate laboratory data review. ADR output was reviewed by the project-designated verification staff and the project laboratory coordinator. The ADR product is retained in the project database and available within that structure.

D3.1 FIELD DATA VERIFICATION

DQCRs were completed by the Field Team Leader. The DQCRs and other field-generated documents such as sampling logs, boring logs, daily health and safety summaries, daily safety inspections, equipment calibration and maintenance logs, and sample management logs were peer reviewed on-site. These logs and all associated field information have been delivered to the USACE, Louisville District Project Manager and can be obtained through his office.

D3.2 LABORATORY DATA VERIFICATION

Analytical data generated for this project have been subjected to a process of data verification and review. The following describes this systematic process and the evaluation activities performed. Several criteria have been established against which the data were compared and from which a judgment was rendered regarding the acceptance and qualification of the data. These and project specific QC criteria are programmed into the database and evaluated using the ADR programming. Because it is beyond the scope of this report to cite those criteria, the reader is directed to the following documents for specific detail:

- SAIC Technical Support Contractor QA Technical Procedure (TP-DM-300-7) Data Verification and Validation;
- EPA – National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013, February 1994;
- EPA – National Functional Guidelines for Organic Data Review, EPA-540/R-99/008, October 1999; and
- Supplemental Phase II RI at RVAAP, SAP Addendum, USACE, November 2005.

Upon receipt of field and analytical data, verification staff performed a systematic examination of the reports, utilizing the ADR process to ensure the content, presentation, and administrative validity of the data. Discrepancies identified during this process were recorded and documented utilizing the dataset. As part of data verification, standardized laboratory electronic data deliverables were subjected to review. This technical evaluation ensured that all contract-specified requirements had been met, and that electronic information

conformed to reported hardcopy data. QA Program Nonconformance Report and Corrective Action systems were implemented as required.

During the verification phase of the review and evaluation process, data were subjected to a systematic technical review by examining all field and analytical QC results and laboratory documentation, following EPA functional guidelines, the ADR process, and SAIC internal procedures for laboratory data review. These data review guidelines define the technical review criteria, methods for evaluation of the criteria, and actions to be taken resulting from the review of these criteria. The primary objective of this phase was to assess and summarize the quality and reliability of the data for the intended use and to document factors that may affect the usability of the data. This process did not include in-depth review of raw data instrument out-put or recalculation of results from the primary instrument out-put. This data verification, validation, and analytical review process included, but was not necessarily limited to, the following parameters:

- data completeness;
- analytical holding times and sample preservation;
- calibration (initial and continuing);
- method blanks;
- sample results verification;
- surrogate recovery;
- LCS analysis;
- internal standard performance;
- MS recovery;
- duplicate analysis comparison;
- reported detection limits;
- compound, element, and isotope quantification;
- reported detection levels; and
- secondary dilutions.

As an end result of this phase of the review, the data were qualified based on the technical assessment of the verification/validation criteria. Qualifiers were applied to each field and analytical result to indicate the usability of the data for its intended purpose.

D3.3 DEFINITION OF DATA QUALIFIERS (FLAGS)

During the data verification process, all laboratory data were assigned appropriate data qualification flags and reason codes. Qualification flags are defined as follows:

"U" Indicates the analyte was analyzed for, but not detected above, the level of the associated value.

"J" Indicates the analyte was positively identified; however, the associated numerical value is an approximate concentration of the analyte in the sample.

"UJ" Indicates the analyte was analyzed for, but not detected above, the associated value; however, the reported value is an estimate and demonstrates a decreased knowledge of its accuracy or precision.

"R" Indicates the analyte value reported is unusable. The integrity of the analyte's identification, accuracy, precision, or sensitivity has raised significant questions as to the reality of the information presented.

"=" Indicates the analyte has been validated, the analyte has been positively identified, and the associated concentration value is accurate.

D3.4 DATA ACCEPTABILITY

Fourteen environmental soil and field QC samples were collected with approximately 500 discrete analyses (i.e., analytes) being obtained, reviewed, and integrated into the assessment (these totals do not include field measurements and field descriptions). The project produced acceptable results for 100% of the sample analyses performed and successfully collected investigation samples under the direction of the SAP and the USACE, Louisville District.

Table D-1 presents a summary of the collected investigation samples. It tallies the successful collection of all targeted field QC and QA split samples, while Table D-2 identifies a cross reference for duplicate and QA split sample pair numbers. Table D-3 provides a summary of rejected analyses grouped by media and analyte category. The majority of estimated values were based on values observed between the laboratory method detection levels (MDLs) and the project reporting levels. Values determined in this region have an inherently higher variability and need to be considered estimated at best.

Table D-1. Demolition Area 2 Investigation Summary

Area	Media	Environmental Samples	Field Duplicates	Trip Blanks	Equipment Rinsate Blanks	Site Source Water Blanks	USACE Split Samples
CBP	Soils	12	2	-	*	*	2

USACE = U. S. Army Corps of Engineers.
* = Associated Equipment Rinsate and Source Water analyzed in conjunction with Central Burn Pit samples.

Table D-2. Primary, Duplicate, and Split Sample Correlation Table
Demolition Area 2 Investigation

Media	Station #	Sample #	Duplicate #	Laboratory SDG #	Split #
Soil	DA2-129	DA2SS-129-0908-SO	DA2SS-129-0912-SO	511101	DA2SS-129-0913-SO
Soil	DA2-129	DA2SO-129-0909-SO	DA2SO-129-0914-SO	511093	DA2SO-129-0915-SO

SDG = Sample delivery group.

Table D-3. Demolition Area 2 Investigation
Summary of Rejected Analytes (Laboratory)
(grouped by medium and analysis group)

Media	Analysis Group	Rejected/	Total	Percent Rejected
Soil (surface and subsurface	Metals Explosives	0/ 0/	322 196	0.0 0.0
Project Total		0/	518	0.0

For this RVAAP study, one field duplicate was analyzed for soil media. Equipment rinsate, site potable water source and DI water source samples were collected in conjunction with the concurrent sampling program at the Central Burn Pits.

D4.0 DATA QUALITY EVALUATION

D4.1 METALS ANALYSES, SOILS

Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved for all elements analyzed. Method blank levels or continuing calibration blank levels did not result in any qualification of data. Antimony concentrations were consistently qualified as estimated "J or UJ" due to low MS results; however, none of the values were rejected. Arsenic, barium, magnesium, copper, potassium and vanadium were qualified as estimated "J or UJ" due to MS recoveries being above criteria. Other metals exhibited acceptable recoveries and were not qualified. LCS determinations were considered acceptable throughout the data set. Reporting levels are considered to be acceptable relative to the QAPP goals. Laboratory duplicate comparisons were acceptable. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. None of the metal soil results were rejected. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the main text of the report, and can be found in the RVAAP Environmental Information Management System.

D4.2 EXPLOSIVE ANALYSES, SOILS

Analytical holding times were met for all samples. Initial calibration criteria and continuing calibration criteria were met for all compounds. Method blanks exhibited detectable concentrations of nitrobenzene causing similar values observed in samples to be qualified as non-detect. No other explosive compounds were observed in the method blanks. Surrogate compound recoveries were acceptable for all analyses, with the exception of slightly elevated recoveries for samples DA2SS-126-0902-SO, DA2SS-127-0904-SO, DA2SS-129-0908-SO, and DA2SS-129-0912-SO. Impacted compound results were qualified as estimated "J". LCS and MS/MSD recoveries were within criteria. Values reported for tetryl in DA2SS-127-0904-SO and DA2SS-129-0912-SO were qualified as estimated "J" due to elevated percent differences observed for between column comparisons. Although some analyses were qualified as estimated, the deviations observed should not have a primary influence on the results and the values are considered technically sound and defensible. Complete data summary tables, with associated qualifiers, are provided in Chapter 4.0 of the main text of the report, and can be found in the RVAAP Environmental Information Management System.

D4.3 PRECISION

A field duplicate sample was collected to ascertain the contribution to variability (i.e., precision) due to the combination of environmental media, sampling consistency, and analytical precision. The field duplicate sample was collected from the same spatial and temporal conditions as the primary environmental sample. The sample was collected from the same sampling device, after homogenization.

Field duplicate comparison information in Table D-4 presents the absolute difference or RPD for field duplicate measurements, by analyte. RPD was calculated only when both samples were > 5 times the reporting level. When one or both sample values were between the reporting level and 5 times the reporting level, the absolute difference was evaluated. If both samples were not detected for a given analyte, precision was considered acceptable. To review information, this DQA has implemented general criteria for comparison of absolute difference measurements and RPDs. RPD criteria were set at 50 and

absolute difference criteria were set at 3 times the reporting level. All field duplicate comparisons are considered good, with the highest difference being for arsenic in the soil duplicate pair DA2SS-129-0908-SO/DA2SS-129-0912-SO at 41 RPD.

