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ADDENDUM TO THE PHASE II REMEDIAL INVESTIGATION REPORT

for Open Demolition Area #2

(RVAAP-04)

Ravenna Army Ammunition Plant
Ravenna, Ohio

July 2006

US Army Corps of Engineers®
Louisville District

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

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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TABLE OF CONTENTS

LIST OF TABLES iii
LIST OF FIGURES iv
LIST OF PHOTOGRAPHS iv
LIST OF APPENDICES iv
LIST OF ACRONYMS v

1.0 INTRODUCTION 1-1
1.1 PURPOSE AND SCOPE 1-1
1.2 GENERAL FACILITY DESCRIPTION 1-2
1.2.1 Demography and Land Use 1-3
1.3 ODA2 DESCRIPTION 1-4
1.3.1 Operational History 1-4
1.3.2 Previous Investigations 1-5
1.4 REPORT ORGANIZATION 1-7

2.0 ENVIRONMENTAL SETTING 2-1
2.1 RVAAP Physiographic Setting 2-1
2.2 Surface Features 2-1

3.0 STUDY AREA INVESTIGATION 3-1
3.1 SURFACE AND SUBSURFACE SOIL CHARACTERIZATION 3-1
3.1.1 Rationale 3-1
3.1.2 Surface and Subsurface Soil Field Sampling Methods 3-2
3.2 ANALYTICAL PROGRAM OVERVIEW 3-4
3.2.1 Laboratory Analyses 3-4
3.2.2 Data Review, Validation, and Quality Assessment 3-5
3.3 MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE 3-6

4.0 NATURE AND EXTENT OF CONTAMINATION 4-1
4.1 DATA EVALUATION METHODS 4-1
4.1.1 Data Aggregates 4-1
4.1.2 Data Reduction and Screening 4-1
4.1.3 Data Presentation 4-2
4.2 RESULTS OF SOIL SAMPLING AND ANALYSIS 4-2
4.2.1 Surface Soils (0-1 ft BGS) 4-2
4.2.2 Subsurface Soils (1-3 ft BGS) 4-7
4.3 QUALITATIVE RISK EVALUATION 4-8
4.3.1 Shallow Surface Soils (0-1 ft BGS) 4-8
4.3.2 Subsurface Soils (1-3 ft BGS) 4-10
4.4 SUMMARY 4-12

5.0 CONTAMINANT FATE AND TRANSPORT 5-1
5.1 EVALUATION 5-1
5.1.1 RI Evaluation Process 5-1
5.1.2 AOC-Specific Evaluation 5-2
5.1.3 Refined AOC-Specific Modeling Results 5-5
5.2 CONCLUSIONS 5-5

6.0 HUMAN HEALTH RISK ASSESSMENT 6-1
6.1 IDENTIFICATION OF HUMAN HEALTH PRELIMINARY CLEANUP GOALS .... FOR ODA2 6-1
6.1.1 Land Use and Potential Receptors at ODA2 6-3
6.1.2 Constituents of Concern 6-4
6.1.3 Target Risk for Preliminary Cleanup Goals 6-4
6.1.4 Preliminary Cleanup Goals 6-5
6.1.5 Risk Management Considerations 6-5

7.0 ECOLOGICAL RISK ASSESSMENT 7-1
7.1 SUMMARY OF ECOLOGICAL RISK ASSESSMENT 7-1
7.2 ECOLOGICAL PROTECTION 7-5
7.2.1 Ecological Preliminary Cleanup Goals for ODA2 7-5
7.2.2 Ecological Cleanup Goal Development Weight of Evidence 7-5
7.3 SUMMARY 7-11

8.0 SUMMARY AND CONCLUSIONS 8-1

9.0 RECOMMENDATIONS 9-1

10.0 REFERENCES 10-1

LIST OF TABLES

Table 3-1. Soil Sample List, ODA2 Supplemental Phase II RI 3-2
Table 4-1. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Surface Soils (0-1 ft BGS) 4-3
Table 4-2. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Subsurface Soils (1-3 ft BGS) 4-5
Table 4-3. Explosive SRCs Detected in Surface Soils (0-1 ft BGS) at ODA2 4-6
Table 4-4. Inorganic SRCs Detected in Surface Soils (0-1 ft BGS) at ODA2 4-6
Table 4-5. Explosive SRCs Detected in Subsurface Soils (1-3 ft BGS) at ODA2 4-7
Table 4-6. Inorganic SRCs Detected in Subsurface Soils (1-3 ft BGS) at ODA2 4-7
Table 4-7. Summary of RI Report and Supplemental Phase II Shallow Surface Soils (0-1 ft BGS) Data: Open Demolition Area2 4-14
Table 4-8. Summary of RI Report (USACE 2005c) and Supplemental Subsurface Soils (1-3 ft BGS) Data: Open Demolition Area 2 4-19
Table 5-1. Potential Groundwater Impacts Identified in Phase II RI Report for ODA2 5-3
Table 6-1. Summary of HHRA Risk Results for the Security Guard/Maintenance Worker Scenario Exposed to Surface Soils (0-1 ft BGS) at Open Demolition Area 2 6-1
Table 6-2. Soil Preliminary Cleanup Goals for Security Guard/Maintenance Worker Scenario at ODA2 6-5
Table 7-1. Surface (0-1 ft BGS) and Subsurface Soil (1-3 ft BGS) COPECs at ODA2 SERA (Level II) 7-2
Table 7-2. Summary of Sand Creek Sediment COPECs for ODA2 and Rationale for Retention 7-3
Table 7-3. Summary of Sand Creek Surface Water COPECs for ODA2 and Rationale for Retention 7-4
Table 7-4. COPECs in Surface Soils (0-1 ft BGS) at ODA2 Compared to Background and ESV 7-10

LIST OF FIGURES

Figure 1-1. General Location and Orientation of RVAAP....1-9
Figure 1-2. RVAAP/RTLS Installation Map 1-11
Figure 1-3. Features of ODA2....1-12
Figure 3-1. Sample Locations at ODA2....3-7
Figure 4-1. Occurrences of Detected Explosives in Surface Soils (0-1 ft BGS), ODA2 Supplemental Phase II RI....4-25
Figure 4-2. Occurrences of Detected Inorganic SRCs in Surface Soils (0-1 ft BGS), ODA2 Supplemental Phase II RI....4-26
Figure 4-3. Occurrences of Detected Inorganic SRCs in Subsurface Soils (1-3 ft BGS), ODA2 Supplemental Phase II RI....4-27

LIST OF PHOTOGRAPHS

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

LIST OF APPENDICES

Appendix A. Soil Sampling Logs
Appendix B. IDW Disposal Report
Appendix C. Project Quality Assurance Summary
Appendix D. Data Quality Control Summary Report
Appendix E. Laboratory Analytical Results and COCs
Appendix F. Topographic Survey Report
Appendix G. MEC Avoidance Survey Report

LIST OF ACRONYMS

ADR	Automated Data Review
AMSL	above mean sea level
AOC	Area of Concern
AT123D	Analytical Transient 1-, 2-, 3-Dimensional
BGS	below ground surface
BRAC	Base Realignment and Closure
CBP	Central Burn Pits
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMCOC	contaminant migration chemical of concern
CMCOPC	contaminant migration chemical of potential concern
COC	constituent of concern
COEC	constituent of ecological concern
COPC	constituent of potential concern
COPEC	constituent of potential ecological concern
CQC	contractor quality control
CTT	closed, transferring, and transferred
DERR	Division of Emergency and Remedial Response
DNT	dinitrotoluene
DoD	U. S. Department of Defense
DOT	U. S. Department of Transportation
DQA	data quality assessment
DQO	Data quality objective
DQSR	Data Quality Summary Report
EPC	exposure point concentration
ERA	ecological risk assessment
ESV	ecological screening value
EU	exposure unit
FCO	field change order
FS	Feasibility Study
FWHHRAM	Facility Wide Human Health Risk Assessor Manual
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IDW	Investigation derived waste
ILCR	incremental lifetime cancer risk
IRP	Installation Restoration Program
LCS	laboratory control sample
M&TE	materials and testing equipment
MCL	maximum contaminant level
MDC	maximum detected concentration
MDL	method detection level

LIST OF ACRONYMS (CONTINUED)

MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
MPR	monthly progress report
MS	matrix spike
MSD	matrix spike duplicate
NCR	nonconformance report
NFA	no further action
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
PRG	preliminary remediation goal
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
QHEI	Qualitative Habitat Evaluation Index
RAGS	Risk Assessment Guidance for Superfund
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RGO	Remedial goal option
RI	Remedial Investigation
ROD	Record of Decision
RPD	relative percent difference
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SDG	sample delivery group
SERA	Screening Ecological Risk Assessment
SESOIL	Seasonal Soil Compartment Model
SMDP	Scientific decision management plan
SOW	Statement of Work
SRC	site-related contaminant
SVOC	semivolatile organic compound

LIST OF ACRONYMS (CONTINUED)

THI	target hazard index
TNT	trinitrotoluene
TR	target risk
UCL	upper confidence limit
USACE	U. S. Army Corps of Engineers
USAEHA	U. S. Army Environmental Hygiene Agency
USEPA	U. S. Environmental Protection Agency
USGS	U. S. Geological Society
USIOC	U. S. Industrial Operations Command
VOC	volatile organic compound
WWH	Warmwater habitat
WQC	water quality criteria

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ES.0 EXECUTIVE SUMMARY

Science Applications International Corporation (SAIC) has been contracted by the U. S. Army Corps of Engineers (USACE), Louisville District to provide environmental services to achieve remedy for (or cleanup of) soils and dry sediments at Open Demolition Area #2 (ODA2) (RVAAP-04). ODA2 is one of the six high priority areas of concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio, requiring remedy for (or cleanup of) soils and dry sediments by September 30, 2007.