Table D-4. Field Duplicate Comparison, Demolition Area 2 Investigation

Analysis	DA2SS-129-0908-SO/ DA2SS-129-0912-SO Soil RPD	DA2SO-129-0909-SO/ DA2SO-129-0914-SO Soil RPD
Metals		
Aluminum	1	3
Antimony	*	*
Arsenic	41	3
Barium	1	2
Beryllium	*	*
Cadmium	*	9
Calcium	0	6
Chromium	3	3
Cobalt	0	1
Copper	0	5
Iron	5	5
Lead	4	1
Magnesium	1	5
Manganese	0	1
Mercury	4	*
Nickel	0	0
Potassium	1	0
Selenium	*	*
Silver	*	*
Sodium	*	*
Thallium	*	*
Vanadium	1	2
Zinc	2	2
Explosives		
All compounds	*	*

* = At least one value is < 5 times the reporting level, and duplicate comparison is within 3 times the reporting level.

RPD = Relative percent difference.

D4.4 SENSITIVITY

Determination of minimum detectable values allows the investigation to assess the relative confidence that can be placed in a value relative to the magnitude or level of analyte concentration observed. The closer a measured value comes to the minimum detectable concentration, the less confidence and more variation the measurement will have. Project sensitivity goals were expressed as quantitation level goals in the QAPP. These levels were achieved or exceeded throughout the analytical process. Actual laboratory MDLs achieved during this investigation achieved project quantitation level goals. Individual analyte reporting levels varied due to matrix differences and contaminant analyte concentrations. Reporting levels were elevated in soils due to inherent moisture content variability and results being reported in the standard dry weight format. Reporting level variations have been considered during data interpretation and statistical applications.

Method blank determinations were performed with each analytical sample batch for each analyte under investigation. These blanks were evaluated during data review to determine their potential impact on

individual data points, if any. Review action levels are set at 5 times the reporting level for all analytes, except those designated as common laboratory contaminants (methylene chloride, acetone, toluene, 2-butanone, and phthalate compounds) with action levels set at 10 times reporting levels. During data review, reported sample concentrations are assessed against method blank action levels and the following qualifications are made when reportable quantities of analyte were observed in the associated method blank.

- When the analyte sample concentration is above 5 or 10 times the action level, the data are not qualified and it is considered a positive value.

- When the analyte sample concentration is determined below 5 or 10 times the action level but above the reporting level, the data are considered impacted by the method blank and the value reported is qualified as a non-detect at the analyte value reported. These data are then qualified as "U.

- When the analyte sample concentration is determined below 5 or 10 times the action level and below the reporting level, the data are considered impacted by the method blank and the value reported is qualified as a non-detect at the reporting level. These data are then qualified as "U".

Evaluation of overall project sensitivity can be gained through review of field blank information. These actual sample analyses may provide a comprehensive look at the combined sampling and analysis sensitivity attained by the project. Field QC blanks obtained during sampling activities at RVAAP included samples of VOC trip blank waters and site water sources.

Equipment rinsate sample (CBP-QC-130-QC) did not exhibit any concentrations of explosive compounds. Minor levels of chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, and sodium were observed. All rinsates were associated with soil sampling equipment cleaning operations and none of the contaminant levels impacted the sample values being reported.

Field source water blank CBP-QC-132-QC (DI water source) exhibited a few analyte levels similar to those observed in the equipment blanks. Source water blank CBP-QC-131-QC (potable water source) contained normal levels of barium, calcium, copper, iron, lead, magnesium, manganese, potassium, sodium, and zinc for this type of water source. Neither of these sources contained any explosive compound levels. There is no indication that the source waters impacted associated sample levels.

D4.5 REPRESENTATIVENESS AND COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental site and is the qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include proper preservation, holding times, use of standard sampling and analytical methods, and determination of matrix or analyte interferences. Samples were delivered to the laboratory by overnight express courier, were received in good condition, and at appropriate temperature. All analyses were performed within the recommended analytical holding times. Sample preservation, analytical methodologies, and soil sampling methodologies were documented to be adequate and consistently applied.

Comparability, like representativeness, is a qualitative term relative to an individual project data set. These RVAAP AOC investigations employed appropriate sampling methodologies, site surveillance, use of standard sampling devices, uniform training, documentation of sampling, standard analytical protocols/procedures, QC checks with standard control limits, and universally accepted data reporting units to ensure comparability to other data sets. Through the proper implementation and documentation of these standard practices, the project has established the confidence that the data will be comparable to other project

and programmatic information. Table D-5 presents the standardized parameter groups, analytical methods, sample containers, preservation techniques, and associated holding times.

D4.6 COMPLETENESS

Usable data are defined as those data that pass individual scrutiny during the verification and validation process and are accepted for unrestricted application to the human health risk assessment evaluation or equivalent type applications. It has been determined that estimated data are acceptable for RVAAP project objectives.

Objectives for Demolition Area 2 data have been achieved. The project produced usable results for 100% of the sample analyses performed and successfully collected all the samples planned.

D5.0 DATA QUALITY ASSESSMENT SUMMARY

The overall quality of RVAAP Demolition Area 2 information meets or exceeds the established project objectives. Through proper implementation of the project data verification and assessment process, project information has been determined to be acceptable for use.

Data, as presented, have been qualified as usable or estimated "J or UJ". Data that have been estimated provide indications of either accuracy, precision, or sensitivity being less than desired but adequate for interpretation. Qualifiers have been applied to data when necessary.
Data produced for this project demonstrate that they can withstand scientific scrutiny, are appropriate for its intended purpose, are technically defensible, and are of known and acceptable sensitivity, precision, and accuracy. Data integrity has been documented through proper implementation of QA and QC measures. The environmental information presented has an established confidence that allows utilization for the project objectives and provides data for future needs.

Table D-5. Container Requirements for Soil and Sediment Samples at RVAAP, Ravenna, Ohio

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Explosive Compounds 8330	One 4-oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 day (extraction) 40 day (analysis)
Metals 6010B and 7471	One 4-oz glass jar with Teflon®-lined cap	50 g	Cool, 4°C	180 day; Hg @ 28 day

ATTACHMENT E

LABORATORY ANALYTICAL RESULTS AND COCs

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ATTACHMENT E
LABORATORY ANALYTICAL RESULTS

DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

Table 1. Discrete Surface Soil Samples - Inorganics

Station			**DA2-125**	**DA2-126**	**DA2-127**	**DA2-128**
Sample ID			**DA2SS-125-0900-SO**	**DA2SS-126-0902-SO**	**DA2SS-127-0904-SO**	**DA2SS-128-0906-SO**
Customer ID			**DA2SS-125-0900-SO**	**DA2SS-126-0902-SO**	**DA2SS-127-0904-SO**	**DA2SS-128-0906-SO**
Date			**11/15/2005**	**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)			**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Field Type			**Spatial Composite**	**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**	**Facility-wide Background**				
Inorganics						
Aluminum	MG/KG	17700	14600 /=	12700 /=	9400 /=	18400 /=#
Antimony	MG/KG	0.96	0.37 UN/UJ	0.27 UN/UJ	0.33 JN/J	0.52 JN/J
Arsenic	MG/KG	15.4	8.5 N/J	8.7 /=	11.4 /=	19.4 N/J#
Barium	MG/KG	88.4	61.3 N/J	80.8 N/J	92.1 N/J#	132 N/J#
Beryllium	MG/KG	0.88	0.58 /=	0.69 /=	0.53 /=	1 /=#
Cadmium	MG/KG		0.05 J/J#	0.02 U/U	0.33 /=#	0.73 /=#
Calcium	MG/KG	15800	266 /=	637 /=	2160 /=	946 /=
Chromium	MG/KG	17.4	21.9 /=#	16.6 /=	14.5 /=	23.9 /=#
Cobalt	MG/KG	10.4	10.4 /=	12.1 /=#	9 /=	18.3 /=#
Copper	MG/KG	17.7	13.5 /=	22.1 N/J#	31.2 N/J#	25.3 /=#
Iron	MG/KG	23100	19400 /=	20600 /=	18600 /=	29200 /=#
Lead	MG/KG	26.1	15.6 /=	15.7 /=	24.5 /=	32.3 /=#
Magnesium	MG/KG	3030	2240 N/J	2150 N/J	1950 N/J	2610 N/J
Manganese	MG/KG	1450	702 /=	971 D/=	760 /=	2890 D/=#
Mercury	MG/KG	0.036	0.04 /=#	0.04 /=#	0.07 /=#	0.08 /=#
Nickel	MG/KG	21.1	15.2 /=	14.1 /=	14.8 /=	22.9 /=#
Potassium	MG/KG	927	1020 N/J#	865 N/J	704 N/J	1650 N/J#
Selenium	MG/KG	1.4	0.35 J/J	0.41 U/U	0.53 J/J	0.94 J/J
Silver	MG/KG		0.04 U/U	0.04 U/U	0.04 U/U	0.04 U/U
Sodium	MG/KG	123	70 J/J	79.1 J/UJ	80.2 /U	78.1 J/J
Thallium	MG/KG		0.36 J/J#	0.98 UD/U	0.48 U/U	0.49 U/U
Vanadium	MG/KG	31.1	23.7 N/J	24.3 N/=	17.7 N/=	40.1 N/J#
Zinc	MG/KG	61.8	61.3 /=	63.9 /=#	87.9 /=#	101 /=#