The ODA2 Remedial Investigation (RI) phase is complete with submittal of this addendum to the Phase II RI Report (USACE 2005e). This RI Addendum recommends no further action at ODA2 with respect to soils and dry sediments in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. Remediation of impacts to aqueous media (groundwater and surface water) and underwater sediment is not included under the scope of the Performance Based Contract (PBC) and will be addressed under future decisions.

ES.1 SCOPE

This RI Addendum evaluates necessary CERCLA requirements with respect to chemical contamination in soils and dry sediments at ODA2 with the exception of the following areas:

- 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 munitions and explosives of concern (MEC) issues will be addressed in the Military Munitions Response Program (MMRP).

An assessment to achieve remedy for (or cleanup of) aqueous media (i.e., groundwater, surface water, and wet sediments) or MEC contamination in soils is not included in the scope of this RI Addendum as they are to be addressed under future decisions.

ES.2 SUMMARY OF UPDATED ANALYSIS

The results of the Supplemental Phase II RI identified one explosive (nitrobenzene) not previously detected. Sample DA2-129 has the most detected concentrations 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. Also, inclusion of the supplemental data did not change the conclusions of the HHRA or SERA for shallow surface soils (0-1 ft BGS) or subsurface soils (1-3 ft BGS) at ODA2.

ES.2.1 Fate and Transport Assessment of COCs in Soils

Based on analyses of the fate and transport assessment performed in support of the RI for ODA2, no constituents of concern (COCs) were identified for further analysis using the Seasonal Soil Compartment Model (SESOIL)/Analytical 1-,2-,3-Dimensional (AT123D) models previously developed with refined input parameters.

Groundwater impacts in excess of maximum contaminant levels (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 as groundwater use at the AOC will be restricted.

ES.2.2 Identification of Human Health Preliminary Cleanup Goals for ODA2

Preliminary cleanup goals were developed for soil COCs at ODA2. Preliminary cleanup goals are the chemical-specific, risk-based values used to meet the objective for protection of human health.

Only one COC (arsenic) was identified in the HHRA. The calculated exposure point concentration (EPC) for arsenic in soil (14 mg/kg) and all individual concentrations are less than the preliminary cleanup goal established for this metal for the Security Guard/Maintenance Worker land use; the EPC is also less than background. Therefore, remediation of arsenic is not required.

ES.2.3 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 comes from applying steps in the Facility-Wide Ecological Risk Work Plan and specifically steps in Figure III to reach a Scientific Management Decision Point (SMDP) that few ecological resources are at risk. This recommendation is based principally on the following three weight-of-evidence conclusions:

- Field observations (Level I of Ohio Environmental Protection Agency [Ohio EPA] protocol) indicate there are currently few adverse ecological effects (USACE 2005e), and there is ample nearby habitat to maintain ecological communities at ODA2 and elsewhere on RVAAP. 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.

ES.3 COCs AT ODA2

No COCs are identified for further evaluation for the representative receptor (Security Guard/Maintenance Worker) at ODA2; residential land use was not evaluated at ODA2. The presence of MEC and the active RCRA unit is anticipated to preclude future residential land use of this AOC.

ES.4 RECOMMENDATIONS

It is recommended ODA2 undergoes no further action (NFA) with respect to chemical contamination in soils/dry sediments. The ecosystems appear healthy and no preliminary cleanup values for ecological resources are recommended. No human health COCs are identified for the representative land use receptor (Security Guard/Maintenance Worker) at ODA2, which is not a candidate for residential 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. Therefore, MEC issues at ODA2 will be addressed under the MMRP. Required land use controls with respect to MEC issues will be developed and implemented by the US Army and OHARNG. Restrictions will be maintained at ODA2 until a final remedial decision regarding MEC is determined under the MMRP.

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1.0 INTRODUCTION

Science Applications International Corporation (SAIC) has been contracted by the U. S. Army Corps of Engineers (USACE), Louisville District to provide environmental services to achieve remedy for (or cleanup of) soils and dry sediments at Open Demolition Area #2 (ODA2) (RVAAP-04) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio by September 30, 2007.

A Supplemental Phase II RI investigation was conducted under the U. S. Department of Defense (DoD) Installation Restoration Program (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 2005c), and the supplemental investigation presented in this report, were conducted in compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 following work plans reviewed and commented on by the Ohio Environmental Protection Agency (Ohio EPA).

This Remedial Investigation (RI) Addendum presents the results of the Phase II Supplemental RI of ODA2, as well as updates the contaminant fate and transport analysis, human health risk assessment (HHRA), and ecological risk assessment (ERA). This RI Addendum further addresses soils (including dry sediments) under the scope of the Performance Based Contract (PBC). Remedy for (or cleanup of) aqueous media (groundwater, surface water, and wet sediment) are not assessed in this RI Addendum, but will be addressed under future decisions.

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 (USACE 2005e). This RI Addendum does not address the findings of the investigation at Fuze and Booster Quarry Landfill/Ponds and Central Burn Pits. Supplemental Phase II RI reports for Fuze and Booster Quarry Landfill/Ponds and Central Burn Pits are issued separately.

1.1 PURPOSE AND SCOPE

The purpose of the Supplemental Phase II field investigation was to complete the delineation of the nature and extent of contamination in affected soil media following the Phase II RI. The Phase II RI required further delineation of explosives in the northwestern portion of ODA2. This RI Addendum is further prepared to

- Update the fate and transport analysis conducted in the Phase II RI;

- Develop preliminary cleanup goals and apply risk management considerations to the HHRA completed in the Phase II RI;

- Incorporate further weight of evidence into the ERA completed in the Phase II RI; and

- Determine if ODA2 will require no further action with respect to soils and dry sediments or will be the subject of a Feasibility Study (FS) to evaluate potential remedies and future actions using the results of the updated risk assessments.

This RI Addendum evaluates necessary CERCLA requirements with respect to chemical contamination in soils and dry sediments. The following Area of Concern (AOC) features are not included in the scope of this RI Addendum:

- 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 munitions and explosives of concern (MEC) issues will be addressed under the Military Munitions Response Program (MMRP).

Ohio Army National Guard (OHARNG) has established future land uses at ODA2 based on anticipated training mission and utilization of the Ravenna Training and Logistics Site (RTLS) (USACE 2004e). These anticipated future land uses in conjunction with the evaluation of residential land use and associated receptors form the basis for identifying and evaluating future action.

1.2 GENERAL FACILITY DESCRIPTION

When the RVAAP IRP began in 1989, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the OHARNG over a two year period (2002 and 2003) and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the National Guard Bureau (NGB) and subsequently licensed to the OHARNG for use as a military training site. The current RVAAP consists of 1,280 acres scattered throughout the OHARNG RTLS.

The RTLS is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 km (3 miles) east northeast of the city of Ravenna and approximately 1.6 km (1 mile) northwest of the city of Newton Falls. The RVAAP portions of the property are solely located within Portage County. The RTLS/RVAAP is a parcel of property approximately 17.7 km (11 miles) long and 5.6 km (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see Figures 1-1 and 1-2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 9.6 km (6 miles) to the northwest; Newton Falls

1.6 km (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 km (3 miles) to the south.

When the RVAAP was operational the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and therefore references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

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, Load Line12 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 AOCs 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.

1.2.1 Demography and Land Use

RVAAP consists of 8,775 hectares (21,683 acres) and is located in northeastern Ohio, approximately 37 km (23 miles) east-northeast of Akron and 48.3 km (30 miles) west-northwest of Youngstown. RVAAP occupies east-central Portage County and southwestern Trumbull County. U. S. 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 are Ravenna, with a population of 12,100, and Newton Falls, with a population of 4,866.

The RVAAP 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 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 south of State Route 5.

RVAAP is in the process of environmental study and cleanup and is operated by the Base Realignment and Closure (BRAC) District. The BRAC District controls environmental AOCs at RVAAP. The 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 District to NGB is conducted.

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

1.3 ODA2 DESCRIPTION

1.3.1 Operational History

ODA2 is located in the central portion of the facility and is 25 acres in size (Figure 1-2). 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 destroyed by open detonation at ODA2. Materials destroyed by open detonation were placed in a pit excavated to a depth of at least 4 ft, then covered with 2 ft of soil, and detonated. Following detonation, ODA2 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 ft for non-fragmenting explosives to 4,000 ft for 5-inch caliber or larger munitions. In addition, past operations at ODA2 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 ft northeast of Building 1501 with an approximate size of 2 acres. Burial Site 2 is located approximately 100 ft 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-ft 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.

Features of ODA2 are shown on Figure 2-3. Two of these source contamination areas are not within the scope of this RI Addendum: the RCRA permitted unit and “Rocket Ridge.” The RCRA unit underwent MEC clearance to a depth of 4 ft (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 managed as a 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 2004e). There are no immediate plans for active re-use of ODA2; however, occasional demolition of MEC will continue at the RCRA unit as part of the Restoration and MMRP activities. Activity outside the RCRA unit would be limited to MEC technicians transporting material from storage to the RCRA unit for demolition.