Table 1. Discrete Surface Soil Samples – Inorganics (continued)

Station			**DA2-129**	**DA2-129**	**DA2-130**
Sample ID			**DA2SS-129-0908-SO**	**DA2SS-129-0912-SO**	**DA2SS-130-0910-SO**
Customer ID			**DA2SS-129-0908-SO**	**DA2SS-129-0912-SO**	**DA2SS-130-0910-SO**
Date			**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)			**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Field Type			**Spatial Composite**	**Field Duplicate**	**Spatial Composite**
Analyte (mg/kg)	**Units**	**Facility-wide Background**			
Inorganics					
Aluminum	MG/KG	17700	8100 /=	8030 /=	10800 /=
Antimony	MG/KG	0.96	0.44 JN/J	0.25 JN/J	0.71 JN/J
Arsenic	MG/KG	15.4	16.1 /=#	10.6 /=	8.2 N/J
Barium	MG/KG	88.4	51.7 N/J	51.4 N/J	46.1 N/J
Beryllium	MG/KG	0.88	0.44 /=	0.45 /=	0.42 /=
Cadmium	MG/KG		0.91 /=#	1 /=#	0.18 /=#
Calcium	MG/KG	15800	1150 /=	1150 /=	340 /=
Chromium	MG/KG	17.4	14 /=	14.4 /=	28.7 /=#
Cobalt	MG/KG	10.4	9.7 /=	9.7 /=	8 /=
Copper	MG/KG	17.7	175 N/J#	175 N/J#	23.2 /=#
Iron	MG/KG	23100	20700 /=	19600 /=	14700 /=
Lead	MG/KG	26.1	32.3 /=#	31 /=#	36.8 /=#
Magnesium	MG/KG	3030	1930 N/J	1920 N/J	1620 N/J
Manganese	MG/KG	1450	454 /=	454 /=	311 /=
Mercury	MG/KG	0.036	2.4 D/=#	2.3 D/=#	0.07 /=#
Nickel	MG/KG	21.1	16.8 /=	16.8 /=	19.5 /=
Potassium	MG/KG	927	836 N/J	826 N/J	796 N/J
Selenium	MG/KG	1.4	0.39 U/U	0.36 U/U	0.63 J/J
Silver	MG/KG		0.04 U/U	0.04 U/U	0.05 U/U
Sodium	MG/KG	123	73.4 J/UJ	65.9 J/UJ	76.7 J/J
Thallium	MG/KG		0.47 U/U	0.44 U/U	0.31 U/U
Vanadium	MG/KG	31.1	15.6 N/=	15.4 N/=	19.5 N/J
Zinc	MG/KG	61.8	199 /=#	203 /=#	72.6 /=#

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

# - value above facility wide background	= - analyte present and concentration accurate.
J - estimated value less than reporting limits.	U - Not detected
N - Matrix spike recovery outside control limits	* - Duplicate analysis outside control limits.
E - Result estimated because of the presence of interference.	P - greater than 25% difference between two GC columns
B - for organics-compound was detected in the blank as well as the sample	NA – not analyzed

B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.
Facility wide background was determined for the Winklepeck Burning Ground Phase II Remedial Investigation (USACE 2001c)

Table 2. Discrete Surface Soil Samples - Explosives

Station		**DA2-125**	**DA2-126**	**DA2-127**	**DA2-128**
Sample ID		**DA2SS-125-0900-SO**	**DA2SS-126-0902-SO**	**DA2SS-127-0904-SO**	**DA2SS-128-0906-SO**
Customer ID		**DA2SS-125-0900-SO**	**DA2SS-126-0902-SO**	**DA2SS-127-0904-SO**	**DA2SS-128-0906-SO**
Date		**11/15/2005**	**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Field Type		**Spatial Composite**	**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**				
Explosives					
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.1 JB/UJ	0.03 J/J	0.02 J/J	0.1 JB/UJ
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.01 J/J	0.2 U/U

Table 2. Discrete Surface Soil Samples – Explosives (continued)

Station		**DA2-129**	**DA2-129**	**DA2-130**
Sample ID		**DA2SS-129-0908-SO**	**DA2SS-129-0912-SO**	**DA2SS-130-0910-SO**
Customer ID		**DA2SS-129-0908-SO**	**DA2SS-129-0912-SO**	**DA2SS-130-0910-SO**
Date		**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)		**0.0 - 1.0**	**0.0 - 1.0**	**0.0 - 1.0**
Field Type		**Spatial Composite**	**Field Duplicate**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Explosives				
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.04 J/J	0.05 J/J	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.03 J/J	0.06 J/J	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.02 J/J	0.1 U/U	0.1 U/U
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.23 /J	0.15 J/J	0.2 U/U

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background

= - analyte present and concentration accurate.

J - estimated value less than reporting limits.

U - Not detected

N - Matrix spike recovery outside control limits

* - Duplicate analysis outside control limits.

E - Result estimated because of the presence of interference.

P - greater than 25% difference between two GC columns

B - for organics-compound was detected in the blank as well as the sample

NA – not analyzed

B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

Facility wide background was determined for the Winklepeck Burning Ground Phase II Remedial Investigation (USACE 2001c)

Table 3. Discrete Subsurface Soil Samples - Inorganics

Station			**DA2-125**	**DA2-126**	**DA2-127**	**DA2-128**
Sample ID			**DA2SO-125-0901-SO**	**DA2SO-126-0903-SO**	**DA2SO-127-0905-SO**	**DA2SO-128-0907-SO**
Customer ID			**DA2SO-125-0901-SO**	**DA2SO-126-0903-SO**	**DA2SO-127-0905-SO**	**DA2SO-128-0907-SO**
Date			**11/15/2005**	**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)			**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**
Field Type			**Spatial Composite**	**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**	**Facility-wide Background**				
Inorganics						
Aluminum	MG/KG	19500	20500 /=#	11700 /=	9570 /=	20000 /=#
Antimony	MG/KG	0.96	0.36 JN/J	0.32 JN/J	0.34 UN/UJ	0.51 JN/J
Arsenic	MG/KG	19.8	15.1 N/J	13.5 /=	11 N/J	20.4 N/J#
Barium	MG/KG	124	102 N/J	83.7 N/J	37.5 N/J	102 N/J
Beryllium	MG/KG	0.88	1.2 /=#	0.68 /=	0.38 /=	0.93 /=#
Cadmium	MG/KG		0.02 U/U	0.07 J/J#	0.01 U/U	0.01 U/U
Calcium	MG/KG	35500	1260 /=	3690 /=	455 /=	1010 /=
Chromium	MG/KG	27.2	29.1 /=#	19.3 /=	13.5 /=	27.8 /=#
Cobalt	MG/KG	23.2	16.9 /=	16.6 /=	7.6 /=	18.1 /=
Copper	MG/KG	32.3	24.9 /=	31.4 N/J	9.5 /=	21.6 /=
Iron	MG/KG	35200	34000 /=	23800 /=	17500 /=	36000 /=#
Lead	MG/KG	19.1	15 /=	28.4 /=#	10.5 /=	18.9 /=
Magnesium	MG/KG	8790	4930 N/J	2970 N/J	1690 N/J	3870 N/J
Manganese	MG/KG	3030	376 /=	535 /=	373 /=	587 /=
Mercury	MG/KG	0.044	0.02 J/J	0.06 /=#	0.03 J/J	0.02 J/J
Nickel	MG/KG	60.7	37 /=	22 /=	12.2 /=	27.6 /=
Potassium	MG/KG	3350	2830 N/J	1060 N/J	959 N/J	2360 N/J
Selenium	MG/KG	1.5	0.59 J/J	0.4 U/U	0.39 J/J	0.87 /=
Silver	MG/KG		0.04 U/U	0.04 U/U	0.04 U/U	0.04 U/U
Sodium	MG/KG	145	101 J/J	80.4 /U	71.2 J/J	80.9 J/J
Thallium	MG/KG	0.91	0.76 J/J	0.48 U/U	0.27 U/U	1 J/J#
Vanadium	MG/KG	37.6	32.1 N/J	21.1 N/=	18.9 N/J	36.4 N/J
Zinc	MG/KG	93.3	78.1 /=	75.8 /=	40.3 /=	69.8 /=

Table 3. Discrete Subsurface Soil Samples – Inorganics (continued)

Station			**DA2-129**	**DA2-129**	**DA2-130**
Sample ID			**DA2SO-129-0909-SO**	**DA2SO-129-0914-SO**	**DA2SO-130-0911-SO**
Customer ID			**DA2SO-129-0909-SO**	**DA2SO-129-0914-SO**	**DA2SO-130-0911-SO**
Date			**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)			**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 1.9**
Field Type			**Spatial Composite**	**Field Duplicate**	**Spatial Composite**
Analyte (mg/kg)	**Units**	**Facility-wide Background**			
Inorganics					
Aluminum	MG/KG	19500	16500 /=	17000 /=	12700 /=
Antimony	MG/KG	0.96	0.55 JN/J	0.42 JN/J	0.37 JN/J
Arsenic	MG/KG	19.8	16.6 N/J	16.1 N/J	11.8 N/J
Barium	MG/KG	124	48.6 N/J	49.7 N/J	37.6 N/J
Beryllium	MG/KG	0.88	0.64 /=	0.65 /=	0.45 /=
Cadmium	MG/KG		0.06 /=#	0.06 /=#	0.05 /=#
Calcium	MG/KG	35500	343 /=	363 /=	205 /=
Chromium	MG/KG	27.2	25 /=	24.2 /=	18.9 /=
Cobalt	MG/KG	23.2	8.6 /=	8.7 /=	7.9 /=
Copper	MG/KG	32.3	24.5 /=	25.8 /=	16.6 /=
Iron	MG/KG	35200	27700 /=	29100 /=	21300 /=
Lead	MG/KG	19.1	14 /=	14.2 /=	12.4 /=
Magnesium	MG/KG	8790	3170 N/J	3320 N/J	2380 N/J
Manganese	MG/KG	3030	222 /=	219 /=	250 /=
Mercury	MG/KG	0.044	0.13 /=#	0.13 /=#	0.04 /=
Nickel	MG/KG	60.7	21.9 /=	21.9 /=	17 /=
Potassium	MG/KG	3350	1790 N/J	1790 N/J	1130 N/J
Selenium	MG/KG	1.5	0.48 J/J	0.58 J/J	0.55 J/J
Silver	MG/KG		0.04 U/U	0.04 U/U	0.04 U/U
Sodium	MG/KG	145	74.5 J/J	79.8 J/J	64.2 J/J
Thallium	MG/KG	0.91	0.49 J/J	0.48 J/J	0.47 J/J
Vanadium	MG/KG	37.6	27.5 N/J	28 N/J	23.5 N/J
Zinc	MG/KG	93.3	82.7 /=	84.7 /=	53.8 /=

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

# - value above facility wide background	= - analyte present and concentration accurate.
J - estimated value less than reporting limits.	U - Not detected
N - Matrix spike recovery outside control limits	* - Duplicate analysis outside control limits.
E - Result estimated because of the presence of interference.	P - greater than 25% difference between two GC columns
B - for organics-compound was detected in the blank as well as the sample	NA – not analyzed

B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.
Facility wide background was determined for the Winklepeck Burning Ground Phase II Remedial Investigation (USACE 2001c)

Table 4. Discrete Subsurface Soil Samples - Explosives

Station		**DA2-125**	**DA2-126**	**DA2-127**	**DA2-128**
Sample ID		**DA2SO-125-0901-SO**	**DA2SO-126-0903-SO**	**DA2SO-127-0905-SO**	**DA2SO-128-0907-SO**
Customer ID		**DA2SO-125-0901-SO**	**DA2SO-126-0903-SO**	**DA2SO-127-0905-SO**	**DA2SO-128-0907-SO**
Date		**11/15/2005**	**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)		**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 3.0**
Field Type		**Spatial Composite**	**Spatial Composite**	**Spatial Composite**	**Spatial Composite**
Analyte (mg/kg)	**Units**				
Explosives					
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.1 B/UJ	0.03 J/J	0.1 JB/UJ	0.1 B/UJ
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U	0.2 U/U

Table 4. Discrete Subsurface Soil Samples – Explosives (continued)

Station		**DA2-129**	**DA2-129**	**DA2-130**
Sample ID		**DA2SO-129-0909-SO**	**DA2SO-129-0914-SO**	**DA2SO-130-0911-SO**
Customer ID		**DA2SO-129-0909-SO**	**DA2SO-129-0914-SO**	**DA2SO-130-0911-SO**
Date		**11/15/2005**	**11/15/2005**	**11/15/2005**
Depth (ft)		**1.0 - 3.0**	**1.0 - 3.0**	**1.0 - 1.9**
Field Type		**Spatial Composite**	**Field Duplicate**	**Spatial Composite**
Analyte (mg/kg)	**Units**			
Explosives				
1,3,5-Trinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
1,3-Dinitrobenzene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4,6-Trinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,4-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
2-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
3-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.1 U/U	0.1 U/U	0.1 U/U
4-Nitrotoluene	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
HMX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Nitrobenzene	MG/KG	0.1 JB/UJ	0.1 JB/UJ	0.1 JB/UJ
RDX	MG/KG	0.2 U/U	0.2 U/U	0.2 U/U
Tetryl	MG/KG	0.03 J/J	0.16 J/J	0.2 U/U

Note: Data Qualifiers are presented as Laboratory qualifiers/Validation qualifiers

- value above facility wide background
J - estimated value less than reporting limits.
N - Matrix spike recovery outside control limits
E - Result estimated because of the presence of interference.
B - for organics-compound was detected in the blank as well as the sample
B - for inorganics-result was less than the contract required detection limit but greater than the instrument detection limit.

= - analyte present and concentration accurate.
U - Not detected
* - Duplicate analysis outside control limits.
P - greater than 25% difference between two GC columns
NA – not analyzed

Facility wide background was determined for the Winklepeck Burning Ground Phase II Remedial Investigation (USACE 2001c)

Chain of Custody

SAIC

SDG: 511091

Chain of Custody Record

Science Applications International Corporation
An Employee Owned Company

Page 1 of 2

COC No.: RVAAP-GPL-001
Date: 11/16/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler Signature: Martha Clough (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ☒Explosives (A)	☒Metals, TAL (A)	☒Chromium +6 (A)	☒TCLP- VOC, SVOC, PEST, HERB, MET (A)	☒Chromium +6 and Total Chromium				☒Explosives (A)	☒Metals (C)	☒Chromium +6 (A)			No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
FBQ-193	FBQSS-193-500-SO	0-1	11/15/2005	0825	SO	1	1												2	
FBQ-193	FBQSO-193-0501-SO	1-3	11/15/2005	0835	SO	1	1												2	
FBQ-194	FBQSS-194-0502-SO	0-1	11/15/2005	0810	SO	1	1												2	
FBQ-194	FBQSO-194-0503-SO	1-2.3	11/15/2005	0820	SO	1	1												2	
FBQ-195	FBQSS-195-0504-SO	0-1	11/15/2005	0835	SO	1	1												2	
FBQ-195	FBQSO-195-0505-SO	1-2.3	11/15/2005	0850	SO	1	1												2	
FBQ-196	FBQSS-196-0506-SO	0-1	11/15/2005	0930	SO	1	1												2	
FBQ-196	FBQSS-196-0507-SO	1-2.8	11/15/2005	0945	SO	1	1												2	
FBQ-196	FBQSS-196-0512-SO	0-1	11/15/2005	0930	SO	1	1												2	
FBQ-197	FBQSS-197-0508-SO	0-1	11/14/2005	1400	SO	1	1												2	
FBQ-197	FBQSO-197-0509-SO	1-2.9	11/14/2005	1415	SO	1	1												2	
FBQ-198	FBQSS-198-0510-SO	0-1	11/14/2005	1445	SO	1	1												2	
FBQ-198	FBQSO-198-0511-SO	1-3	11/14/2005	1505	SO	1	1												2	

Subtotal Number of Containers: 26

Relinquished by: Martha Clough — Date: 11/16/05 — Time: 1700 — Company: GPL
Received by: Signature: Chino — Printed Name: Chino — Company: GPL — Date: 11/17/05 — Time: 9:30
Relinquished by — Signature — Printed Name — Company — Date — Time
Received by — Signature — Printed Name — Company — Date — Time

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-01 AND GPL-02

Shipment Method: FEDEX
Airbill No.: 853098788814 853098769603

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

S=soils
W=water

511091

Science Applications International Corporation

Chain of Custody

SAIC

SDG: 511093

Chain of Custody Record

Science Applications International Corporation
An Employee Owned Company

Page 2 of 2

COC No.: RVAAP-GPL-001
Date: 11/16/2005

Name: Science Applications International Corporation
Address: 151 Lafayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler (Signature): Martha Clough (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ss Explosives (A)	ss Metals, TAL (A)	ss Chromium +6 (A)	ss TCLP- VOC, SVOC, PEST, HERB, MET (A)	ss Chromium +6 and Total Chromium	w Explosives (A)	w Metals (C)	w Chromium +6 (A)	No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
DA2-125	DA2SS-125-0900-SO	0-1	11/15/2005	1315	SO	1	1							2	
DA2-125	DA2SO-125-0901-SO	1-3	11/15/2005	1330	SO	1	1							2	
DA2-127	DA2SO-127-0905-SO	1-3	11/15/2005	1425	SO	1	1							2	
DA2-128	DA2SS-128-0906-SO	0-1	11/15/2005	1440	SO	1	1							2	
DA2-128	DA2SO-128-0907-SO	1-3	11/15/2005	1455	SO	1	1							2	
DA2-129	DA2SO-129-0909-SO	1-3	11/15/2005	1215	SO	1	1							2	
DA2-129	DA2SO-129-0914-SO	1-3	11/15/2005	1215	SO	1	1							2	
DA2-130	DA2SS-130-0910-SO	0-1	11/15/2005	1230	SO	1	1							2	
DA2-130	DA2SO-130-0911-SO	0-1.9	11/15/2005	1250	SO	1	1							2	
CBP-035	CBPSS-035-0100-SO	0-1	11/14/2005	1410	SO	1	1							2	
CBP-035	CBPSO-035-0101-SO	1-3	11/14/2005	1425	SO	1	1							2	
CBP-QC	CBP-QC-0131-QC	na	11/16/2005	1530	WA						2	1	1	4	
CBP-QC	CBP-QC-0132-QC	NA	11/16/2005	1550	WA						2	1	1	4	