1.3.2 Previous Investigations

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

- Hazardous Waste Management Study No. 37-26-0442-84 [U. S. Army Environmental Hygiene 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 investigations included sampling of surface and subsurface soil, surface water, groundwater, sediment, surface runoff, and aquatic organisms. Explosives and metals were common contaminants found at these areas. The RCRA unit underwent a MEC removal. The soils were excavated to a depth of 4 ft, 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 [U. S. Industrial Operations Command (USIOC 2000)]; and

- Phase II RI Report for the ODA2 (AOC-4) at the RVAAP, Ravenna, Ohio (USACE 2005c).

These investigation included sampling of surface [0-1 ft below ground surface (BGS)] and subsurface (1-3 ft BGS) soil, sediment, surface water, and groundwater. Sample analysis indicated contamination with metals and explosives. In addition, water sample analysis indicated contamination with volatile organic compound (VOCs) and semivolatile organic compounds (SVOCs).

1.3.2.1 <u>Phase II RI Summary</u>

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 2005c).

The Phase II RI Report concluded that the vertical and horizontal extent of soil site-related contaminants (SRCs) was not defined. Explosives detected in surface soils (0-1 ft BGS) in the northwestern portion of ODA2 require further delineation. Inorganics detected at ODA2 were compared to USEPA 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 were similar to naturally occurring concentrations. Average results for aluminum, arsenic, and manganese were at or below background.

The Phase II investigation determined constituents of concern (COCs), contaminant migration constituents of concern (CMCOCs), and constituents of potential ecological concern (COPECs).

1.4 REPORT ORGANIZATION

This RI Addendum is organized to meet Ohio EPA requirements in accordance with U. S. Environmental Protection Agency (USEPA) CERCLA Superfund and USACE guidance. This RI Addendum is organized as follows:

- Chapter 2 presents the environmental setting;

- Chapter 3 presents the study area field investigation and the methodologies used for data collection;

- Chapter 4 describes the updated nature and extent of soil contamination at ODA2 and provides a qualitative risk evaluation of the Supplemental Phase II RI data;

- Chapter 5 details the updated contaminant fate and transport;

- Chapter 6 presents the updated HHRA including calculation of preliminary cleanup goals and risk management considerations;

- Chapter 7 presents the updated ERA;

- Chapter 8 presents a summary of the report;

- Chapter 9 lists the recommendations for ODA2; and

- Chapter 10 cites the references used in this report.

Appendices (A through G) contain information in support of the Supplemental Phase II RI field activities. These appendices consist of:

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

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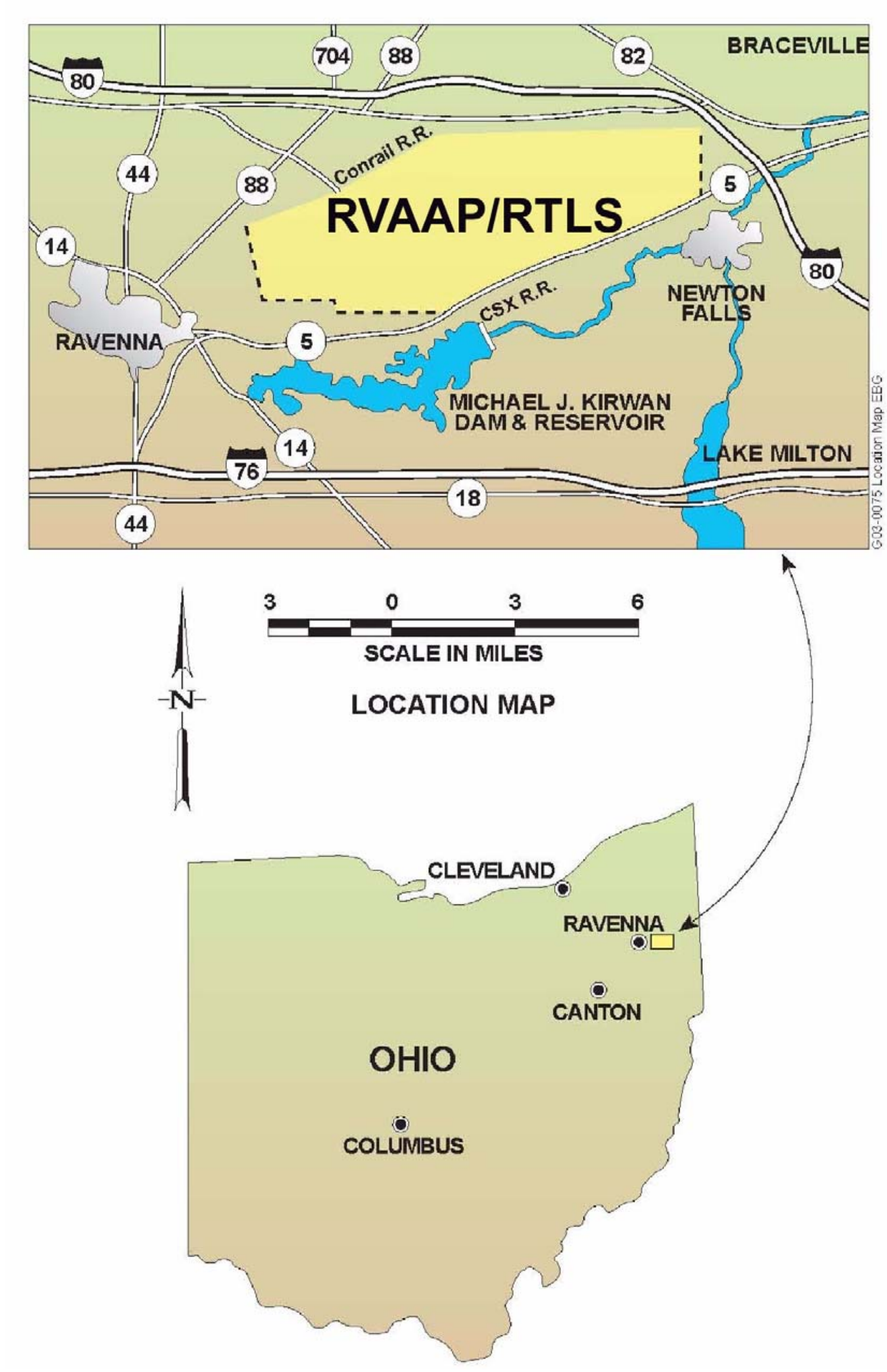

Figure 1-1. General Location and Orientation of RVAAP

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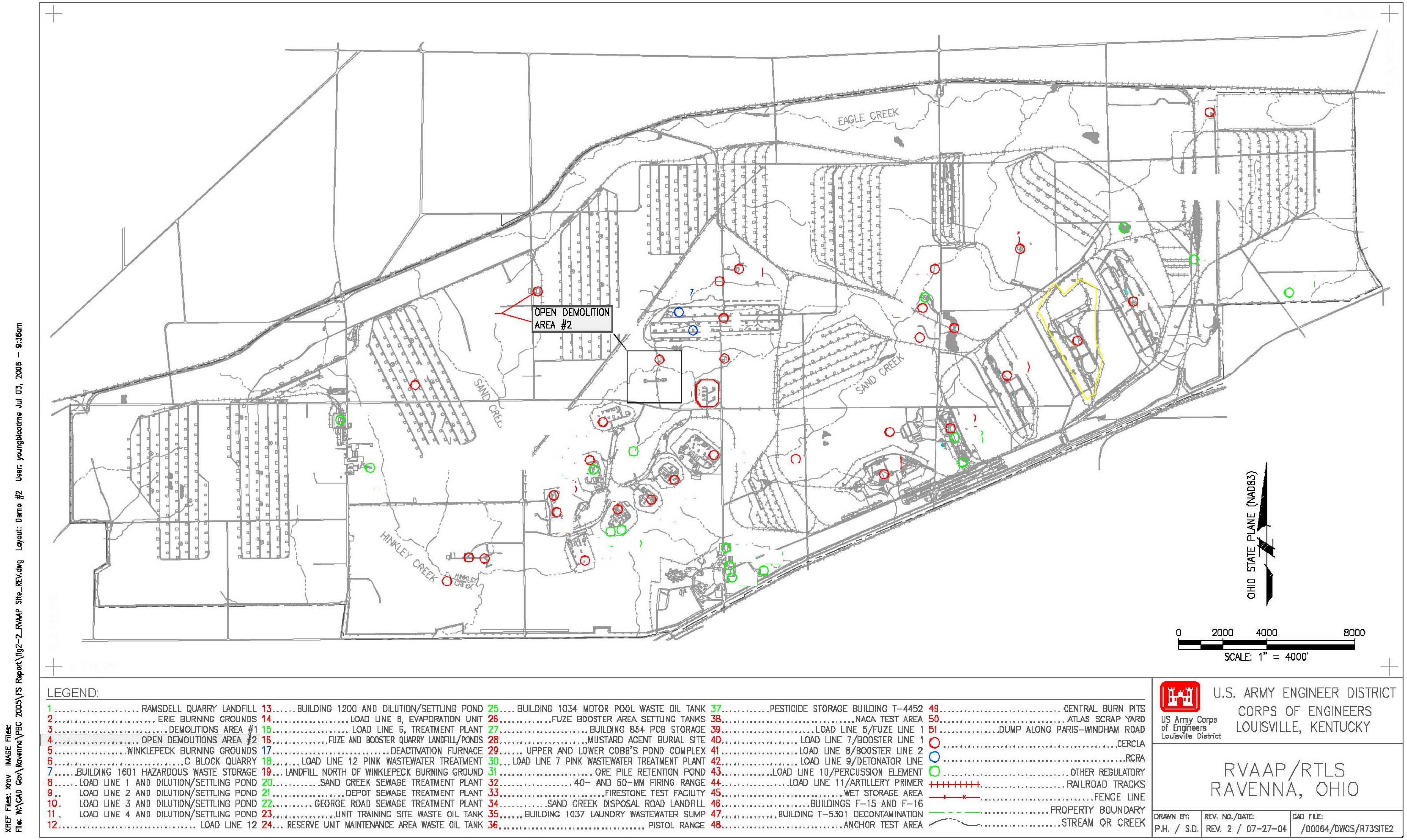