Subtotal Number of Containers: 30 | 1 | 1 | 4
TOTAL NUMBER OF CONTAINERS 58

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

Shipment Method: FEDEX
Airbill No.: 853098769614 853098769603

COOLER IDs: GPL-01 AND GPL-02

Relinquished by: Martha Clough — Company: SAIC — Date: 11/16/05 — Time: 1700
Received by: Chuck — Company: GPL — Date: 11/17/05 — Time: 9:30

Relinquished by — Company — Date — Time
Received by — Company — Date — Time

S=soils
W=water

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

511093

Science Applications International Corporation

Chain of Custody

SAIC

SDG: 511101

Chain of Custody Record

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Page 1 of 2

COC No.: RVAAP-GPL-002
Date: 11/17/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler (Signature) (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ☆Explosives (A)	☆Metals, TAL (A)	☆Chromium +6 (A)	☆TCLP- VOC, SVOC, PEST, HERB, MET (A)	☆Chromium +6 and Total Chromium	☆Metals, TAL and Chromium +6	W Explosives (A)	W Metals (C)	W Chromium +6 (A)	No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
DA2-126	DA2SS-126-0902-SO	0-1	11/15/2005	1515	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-126	DA2SO-126-0903-SO	1-3	11/15/2005	1525	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-127	DA2SS-127-0804-SO	0-1	11/15/2005	1405	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-129	DA2SS-129-0908-SO	0-1	11/15/2005	1155	SO	1	1								2	14-21 day Turn Around Time Requested
DA2-129	DASS-129-0912-SO	0-1	11/15/2005	1155	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-037	CBPSO-037-0105-SO	1-3	11/16/2005	1015	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-037	CBPSS-037-0104-SO	0-1	11/16/2005	1005	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-037	CBPSS-037-0125-SO	0-1	11/16/2005	1005	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-038	CBPSS-038-0106-SO	0-1	11/16/2005	1030	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-038	CBPSO-038-0107-SO	1-3	11/16/2005	1040	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-052	CBPSS-052-0122-SO	0-1	11/16/2005	0920	SO				1						1	14-21 day Turn Around Time Requested
CBP-052	CBPSS-052-0129-SO	0-1	11/16/2005	0920	SO					1					1	14-21 day Turn Around Time Requested
CBP-044	CBPSS-044-0114M-SO	0-5	11/16/2005	1430	SO	1									3	7-14 day Turn Around Time Requested
						Subtotal Number of Containers:									25	

Relinquished by: Date 11/17/05 Time 1700
Signature
Printed Name
Company: SAIC

Received by: Date 11/17/05 Time 0920
Signature
Printed Name
Company

Relinquished by: Date Time
Signature
Printed Name
Company

Received by: Date Time
Signature
Printed Name
Company

Relinquished by: Date Time
Signature
Printed Name
Company

Received by: Date Time
Signature
Printed Name
Company

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-03

S=soils
W=water

511101

Shipment Method: FEDEX
Airbill No.: 853098769669

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

Science Applications International Corporation

Chain of Custody Record

Science Applications International Corporation
An Employee Owned Company

Page 2 of 2

COC No.: RVAAP-GPL-002
Date: 11/17/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O. #: 01 1700 04 3265 505
Sampler (Signature): Martha Clough (Printed Name): Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters									No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
						Explosives (A)	Metals, TAL (A)	Chromium +6 (A)	TCLP- VOC, SVOC, PEST, HERB, MET (A)	Chromium +6 and Total Chromium	Metals, TAL and Chromium +6					
CBP-QC	CBP-QC-0130-QC	NA	11/17/2005	1615	WA							2	1	1	4	14-21 day Turn Around Time Requested
CBP-053	CBPSS-053-0123-SO	0-1	11/16/2005	0915	SO					1					1	14-21 day Turn Around Time Requested
CBP-036	CBPSS-036-0102-SO	0-1	11/16/2005	0825	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-036	CBPSO-036-0103-SO	1-3	11/16/2005	0845	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-039	CBPSS-039-0108-SO	0-1	11/16/2005	1105	SO	1	1								2	14-21 day Turn Around Time Requested
CBP-039	CBPSO-039-0109-SO	1-3	11/16/2005	1115	SO	1	1								2	14-21 day Turn Around Time Requested

Subtotal Number of Containers: 13
TOTAL NUMBER OF CONTAINERS 38

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-03

Shipment Method: FEDEX
Airbill No.: 853098789669

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

S=soils
W=water

511101

Relinquished by	Date	Time	Received by	Date	Time
Signature: Martha Clough	11/17/05	1700	Signature: Chris Cox	11/17/05	1700
Printed Name: Martha Clough			Printed Name: Chris Cox		
Company: SAIC			Company: GPL		
Relinquished by	Date	Time	Received by	Date	Time
Signature			Signature		
Printed Name			Printed Name		
Company			Company		
Relinquished by	Date	Time	Received by	Date	Time
Signature			Signature		
Printed Name			Printed Name		
Company			Company		

Science Applications International Corporation

Chain of Custody

SAIC

SDG: 511115

Science Applications International Corporation — *An Employee Owned Company*

Chain of Custody Record

Page 1 of 1

COC No.: RVAAP-GPL-003

Date: 11/18/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O.#: 01 1700 04 3265 505
Sampler (Signature): Martha Clough (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Station	Sample ID	Depth	Date	Time	Matrix	Requested Parameters: ∞Explosives (A)	∞Metals, TAL (A)	∞Chromium +6 (A)	∞TCLP- VOC, SVOC, PEST, HERB, MET (A)	∞Chromium +6 and Total Chromium (	∞Metals, TAL and Chromium +6	W Explosives (A)	W Metals (C)	W Chromium +6 (A)	No. of Containers	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
CBP-040	CBPSS-040-0110M-SO	0-3	11/17/2005	0800	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-041	CBPSS-041-0111M-SO	0-7	11/17/2005	0945	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-041	CBPSS-041-0127M-SO	0-7	11/17/2005	0945	SO	1					1				2	7-14 day Turn Around Time Requested
CBP-042	CBPSS-042-0112M-SO	0-10	11/17/2005	1020	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-042	CBPSS-042-0136M-SO	0-10	11/17/2005	1020	SO	1					1				2	7-14 day Turn Around Time Requested
CBP-043	CBPSS-043-0113M-SO	0-5	11/17/2005	1225	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-045	CBPSS-045-0115M-SO	0-8	11/17/2005	1350	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-046	CBPSS-046-0116M-SO	0-3	11/17/2005	1245	SO	1			1		1				3	7-14 day Turn Around Time Requested
CBP-048	CBPSS-048-0118M-SO	0-3	11/17/2005	1530	SO	1			1		1				3	7-14 day Turn Around Time Requested

Subtotal Number of Containers: 25

Notes: TOTAL NUMBER OF CONTAINERS 25
A: Cool 4°C C: HNO3 to pH<2, Cool 4°C
B: HCl to pH<2, Cool 4°C D: H2SO4 to pH<2, Cool 4°C
E: NaOH + Zn, Cool 4°C F: $Na_2S_2O_3$ + Cool 4°C

COOLER IDs: GPL-04

Shipment Method: FEDEX
Airbill No.: 853098769636

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

Relinquished by	Date	Time	Received by	Date	Time
Signature: Martha Clough	11/18/2005	1700	Signature: Isaac Clough	11/18/05	1015
Printed Name: Martha Clough			Printed Name: Isaac Clough		
Company: SAIC			Company: GPL		
Relinquished by	Date	Time	Received by	Date	Time
Signature			Signature		
Printed Name			Printed Name		
Company			Company		

S=soils
W=water

511115

Science Applications International Corporation

Chain of Custody Record

SAIC Science Applications International Corporation
An Employee Owned Company

COC No.: RVAAP-GPL-004
Page 1 of 1 Date: 11/21/2005

Name: Science Applications International Corporation
Address: 151 Layfayette Drive Oak Ridge, TN 37831
Phone Number: (865) 481-4600
Project Manager: Kevin Jago
Project Name: RVAAP Six High Priority AOCs
Job/P.O. #: 01 1700 04 3265 505
Sampler (Signature) [signature] (Printed Name) Martha Clough