Figure 1-2. RVAAP/RTLS Installation Map

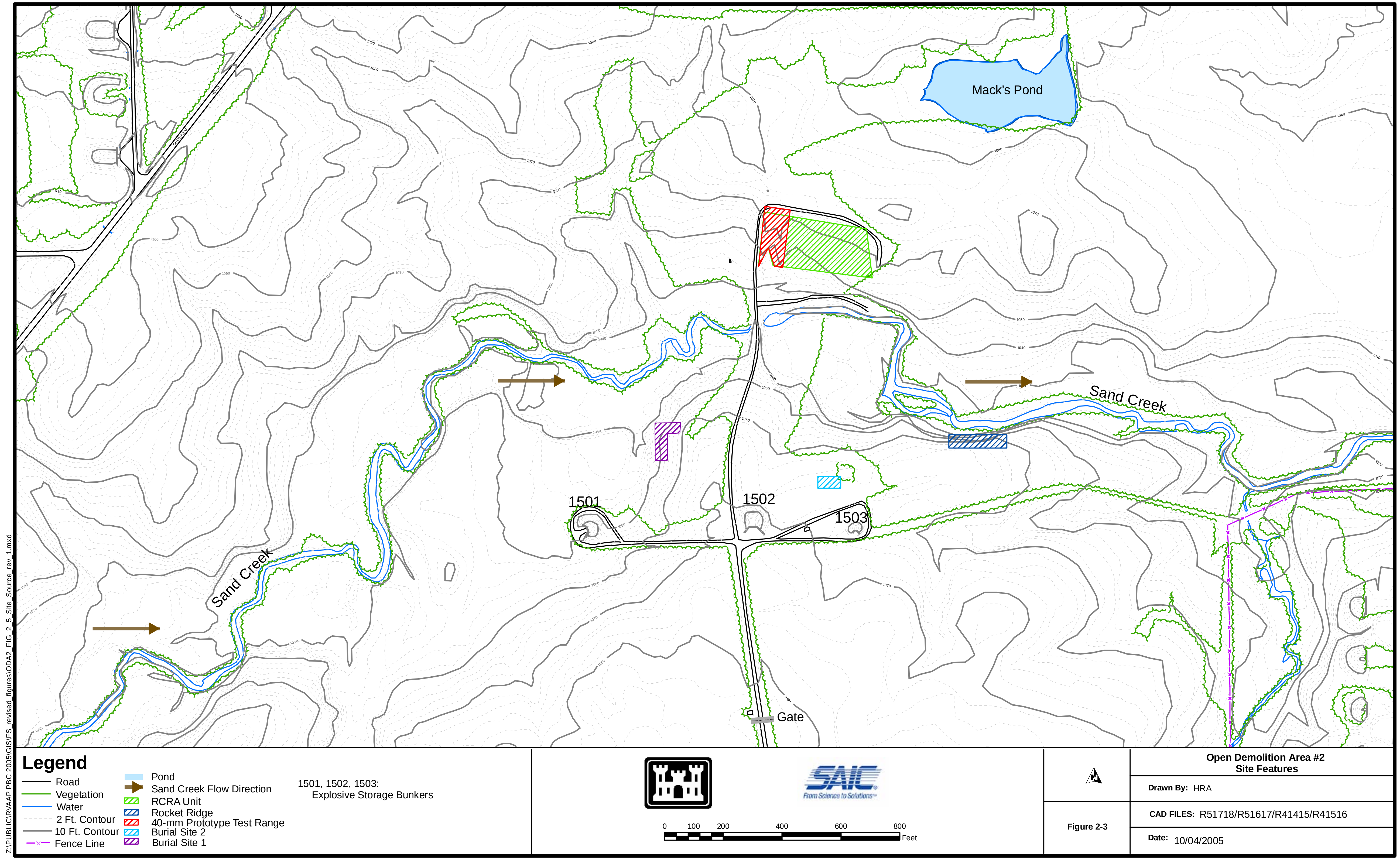

Figure 1-3. Features of ODA2

2.0 ENVIRONMENTAL SETTING

This chapter describes the physical characteristics of ODA2 and the surrounding environment that are factors in understanding potential contaminant transport pathways, receptors, and exposure scenarios for human health and ecological risks. Chapter 2 of the Phase II RI Report for ODA2 (USACE 2005c) describes the physical characteristics of ODA2 in more detail.

2.1 RVAAP PHYSIOGRAPHIC SETTING

RVAAP is located within the Southern New York Section of the Appalachian Plateau physiographic province [U. S. Geological Society (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 SURFACE FEATURES

ODA2 is characterized by gently to steeply sloping topography (Photograph 2-1) on a weathered shale bedrock surface. Elevations vary from approximately 309-326 m (1,017-1,071 ft) above mean seal level (AMSL). ODA2 is bisected by Sand Creek. Structures at ODA2 include three above-ground explosive storage bunkers and gravel access and paved roads (Figure 2-3). Access to ODA2 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 soils are highly disturbed across much of ODA2 down to a depth of 4 ft or more due to the detonation, disposal, and MEC clearance activities at the AOC.

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. Conditions at Open Demolition Area #2, September 2005

The current potential for human exposure to potential contaminants migrating from ODA2 is mitigated by inactivity at the AOC, the absence of permanent residents, and the low population density on adjacent private properties. Substantial disruption of ecological terrestrial habitat was observed at ODA2 because of demolition activities. Outside of the recently remediated RCRA unit, no evidence of substantial ecological stress was observed during the field investigation.

3.0 STUDY AREA INVESTIGATION

The scope of the Supplemental Phase II RI field investigation at ODA2 includes sampling of surface (0-1 ft 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 (USACE 2005e).

3.1 SURFACE AND SUBSURFACE SOIL CHARACTERIZATION

Soil samples for chemical analyses were collected from a total of six stations located throughout ODA2. Figure 3-1 illustrates the locations for surface soils (0-1 ft BGS) and subsurface soils (1-3 ft BGS) sampling. Table 3-1 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 Appendix A.

3.1.1 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 3-1). The final sample locations were determined in the field based on AOC 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 3-1 describes the final placement of individual sampling locations for soils 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 (USACE 2005e).

Table 3-1. Soil Sample List, ODA2 Supplemental Phase II RI

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

AOC = Area of concern.
ODA2 = Open Demolition Area #2.

3.1.2 Surface and Subsurface Soil Field Sampling Methods

3.1.2.1 Surface Soils and Dry Sediments

A decontaminated bucket hand auger was used to collect surface soil samples at each station. The target depth interval for surface soil samples was 0-0.3 m (0-1 ft) 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 soils at sites with a history of explosives contamination in surface soils (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 m (3 ft) per side. Equal portions of soils from the three subsamples were placed into a large, decontaminated stainless steel bowl and labeled with the sample identification number. Field descriptions and classifications for the soil samples were performed and the results were recorded in the project logbooks in accordance with Section 4.4.2.3 of the Facility-

Wide SAP (USACE 2001), as specified in the Supplemental Phase II RI SAP (USACE 2005e), 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 procedure utilized during the 14 Sites AOC field effort (MKM 2005). 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 soils were spread and allowed to air dry overnight or up to two days. The air-dried soils were prepared for sieving by crushing and removing rocks and organic materials. The soils were 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 soils were incrementally placed into sample jars and submitted to the fixed-base laboratory for analysis.

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

3.1.2.2 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.

Soils from the subsurface interval were placed into a stainless steel pan or bowl and labeled with the sample identification number. 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 Addendum, 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 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 soils were spread and allowed to air dry overnight or up to two days. The air-dried soils were prepared for sieving by crushing and removing rocks and organic materials. The soils were then sieved using a #10 and #4 stainless steel sieve. Any materials not passing through the sieve were considered IDW. The remaining air-dried, sieved materials were then ground using a decontaminated coffee grinder. The ground soils were incrementally placed into sample jars and submitted to the fixed-base laboratory for analysis.

Following processing of the samples, excess soils were 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 Appendix B. Hand-auger borings were backfilled to the ground surface with dry bentonite chips.

3.2 ANALYTICAL PROGRAM OVERVIEW

3.2.1 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 soils and subsurface soils. 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, Inc. (herein referred to as GPL), Gaithersburg, Maryland, a USACE Center of Excellence certified laboratory. The specified QC split samples collected for soils 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.