Laboratory Name: GPL Laboratories, LLLP
Address: 7210A Corporate CT
Frederick, MD 21703
Phone: 301.694.5310
Contact: Virginia Zusman

Requested Parameters

Station	Sample ID	Depth	Date	Time	Matrix	S Explosives (1A)	S Metals, TAL and Chromium +6 (A)	S Total Chromium and Chromium +6 (A)	S TCLP - VOC, SVOC, PEST, HERB, MET (A)	W VOC - TCLP (4A)	W SVOCs - TCLP (5A)	W Metals - TCLP (6A)	W Pesticides - TCLP	W Herbicides - TCLP	No. of Containers	Observations, Comments Special Instructions
CBP-054	CBPSS-054-0124-SO	0-1	11/17/2005	0950	SO			1							1	14-21 DAY TURN AROUND
CBP-049	CBPSS-049-0119M-SO	0-5	11/18/2005	0800	SO	1	1		1						3	7-14 DAY TURN AROUND
CBP-047	CBPSS-047-0117M-SO	0-8	11/18/2005	0945	SO	1	1		1						3	7-14 DAY TURN AROUND
CBP-050	CBPSS-050-0120M-SO	0-6	11/18/2005	0810	SO	1	1		1						3	7-14 DAY TURN AROUND
CBP-051	CBPSS-051-0121M-SO	0-6	11/18/2005	0805	SO	1	1		1						3	7-14 DAY TURN AROUND
CBP-IDW	CBP-IDW-0134-SO	NA	11/21/2005	1130	SO				1						1	
CBP-IDW	CBP-IDW-0133-DW	NA	11/21/2005	1230	WA					2	2	1	2	2	9	

Subtotal Number of Containers: 23

Relinquished by	Date	Received by	Date
Signature: [signature]	11/21/05	Signature: Chino	11/22/05
Printed Name: Martha Clough	Time: 1600	Printed Name: [signature]	Time: 9:45
Company: SAIC		Company: GPL	

Relinquished by	Date	Received by	Date
Signature:		Signature:	
Printed Name:	Time:	Printed Name:	Time:
Company:		Company:	

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C
E. NaOH + Zn, Cool 4°C
F. $Na_2S_2O_3$ + Cool 4°C

S=soils
W=water

511120

Shipment Method: FEDEX
Airbill No.: 7924 4374 0739

Field Contact: Martha Clough
330-405-5804 (work)
216-287-0450 (cell)

Science Applications International Corporation

ATTACHMENT F

TOPOGRAPHIC SURVEY DATA

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Sample ID	Easting	Northing	Elevation
DA2-125	2355040.056	561079.86	1066.255
DA2-126	2354615.284	561021.375	1058.328
DA2-127	2354365.621	560743.312	1053.508
DA2-128	2354352.235	560562.243	1062.489
DA2-129	2354671.617	560059.297	1059.22
DA2-130	2355477.404	560407.06	1058.189

- coordinate system is Ohio State Plan 1983 Ohio North 3401 NAD 1983 Feet

ATTACHMENT G

MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE SURVEY REPORT

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4 January 2006

Science Applications International Corporation
Attn: Martha L. Clough
8866 Commons Blvd., Suite 201
Twinsburg, OH 44087

RE: After Action Report (AAR) for the MEC Avoidance Support at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio.

Dear Martha Clough,

USA Environmental, Inc. (USAE) completed the Munitions and Explosives of Concern (MEC) Avoidance Support at the Ravenna Army Ammunition Plant located in Ravenna, Ohio, from 13-19 November 2005. All operations were completed safely, on time, within budgeted funding, and in accordance with the project technical scope of work.

Throughout the project operations, USAE encountered two munitions debris, which were identified as possible fragments from a 3.5-Inch Rocket. Other than the two munitions debris found, USAE did not encounter any unexploded ordnance (UXO)/MEC items at any of the RVAAP areas of concern (AOCs): the Open Demolition Area 2 (RVAAP-04), the Fuze and Booster Quarry Landfill/Ponds (RVAAP-16), and the Central Burn Pits (RVAAP-49).

Upon receipt of the approval of the work plan and a notice to proceed from Science Applications International Corporation (SAIC), USAE mobilized one UXO qualified personnel, Mr. Dale Miller, and the project support equipment to the RVAAP project site. Mr. Miller has completed the U.S. Naval Explosive Ordnance Disposal training, which details procedures for evaluation and disposal of MEC. Prior to beginning work on site, Mr. Miller also completed a health and safety training program, which complies with Occupational Safety and Health Administration (OSHA) Regulations 29 CFR 1910.120e(9). All USAE employees who work on hazardous sites receive training, which includes an equivalent of 40 hours of training off-site and actual field experience under the direct supervision of a trained, experienced Supervisor. Management and Supervisors receive an additional 8 hours of training on program supervision. Each employee receives 8 hours of OSHA refresher training annually.

Mr. Miller arrived on site at Building 1036 at 0830 on 14 November 2005. Mr. Miller coordinated with Ms. Martha Clough (SAIC Site Manager) for site safety and pre-operation orientation. Upon completion of the orientation and prior to beginning the field operations, Mr. Miller performed a tailgate safety briefing for all field personnel. Mr. Miller commenced the marking sample location operations at areas RVAAP 16 and RVAAP-04. During MEC avoidance support of areas RVAAP-16 and RVAAP-04, Mr. Miller did not encounter any MEC/UXO related items.

On 15 November 2005, prior to beginning the field operations, Mr. Miller provided the daily and tailgate safety briefings and then commenced the soil sample collection operations at the RVAAP-16 and RVAAP-04. During the surface sweep of area RVAAP-16, Mr. Miller did not encounter any MEC/UXO related items. However, during the surface sweep of area RVAAP-04, Mr. Miller encountered two pieces of munitions debris located at sample location #130. Mr. Miller identified these items as potential fragments from a 3.5-Inch Rocket. The two munitions debris encountered were reported to SAIC and avoided. Mr. Miller successfully completed the soil sample collection of both areas at RVAAP-16 and RVAAP-04 with no incidents or accidents.

On 16 November 2005, prior to beginning the field operations, Mr. Miller provided the daily and tailgate safety briefings and then commenced the soil sample collection operations at the Central Burn Pits (RVAAP-49). The soil sample collection activities of this sample area continued for the remaining duration of the project. During the surface sweep of area RVAAP-49, Mr. Miller did not encounter any MEC/UXO

related items. Mr. Miller successfully completed the soil sample collection of area RVAAP-49 on 18 November 2005 and demobilized on 19 November 2005.

USAE completed all field operations at the RVAAP in accordance with the approved Work Plan and contract requirements. All site operations were completed safely, efficiently, and in accordance with the Technical Scope of Work.

Sincerely,

Manok N. Synakorn
Project Manager

Encl: Attachment 1, Daily Site Summaries and Daily Safety Briefings

Attachment 1

Daily Site Summaries and Daily Safety Briefings.

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/18/05 **Location:** Ravenna AAP

Time: 7:50 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM/SSHO
Brian Williams	Brian Williams	Tech
Jed Thomas	Jed Thomas	Tech

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/17/05 **Location:** Ravenna AAP

Time: 7:55 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM/55HO
Beau Wilkins	B. Wilkins	Tech
Jed Thomas	Jed Thomas	Tech

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/16/05 **Location:** Ravenna AAP

Time: 7:10 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM SHSO
Jat Thomas	Jat Thomas	Field Crew
Ben Williams	Ben Williams	Field Crew

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/15/05 **Location:** Ravenna AHP

Time: 7:20 (AM) PM **Team #:** _____

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM SHSO
Jed Thomas	Jed Thomas	Field Crew
Beau Williams	Beau Williams	Field Crew

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: 11/14/05 **Location:** Ravenna AAP

Time: 9:15 (AM) PM **Team #:**

1. Reason for Briefing:

✓	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position
Martha Clough	Martha Clough	FM, SH&SO
Jed Thomas	Jed Thomas	Field Crew
Brian Wilkins	Brian Wilkins	Field Crew

Briefing Given By:

Name	Signature	Position
Dale E. Miller	Dale E. Miller	T-3

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description	✓	Emergency Response/Equipment
✓	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
✓	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
✓	PPE		Medical Monitoring
✓	Safe Work Practices	✓	Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
✓	MEC Precautions		Other:

4. Remarks:

DAILY OPERATIONS SUMMARY

DATE: 11/13/05 thru 11/19/05

PAGE 1 OF 5 PAGES

SITE / LOCATION: Ravenna Army Ammunition Plant

1. **WORK SUMMARY**

a. **Work Accomplished:**

	Number Completed	Total Remaining
(1) Survey		
(2) Preparation		
(3) Mag & Flag		
(4) Geophysical		
(5) Intrusive		
(6) Quality Control		
(7) Quality Assurance		

b. **Discrepancies:** _____

c. **Inspection Results:**

	Pass	Fail
(1) Quality Control		
(2) Quality Assurance		
(3) Safety		

2. **INSTRUCTIONS RECEIVED FROM CUSTOMER REPRESENTATIVE:**

Escort SAIC personnel while collecting soil samples to ensure ordnance avoidance in all phases of the project.

Daily Operations Summary Con't.

3. UXO SUMMARY

a. UXO Located: None

Type:	Quantity:	Live/Prac.:	Remarks:

Daily Operations Summary Con't.

b. Demolition Supplies Expended: None

Type:	Quantity:	Remarks:

c. Scrap Generation / Deposition: None

Type:	Quantity:	Weight:	Remarks:

Daily Operations Summary Con't.

4. Utilization

a. Daily Man-hours:

Labor Category:	Task #:	M/H Used this ~~Today:~~ Week!	M/H Remaining:	% M/H Remaining:	Remarks:
Project Manager					
SUXO					
UXO Tech. III		44			
UXO Tech. II					
UXO Tech. I					
Laborer					
UXOSO					
UXOQCS					
Admin Personnel					
Visitor					
Sub-Contractor Personnel (List by Category)					

Daily Operations Summary Con't.

b. Daily Equipment:

Description:	Task:	Hours Used:	Hours Remaining:	% Hours Remaining:	Remarks:
Schonstedt		44			
Geophysical					
Truck (Heavy)					
Truck (Light)		44			
Radio, Base					
Radio, Handheld					
Backhoe					
Front-end Loader					
Rental Car					
GPS					
Weedeater					
Chainsaw					
Chipper					

5. Operational Remarks:

6. Signature / Date:

Dale E. Miller
SUXO / Project Manager

Date: 11/19/05

11/13/05

Dale E. Miller, Tech III mobilized from Aberdeen, OH to Ravenna Army Ammunition Plant.

1935 Arrived at Hampton Inn, Brimfield, OH

Received 4 packages shipped from USA Environmental.

1 Schoenstadt
1 MK 26 Forrester
1 First Aid Kit
1 Water Jug (5 gal)
2 Radios with chargers
1 Hard Hat
4pr Safety glasses
2pr Gloves
1 Safety Vest
1 roll engineers tape
1 roll package tape
10pr ear plugs
1pkg 9V batteries

Dale E. Miller
11/13/05

11/14/05

0830 Arrived at Ravenna Army Ammunition Plant and met SAIC personnel. Martha Clough, site manager, Jed Thomas and Beau Williams.

0900 Morning safety briefing by Martha Clough.

0920 Departed Bldg 1036 for the field.

0935 Tailgate safety brief.

0945 Commenced marking sample sites in Fuse, Booster Quarry area.

1115 Completed marking sample sites in FBQ area. Moved to Open Demolition Area 2.

1200 Lunch break.

1245 Lunch break over, back to ODA2.

1405 Completed marking sample sites in ODA2. Moving back to FBQ area to begin taking soil samples.

1645 Completed taking samples from two sample sites. Returning to bldg 1036.

1700 Secured for the day. No MEC or residue encountered today.

Dale E. Mullen
11/14/05

11/15/05

0700 Morning safety brief.

0720 Tailgate safety brief.

0725 Departed Bldg 1036 to collect soil samples.

0755 Arrived at the FBQ area to collect samples.

1115 Finished collection of samples in the FBQ area. Will break for lunch.

1145 Lunch break complete. Moving to the Open Detonation Area #2 to collect soil samples.

1320 Encountered two pieces of frag from 3.5" rockets at sample site #130. Items moved to facilitate sampling work. No explosive residue associated with these two items.

1615 Finished collection of samples from ODA2, returning to Bldg 1036.

1657 Secured for the day. No MEC items encountered today.

Dale E. Miller
11/15/05

11/16/05 4

0700 Morning Safety Brief

0710 Tail gate safety brief.

0715 Departed Bldg 1036 to collect soil samples from the central burn pits area.

0740 Arrived at the central burn pits area, started collecting samples.

1210 Returned to Bldg 1036 to turn in collected samples.

1215 Taking lunch break

1245 Lunch break over. Returning to central burn pits area to continue collecting samples.

1625 Returned to Bldg 1036 with soil samples.
No MEC or related residue encountered today.

1640 Secured for the day.

Dale E. Miller
11/16/05

11/17/05

0703 Morning safety brief.

0745 Departed Bldg 1036 to collect soil samples from the central burn area.

0755 Tailgate safety brief.

0800 Started collection of soil samples.

1145 lunch break.

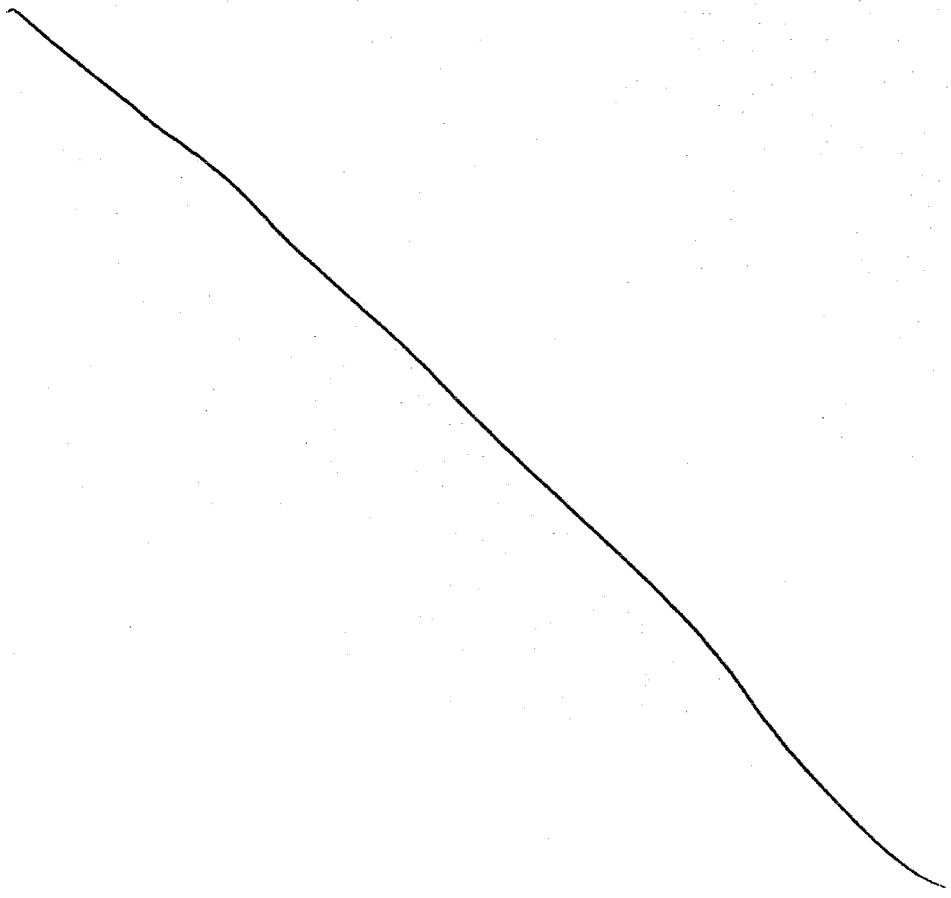
1220 Lunch break over, returned to collecting soil samples.

1650 Returned to Bldg 1036 with collected samples.

1705 Secured for the day.

Dale E. Mullen

11/17/05



11/18/05 6

0600 Gave Mk 26 to desk clerk at Motel, Hampton Inn, who stated that he would call FedEx for pick up. MK 26 is being shipped to James Hannan in Abingdon, MD.

0700 Morning safety brief.

0735 Departed Bldg 1036 to resume collecting soil samples from the central burn area.

0750 Tailgate safety brief.

0800 Resumed collecting soil samples.

1115 Completed collection of all soil samples, returning to Bldg 1036.

1195 Completed packaging of all USHE equipment for shipment back to Tampa, FL.

1200 Departed Ravenna AAP to drop equipment for shipping.

1230 Equipment dropped for shipping.

1400 Completed paperwork for project. On site work complete.

1600 Call Manok Synakorn to report that all documentation will be sent to him via Fedex on Monday.

Dale E. Miller
11/18/05

11/19/05 7

0515 Demolized from Brimfield, Ohio to ~~At~~ Aberdeen, OH.

1230 Washed truck after project use.

1300 Arrived at home of record.

Dale E. Miller

11/19/05

Appendix 3A
Fate and Transport of COCs in Soil

TABLE OF CONTENTS

LIST OF TABLES

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3A.0 CONTAMINANT FATE AND TRANSPORT

3A.1 INTRODUCTION

An assessment of impacted soils at ODA2 was conducted to evaluate their potential to impact groundwater both at the AOC (unrestricted land use exposure scenario) and at an exposure point down-gradient of the AOC (restricted land use exposure scenario) to ensure residual concentrations in soils are protective of groundwater under both potential land use exposure scenarios. The process for identifying these soil constituents with potential to impact groundwater is explained and executed in Section 3A.2. Section 3A.3 presents the conclusion of the evaluation: a list of AOC-specific constituents producing unacceptable impact to groundwater beneath the source (affecting unrestricted land usage) or at a receptor downgradient of the source (affecting restricted land usage).