Appendix 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 (LCS), 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 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 Appendix 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 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.

3.2.2 Data Review, Validation, and Quality Assessment

Samples were properly packaged for shipment and dispatched to GPL 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 U. S. Department of Transportation (DOT) 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 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.

- A report was generated and sent to the laboratory project manager upon acceptance of the raw data by the area supervisor.

- 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 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 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 LCS 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 COCs and calculating risk. Analytical data were verified through the review process outlined in the SAP and are presented in Appendix 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% 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.

3.3 MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE

MEC avoidance subcontractor support staff was present during all field operations. The ordnance and explosives (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. Visitors were briefed on OE avoidance before they were allowed access to ODA2. 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 ODA2 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 (1-3 ft BGS), a magnetometer was lowered into the borehole to screen for subsurface magnetic anomalies at the top of the subsurface interval. Appendix G presents the MEC Survey Report.

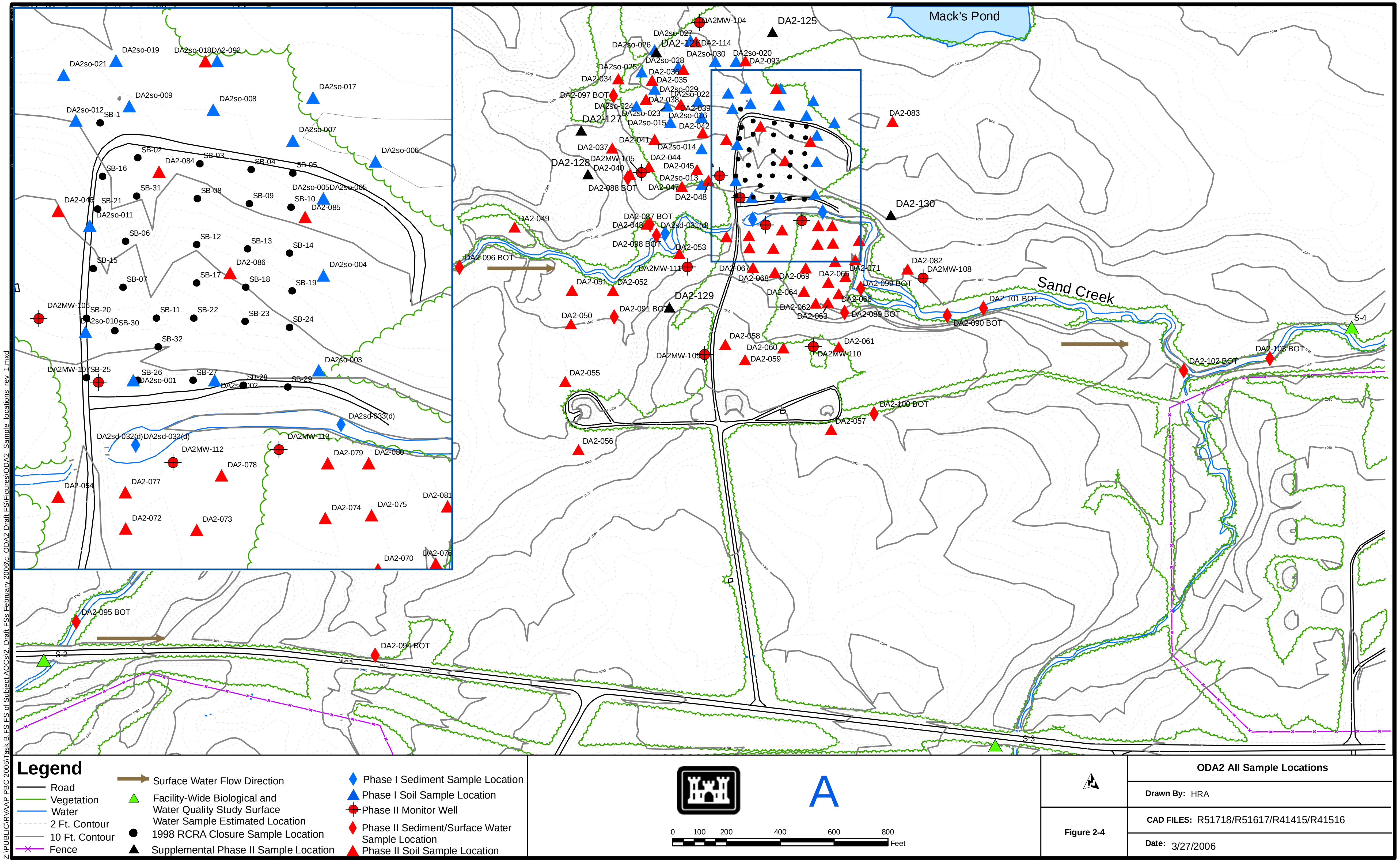

Figure 3-1. Sample Locations at ODA2

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4.0 NATURE AND EXTENT OF CONTAMINATION

This chapter presents results of the Supplemental Phase II RI. Constituents that are deemed to be related to ODA2 operations are classified as SRCs. These SRCs are then evaluated to determine their occurrence and distribution in surface and subsurface soils at ODA2. Section 4.1 presents the statistical methods and screening criteria used to reduce and display data and to distinguish naturally occurring constituents from SRCs indicative of historical AOC operations. Section 4.2 presents the nature and extent of identified SRCs in surface and subsurface soil. Section 4.3 provides an analysis of the impact the Supplemental Phase II soil data has on the conclusions of the HHRA and SERA. Section 4.4 presents the summary of the Supplemental Phase II soil data.

4.1 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 2005c) and other RIs for the facility, including: (1) defining data aggregates, (2) data reduction and screening, and (3) data presentation.

4.1.1 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 soils (0-1 ft BGS) and subsurface soils (1-3 ft BGS). 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.

4.1.2 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 2005c). 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 1999). Any inorganic chemical exceeding its facility-wide background criterion for soils 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 (USEPA 1989 and USEPA 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.

4.1.3 Data Presentation

Data summary statistics and screening results for soil data are presented in Tables 4-1 and 4-2. Analytical results for selected SRCs are presented on figures to depict spatial distribution (Figures 4-1 through 4-3). Analytical results by sample location for classes of SRCs (e.g., explosive compounds or inorganics) are presented in Tables 4-3 through 4-6. Complete analytical results are contained in Appendix E.

4.2 RESULTS OF SOIL SAMPLING AND ANALYSIS

Surface (0-1 ft BGS) and subsurface (1-3 ft BGS) 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 target analyte list metals and explosives. Data summary statistics and screening results to identify SRCs are presented in Tables 4-1 and 4-2.

4.2.1 Surface Soils (0-1 ft BGS)

4.2.1.1 <u>Explosives</u>

Four explosive compounds were detected in the ODA2 discrete surface soil samples (Table 4-1). 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 4-3 and Figure 4-1).

The concentrations of explosives at the Supplemental Phase II sample locations were all below reporting limits with the exception of tetryl at DA2-129. However, DA2-129 is bounded by previous sample locations (Figure 4-1) 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.

Table 4-1. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Surface Soils (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

Table 4-1. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Surface Soils (0-1 ft BGS) (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background	Max. > Bkg.?	Site Related?
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

CAS = Chemical abstract service.
UCL = Upper confidence limit.

Table 4-2. Summary Statistics and Determination of Supplemental Phase II RI SRCs in ODA2 Subsurface Soils (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

CAS = Chemical abstract service.
UCL = Upper confidence limit.

Table 4-3. Explosive SRCs Detected in Surface Soils (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.

4.2.1.2 Inorganics

Twenty-two inorganic constituents were detected in surface soil samples collected during the Supplemental Phase II RI (Table 4-1). Fourteen of these constituents were identified as SRCs (Table 4-4). 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 4-4. Inorganic SRCs Detected in Surface Soils (0-1 ft BGS) at ODA2

Analyte (mg/kg)	Background	Station					
		DA2-125	DA2-126	DA2-127	DA2-128	DA2-129	DA2-130
Aluminum	17700	14600=	12700 =	9400 =	18400 =#	8100 =	10800 =
Arsenic	15.4	8.5 J	8.7 =	11.4 =	19.4 J#	16.1 =#	8.2 J
Barium	88.4	61.3 J	80.8 J	92.1 J#	132 J#	51.7 J	46.1 J
Cadmium	0	0.05 J#	0.02 U	0.33 =#	0.73 =#	0.91 =#	0.18 =#
Chromium	17.4	21.9 =#	16.6 =	14.5 =	23.9 =#	14 =	28.7 =#
Cobalt	10.4	10.4 =	12.1 =#	9 =	18.3 =#	9.7 =	8 =
Copper	17.7	13.5 =	22.1 J#	31.2 J#	25.3 =#	175 J#	23.2 =#
Lead	26.1	15.6 =	15.7 =	24.5 =	32.3 =#	32.3 =#	36.8 =#
Manganese	1450	702 =	971 D=	760 =	2890 =#	454 =	311 =
Mercury	0.036	0.04 =#	0.04 =#	0.07 =#	0.08 =#	2.4 =#	0.07 =#
Nickel	21.1	15.2 =	14.1 =	14.8 =	22.9 =#	16.8 =	19.5 =
Thallium	0	0.36 J#	0.98 U	0.48 U	0.49 U	0.47 U	0.31 U
Vanadium	31.1	23.7 J	24.3 =	17.7 =	40.1 J#	15.6 =	19.5 J
Zinc	61.8	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 4-2 illustrates results for SRCs in supplemental Phase II RI surface soil samples. Miscellaneous inorganics are present above background concentrations in the Supplemental Phase II RI samples collected; however, no substantial data gaps have been identified.