3A.2 EVALUATION

This section describes the steps implemented to identify constituents in soils impacting groundwater:

- Section 3A.2.1 lists constituents identified in the RI Report as potentially impacting groundwater.
- Section 3A.2.2 evaluates these constituents across multiple media to further refine the list of potential constituents.
- Section 3A.2.3 presents refinements to the modeling performed in the RI Report, if appropriate.

3A.2.1 RI Evaluation Process

Constituents are identified in Section 5 (Contaminant Fate and Transport) of the RI Report that potentially impact groundwater at ODA2. The RI Report identified potential impacts beneath the source and at receptor locations downgradient of the source.

The RI Report identified constituents with potential or observed impacts beneath a source area as contaminant migration chemicals of potential concern (CMCOPCs). Potential impacts beneath the source were determined from model predictions of observed soil sample results where the predicted concentration at the water table beneath the source exceeded the MCL or Region 9 PRG. Constituents also are identified as CMCOPCs if they were detected in AOC groundwater and exceeded the MCL or Region 9 PRG.

The RI Report identified constituents with potential groundwater impacts at receptor locations down gradient of the source area as contaminant migration chemicals of concern (CMCOCs). Potential impacts to receptors downgradient of the AOC source were determined in the RI Report based on modeling of contaminant migration (i.e., CMCOPC migration) within the groundwater aquifer. All CMCOPCs were evaluated for impacts at downgradient receptors.

3A.2.2 AOC-Specific Evaluation

The constituents identified in Table 3A-1 are evaluated across multiple media. The evaluation examines characteristics of the constituents detected, distribution in soil or water compared to background concentrations, and the conservative nature of modeling completed during the RI. The criteria below were evaluated to determine the potential for impacts to groundwater from impacted soils at each of the AOCs.

Background: If model input source concentrations are less than either surface or subsurface background, predicted results are compared to observed groundwater data to assess the generally conservative nature of the modeling. As part of this evaluation, the soils data are reviewed for patterns of detections (both vertically and laterally) and nearby surface water and groundwater results are also reviewed to ensure consistency between predicted and observed results when source concentrations from the RI were at or below background:

- For CMCOPCs where all observed sample results are less than background (either surface or subsurface soils), the constituent is removed from further consideration of future groundwater impacts.

- For CMCOPCs where the source concentration (i.e., concentration input to modeling) is less than background levels (either surface or subsurface soils), the constituent is removed from further consideration of future groundwater impacts.

- For CMCOPCs where one or more samples or the source concentration exceeds background levels, RI data are further reviewed for pattern of detection (e.g. do elevated surface and subsurface soil results occur at the same location; is there a pattern of detections indicative of a contaminant plume; are the elevated detections located in separate areas with no recognizable pattern).

Predicted Time of Maximum Impact: If the predicted time of maximum impact in RI is short (e.g., less than 10 years) and activities ceased at the AOC long before that period of time, the predicted maximum impact has likely occurred in the past. In these cases, observed groundwater data are reviewed, and if maximum observed groundwater data are less than the constituent-specific MCL or RBC, the constituent is removed from further consideration of future groundwater impacts. If predicted maximum impact is less than the constituent-specific MCL or RBC, the constituent is removed from further consideration of future groundwater impacts.

Detected in Groundwater: If a constituent is detected in groundwater, but not detected in soils, the constituent is removed from further consideration of future groundwater impacts. If a constituent is detected in groundwater and is detected in soils at or below background levels, the constituent also is removed from further consideration of future groundwater impacts.

3A.2.2.1 Open Demolition Area #2

Based on the results of the Phase II RI for ODA2, ten constituents are evaluated for potential impacts in groundwater beneath the source and all ten constituents also are evaluated for potential impacts to groundwater at downgradient receptors (Table 3A-1). Upon further analysis, nine of these constituents were not predicted or identified to impact groundwater as summarized below.

Table 3A-1. Potential Groundwater Impacts Identified in Phase II RI Report for ODA2

Potential Groundwater Impact Beneath the Source [a]	Potential Groundwater Impact Downgradient of the Source [b]
ODA2	
Antimony	Antimony
Arsenic	Arsenic
Barium	Barium
Chromium (total)	Chromium (total)
Chromium, hexavalent	Chromium, hexavalent
Copper	Copper
Manganese	Manganese
Selenium	Selenium
RDX	RDX
Tetryl	Tetryl

[a]Potential groundwater impact beneath the source is determined from either SESOIL+AT123D modeling in the RI of the concentration at the water table or observed MCL/PRG exceedance of groundwater samples identified in the RI.
[b]Potential groundwater impact downgradient of the source is determined from AT123D modeling of the plume migrating to receptors.

The modeling discussion in the RI presented soil AOC-related contaminants with respect to source areas north and south of Sand Creek. The discussion below does not focus on these soil aggregates but discusses them only if necessary to draw upon relationships established in the fate and transport modeling conducted in the RI Report.

- Antimony is removed from further consideration for future groundwater impacts because there were only two detections of antimony in soil above background (only slightly greater than twice background and clustered near Sand Creek), and there were no detections above background in surface water or groundwater. Due to its conservative nature, modeling results using concentrations near background predict impacts to groundwater; however, no impacts to groundwater are observed.

- Arsenic is removed from further consideration of future groundwater impacts because concentrations detected in soils are consistent with background concentrations. Modeling results indicate background levels of arsenic in soils may result in groundwater impacts in excess of the MCL.

- Barium is removed from further consideration of future groundwater impacts because there were few elevated detects clustered near one location (DA2-045); the EPC in soils is less than

background; and concentrations in surface water/groundwater generally did not exceed background.

- All detections of chromium (total) in soil samples were below subsurface background; therefore chromium (total) is removed from further consideration of future groundwater impacts.

- Chromium (hexavalent) is not naturally occurring. Conservative modeling predicted impact to groundwater within a few hundred years in the areas north and south of Sand Creek. The highest detection of hexavalent chromium occurred in a well upgradient of ODA2. Hexavalent chromium also was detected in monitoring wells located near Sand Creek at ODA2; however hexavalent chromium was not detected in surface water samples collected in Sand Creek (2003). The ODA2 upgradient well, DA2mw-104, is downgradient of Winklepeck Burning Grounds (where hexavalent chromium also detected in surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soils) and also downgradient of former munitions storage facilities. Chromium (hexavalent) in soils is retained for further consideration of future impacts to groundwater; however, impacts are not limited to ODA2 soils contributions – impacts also appear to be migrating from offsite contributors in groundwater.

- Copper concentrations in soils exceeded background both north and south of Sand Creek. The highest concentrations were detected in surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soils south of Sand Creek. Groundwater south of Sand Creek contacts copper in soils directly. Copper also was detected above background in sediment in Sand Creek. Copper concentrations detected in groundwater did not exceed the MCL despite the fact that the water table is in direct contact with copper in soil nor did copper exceed background concentrations in surface water, therefore copper detected in soils north and south of Sand Creek are removed from further consideration of future groundwater impacts.

- Manganese is removed from further consideration of future groundwater impacts because there is only a single exceedance of background; both the source concentration and the EPC are less than subsurface soil background; and observed groundwater results are at or below background.

- All detections of selenium in soils were below background values; therefore selenium is removed from further consideration of future groundwater impacts.

- RDX: RI SESOIL source load modeling in area south of Sand Creek predicted maximum impact in 3 years. Given AOC history, the maximum impact likely occurred in the past. RDX is removed from further consideration of future groundwater impacts at ODA2 because there are few detections in soils, the predicted time of maximum impact to groundwater is 3 years (so maximum impact has likely passed), and RDX has not been detected in surface water nor was it detected in groundwater samples above the Region 9 PRG (6.1E-04 mg/l).

- Tetryl: RI SESOIL source load modeling in the area south of Sand Creek predicted maximum impact in 6 years. Given AOC history, the maximum impact likely occurred in the past. Tetryl

is removed from further consideration of future groundwater impacts at ODA2 because there are limited detections in soils, the predicted time of maximum impact to groundwater is 6 years (so maximum impact has likely passed), and tetryl has not been detected in surface water or groundwater samples at ODA2.

3A.2.3 Refined AOC-Specific Modeling Results

Based on analyses of the conservative fate and transport assessment performed in support of the RI for ODA2, no COCs were identified for further analysis using the SESOIL/AT123D models previously developed with refined input parameters.

3A.3 CONCLUSIONS

Groundwater impacts in excess of MCLs are predicted for impacted soils at ODA2:

- Hexavalent Chromium in soils at ODA2 – North and South of Sand Creek.

The predicted impacts in groundwater beneath ODA2 are not predicted to reach downgradient receptor locations. No remediation of soils is required at ODA2 for groundwater under restricted land use. In addition, observed impacts to groundwater may not be entirely attributable to ODA2 soils contributions – observed impacts also appear to be migrating from offsite contributors to groundwater.

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