4.2.2 Subsurface Soils (1-3 ft BGS)

4.2.2.1 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 4-5). 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 4-5. Explosive SRCs Detected in Subsurface Soils (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.

4.2.2.2 Inorganics

Twenty-two inorganic constituents were detected in subsurface soil samples collected during the Supplemental Phase II RI (Table 4-2). Eight of these constituents were identified as SRCs (Table 4-6). 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 4-3 illustrates the results for inorganic SRCs in Supplemental Phase II RI subsurface soil samples.

Table 4-6. Inorganic SRCs Detected in Subsurface Soils (1-3 ft BGS) at ODA2

Analyte (mg/kg)	Background	Station					
		DA2-125	DA2-126	DA2-127	DA2-128	DA2-129	DA2-130
Aluminum	19500	20500 =#	11700 =	9570 =	20000 =#	16500 =	12700 =
Arsenic	19.8	15.1 J	13.5 =	11 J	20.4 J#	16.6 J	11.8 J
Beryllium	0.88	1.2 =#	0.68 =	0.38 =	0.93 =#	0.64 =	0.45 =
Cadmium	0	0.02 U	0.07 J#	0.01 U	0.01 U	0.06 =#	0.05 =#
Chromium	27.2	29.1 =#	19.3 =	13.5 =	27.8 =#	25 =	18.9 =
Lead	19.1	15 =	28.4 =#	10.5 =	18.9 =	14 =	12.4 =
Mercury	0.044	0.02 J	0.06 =#	0.03 J	0.02 J	0.13 =#	0.04 =
Thallium	0.91	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.

4.3 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 Screening Ecological Risk Assessment (SERA) presented in the Final Open Demolition Area #2 Phase II RI Report (USACE 2005c).

Tables 4-7 and 4-8 provide summary statistics and identification of SRCs and constituents of potential concern (COPCs) for the soil data sets used in the RI Report and revised soil data sets including both the original RI Report 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:

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

- SRCs/COPCs that differ between the original RI Report data set and the combined RI Report and supplemental data set; and

- New chemicals detected in the supplemental data but not detected in the RI Report data set.

Chemicals in each of these three categories are summarized below for shallow surface soils (0-1 ft BGS) and subsurface soils (1-3 ft BGS). No deep surface soils (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.

4.3.1 Shallow Surface Soils (0-1 ft BGS)

Summary statistics for shallow surface soil (0-1 ft BGS) data are provided in Table 4-7. The impact of inclusion of the supplemental data on the conclusions of the HHRA and SERA is summarized in the following sections.

4.3.1.1 <u>Chemicals that are Essentially Unchanged</u>

Forty-one chemicals were detected in shallow surface soil (0-1 ft BGS) data in the RI Report. 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% upper confidence limit (UCL) or maximum detected concentration [MDC]) reported in the RI Report is very similar to 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 five 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 for the Security Guard/Maintenance Worker exposed to shallow surface soils 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 one chemical (manganese) is slightly larger with the supplemental data included (revised EPC/original EPC = 1.1). The maximum HQ (0.0082) for the Security Guard/Maintenance Worker 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 COPEC in the RI Report; therefore, inclusion of the supplemental data would not change the weight-of-evidence 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.

4.3.1.2 SRCs/COPCs that Differ

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

Antimony: The MDC of antimony reported in the RI Report (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 1/10th of the Region 9 residential PRG (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 ecological screening value (ESV) (5 mg/kg) (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 RI Report (38 mg/kg) was just above the background criterion (31 mg/kg) but below 1/10th of 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 1/10th of the revised Region 9 PRG (7.8 mg/kg); therefore, vanadium is identified as a COPC due to the change in the Region 9 residential 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 1/10th of 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 COC for evaluation of alternatives).

Vanadium was previously retained as a COPEC in the RI Report; 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.

4.3.1.3 New chemicals detected in the Supplemental Data Only

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

Thallium: This metal was not detected in the RI Report 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 $1/10^{th}$ of 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 ESV 1 mg/kg (Efroymson et al. 1997); therefore, thallium is not identified as a COPEC. A background criterion is available for thallium in subsurface soils (0.91 mg/kg). Because (1) the soils are 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 explosive was not detected in the original RI Report data but was detected in 3 of 6 supplemental shallow surface soil samples. The MDC (0.03 mg/kg) is less than 1/10th of 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) (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.

4.3.1.4 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 soils (0-1 ft BGS) at ODA2.

4.3.2 Subsurface Soils (1-3 ft BGS)

Summary statistics for subsurface soil (1-3 ft BGS) data are provided in Table 4-8. Subsurface soils were not evaluated in the HHRA because the one receptor evaluated at ODA2 (Security Guard/Maintenance Worker) is only exposed to shallow surface soils (0-1 ft BGS). The impact of inclusion of the supplemental data on the conclusions of the SERA is summarized in the following sections.

4.3.2.1 Chemicals that are Essentially Unchanged

Thirty-eight chemicals were detected in subsurface (1-3 ft BGS) soil data in the RI Report. 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 RI Report 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 five 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 three 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.

4.3.2.2 SRCs/COPCs that Differ

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

Aluminum: The MDC of aluminum reported in the RI Report (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 2005c); therefore, inclusion of the supplemental data would not change the conclusions of the SERA.

Antimony: The MDC of antimony reported in the RI Report (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) (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 RI Report (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) (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 RI Report (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) (Efroymson et al. 1997); therefore, chromium is identified as a COPEC. Because hexavalent chromium (which has the same ESV) was previously retained as a COPEC, inclusion of the supplemental data does not change the conclusions of the SERA. Section 7.2.2.3 explains that chromium and other metals do not appear to be associated with any ecological harm.

The conclusions of the SERA are unchanged for these four metals, as discussed above. The EPCs for these four 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 no further action (NFA) required.

4.3.2.3 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 RI Report 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 explosive was not detected in the RI Report 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.

4.4 SUMMARY

The results of the Supplemental Phase II RI identified one explosive (nitrobenzene) not previously detected at ODA2. Sample DA2-129 has the most detected concentrations for 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 soils 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. Inorganics are present above background; however, no substantial data gaps have been identified following completion of the Supplemental Phase II RI.

Based on evaluation of the original (as used in the Phase II RI Report [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 soils (0-1 ft BGS) or subsurface soils (1-3 ft BGS) at ODA2. Further evaluation of the Phase II RI HHRA and ERA is discussed in Chapters 6 and 7, respectively.

Table 4-7. Summary of RI Report and Supplemental Phase II Shallow Surface Soils (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 2005c)							
				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 4-7. Summary of RI Report and Supplemental Phase II Shallow Surface Soils (0-1 ft BGS) Data: Open Demolition Area2 (continued)

				Data included in Phase II RI Report (USACE 2005c)							
					Measured Concentration						
Chemical	CAS Number	Site Background Criteria[a]	Region 9 Res PRG[b]	Freq of Detect	Min	Ave	Max	95% UCL	EPC	SRC[c]?	COPC[d]?
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

1 **Table 4-7. Summary of RI Report 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

Table 4-7. Summary of RI Report and Supplemental Phase II Shallow Surface Soils (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 Min	Measured Concentration Ave	Measured Concentration Max	95% UCL	EPC	SRC[c]?	COPC[d]?	
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 4-7. Summary of RI Report and Supplemental Phase II Shallow Surface Soils (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 Min	Measured Concentration Ave	Measured Concentration Max	95% UCL	EPC	SRC[c]?	COPC[d]?	
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 RI Report 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 RI Report data set but was detected with the Supplemental Phase II data.

EPC for this chemical was larger in the original RI Report data set and is reduced by the inclusion of the Supplemental Phase II data (i.e., Revised EPC/RI Report EPC <1.0).

EPC for this chemical was smaller in the original RI Report data set and is increased by the inclusion of the Supplemental Phase II data (i.e., Revised EPC/RI Report EPC > 1.0).

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

[a]Background criteria for surface soils from USACE 1999. *Final Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

[b]Residential soil 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 (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 Human Health Risk Assessment (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 Region 9 PRG value rather than as a result of inclusion of the supplemental data.

Table 4-8. Summary of RI Report (USACE 2005c) and Supplemental Subsurface Soils (1-3 ft BGS) Data: Open Demolition Area 2

			Data included in Phase II RI Report (USACE 2005c)						
				Measured Concentration					
Chemical	CAS Number	Site Background Criteria[a]	Frequency of Detect	Min	Ave	Max	95% UCL	EPC	SRC[b]?
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

1 **Table 4-8. Summary of RI Report (USACE 2005c) and Supplemental Subsurface Soils (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 2005c)						
			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 4-8. Summary of RI Report (USACE 2005c) and Supplemental Subsurface Soils (1-3 ft BGS) Data: Open Demolition Area 2 (continued)

Chemical	CAS Number	Site Background 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

1 **Table 4-8. Summary of RI Report (USACE 2005c) and Supplemental Subsurface Soils (1-3 ft BGS) Data: Open Demolition Area 2 (continued)**

Chemical	CAS Number	Site Background 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

Table 4-8. Summary of RI Report (USACE 2005c) and Supplemental Subsurface Soils (1-3 ft BGS) Data: Open Demolition Area 2 (continued)

Chemical	CAS Number	Site Background 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 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 Remedial Investigation (RI) Report 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 RI Report data set but was detected with the Supplemental Phase II data.

EPC for this chemical was larger in the original RI Report data set and is reduced by the inclusion of the Supplemental Phase II data (i.e., Revised EPC/RI Report EPC <1.0).

EPC for this chemical was smaller in the original RI Report data set and is increased by the inclusion of the Supplemental Phase II data (i.e., Revised EPC/RI Report EPC > 1.0).

All units are mg/kg. COPC = Constituent of potential concern. EPC = Exposure point concentration.
CAS = Chemical Abstract Service. SRC = Site-related contaminant.
UCL = Upper confidence limit on the mean. NA = not applicable or no data available.

[a]Background criteria for subsurface soils from USACE 1999. 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 (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).

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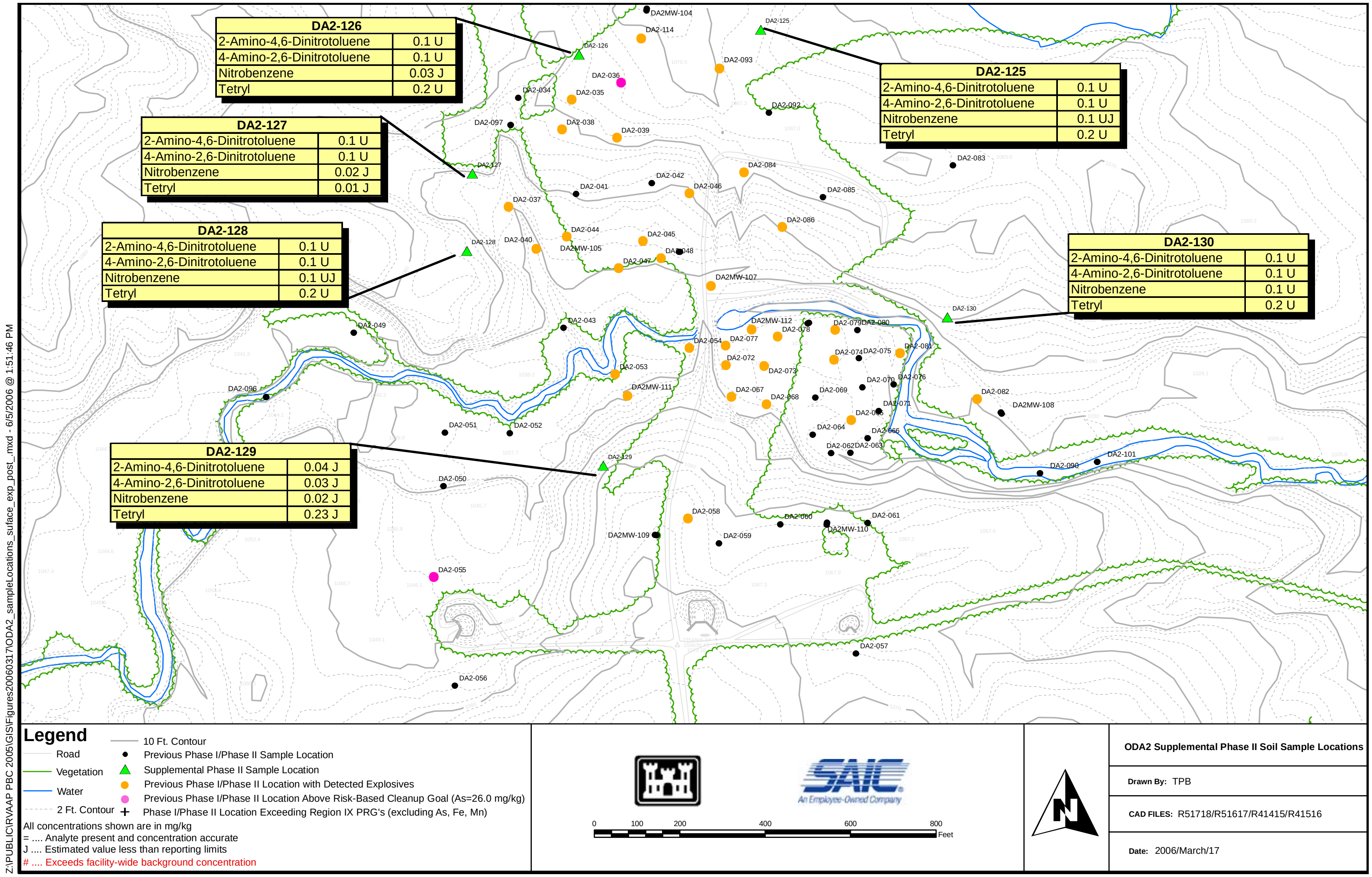

Figure 4-1. Occurrences of Detected Explosives in Surface Soils (0-1 ft BGS), ODA2 Supplemental Phase II RI

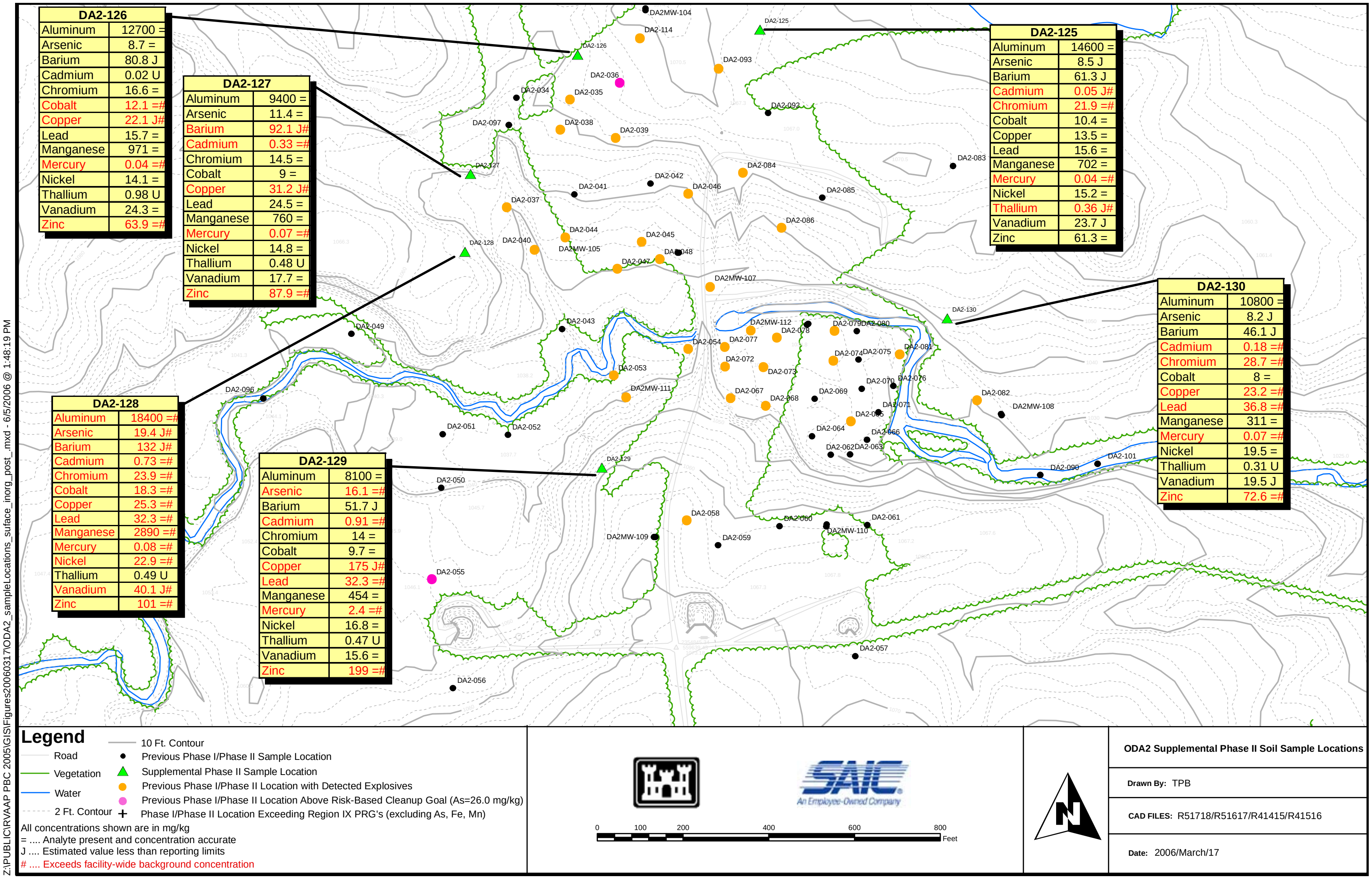

Figure 4-2. Occurrences of Detected Inorganic SRCs in Surface Soils (0-1 ft BGS), ODA2 Supplemental Phase II RI

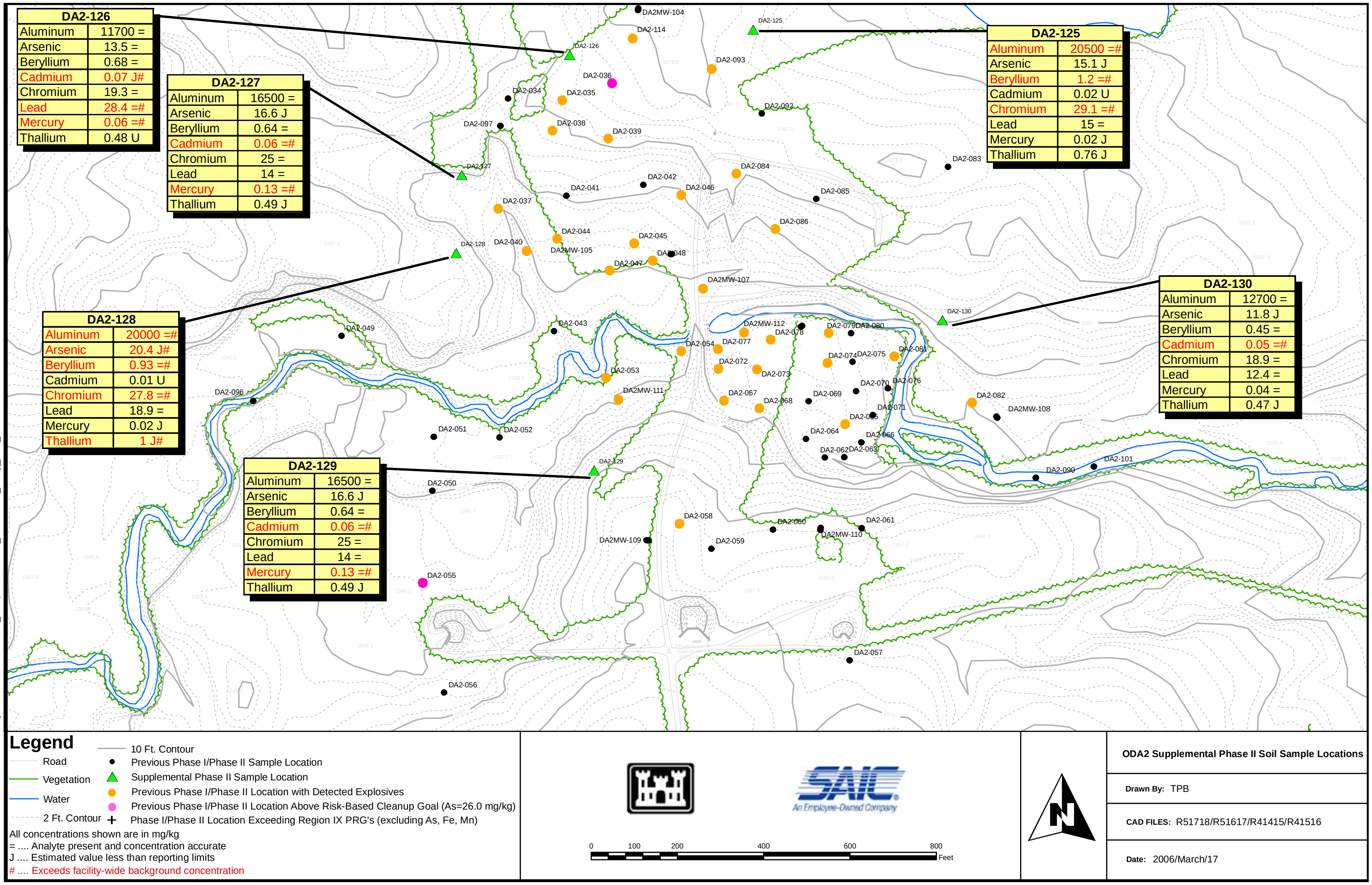

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Figure 4-3. Occurrences of Detected Inorganic SRCs in Subsurface Soils (1-3 ft BGS), ODA2 Supplemental Phase II RI

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5.0 CONTAMINANT FATE AND TRANSPORT

Impacted soils at ODA2 are evaluated to ensure residual concentrations in soils are protective of groundwater at EBG (residential land use scenario) and at an exposure point downgradient of ODA2 (representative land use scenario). Section 5.1 identifies and evaluates soil constituents with potential impact to groundwater. Section 5.2 presents the conclusions of the evaluation.

Inclusion of the supplemental data does not effect the conclusions of the contaminant fate and transport analysis from the Phase II RI Report.

5.1 EVALUATION

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

- Section 5.1.1 lists constituents identified in the RI Report as potentially impacting groundwater.

- Section 5.1.2 evaluates these constituents across multiple media to further refine the list of potential constituents.

- Section 5.1.3 presents refinements to the modeling performed in the RI Report.

5.1.1 RI Evaluation Process

Constituents are identified in Chapter 5 (Contaminant Fate and Transport) of the Phase II RI Report for ODA2 that potentially impact groundwater. 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 constituents 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 maximum contaminant level (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 downgradient of the source area as 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.

5.1.2 AOC-Specific Evaluation

The constituents identified in Table 5-1 are evaluated across multiple media. The evaluation examines characteristics of the constituents detected, distribution in soils or water compared to background concentrations, and the nature of modeling completed during the RI (e.g., using a constant source of contamination and no degradation of contaminants). The criteria below were evaluated to determine the potential for impacts to groundwater from impacted soils at ODA2.

Background: If model input source concentrations are less than either surface soil (0-1 ft BGS) or subsurface soil (1-3 ft BGS) background, predicted results are compared to observed groundwater data to assess the nature of the modeling, which assumes a constant source of contamination and no degradation of contaminants. 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 patter of detection (e.g., proximity and/or patterns of samples with high concentrations, indications of a contaminant plume, etc.).

Predicted Time of Maximum Impact: If the predicted time of maximum impact (as stated in the 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 risk-based concentration (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.

5.1.2.1 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 5-1). Upon further analysis, nine of these constituents were not predicted or identified to impact groundwater as summarized below.

Table 5-1. 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/Region 9 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.
AT123D = Analytical Transient 1-,2-,3-Dimensional.
MCL = Maximum contaminant level.
ODA2 = Open Demolition Area #2.
PRG = Preliminary remediation goal.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
RI = Remedial Investigation.
SESOIL = Seasonal Soil Compartment Model.

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 soils 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. 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 detectable concentrations 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. 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. Only 2 out of 6 surface soil and 1 out of 6 subsurface soil samples had detections of hexavalent chromium, with the maximum concentration being 28 mg/kg. Chromium (hexavalent) in soils is retained for further consideration of future impacts to 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 soils, 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.

- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX): RI Seasonal Soil Compartment Model (SESOIL) source load modeling in the 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.

5.1.3 Refined AOC-Specific Modeling Results

Based on analyses of the fate and transport assessment performed in support of the RI for ODA2, no COCs were identified for further analysis using the SESOIL/Analytical Transient 1-,2-,3-Dimensional (AT123D) models previously developed with refined input parameters.

5.2 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 further action with respect to soils is required at ODA2 for groundwater under representative land use as groundwater use at the AOC will be restricted.

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6.0 HUMAN HEALTH RISK ASSESSMENT

The HHRA was conducted to evaluate risks and hazards associated with contaminated media at ODA2 for one potential receptor (Security Guard/Maintenance Worker) exposed to one medium (surface soil, from a depth interval of 0-1 ft BGS). The extensive presence of MEC prevents most activity at ODA2, including most OHARNG training activities and is anticipated to preclude residential land use; therefore, residential land use receptors were not evaluated in the previous RIs or in this RI Addendum. 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 soils (0-1 ft BGS) for the Security Guard/Maintenance Worker at ODA2.

A summary of the HHRA results is provided in Table 6-1.

Table 6-1. Summary of HHRA Risk Results for the Security Guard/Maintenance Worker Scenario Exposed to Surface Soils (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 *de minimis* risk but is below Ohio EPA target risk value.

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

Supplemental soil samples were collected from surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soils at ODA2 to complete the analysis of nature and extent of contamination. These supplemental data were presented in Chapter 4. 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. Shallow surface soils are the only exposure medium evaluated in the HHRA at ODA2.

6.1 IDENTIFICATION OF HUMAN HEALTH PRELIMINARY CLEANUP GOALS FOR ODA2

This section documents the proposed land use and corresponding preliminary cleanup goals at ODA2. Preliminary cleanup goals are the chemical-specific numeric cleanup goals for protection of human health in the residential or representative land use scenarios.

The HHRA performed for ODA2 is detailed in the Phase II RI Report. The risk assessments included in the Phase II 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 RI Addendum.

Chemical-specific preliminary cleanup goals are established for representative (i.e., Security Guard/Maintenance Worker) land use from risk-based cleanup goals, background concentrations, and other information in this section. ODA2 is not currently a candidate for residential 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 (RAGS), Part B (USEPA 1991), while incorporating site-specific exposure parameters applicable to the Security Guard/Maintenance Worker, as 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, to solve for the concentration that will produce a specific risk or hazard level instead of calculating risk/hazard from a given concentration. 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 2004).

The FWHHRAM (USACE 2004) identifies 1E-05 as a target for cumulative ILCR (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 may require these targets to be decreased 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 6.1.3.

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 are identified for ODA2 based on risk management considerations including:

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

- Comparison of EPC to upgradient concentrations for sediment, surface water, and groundwater;

- Consideration of soils 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 AOC-specific and receptor-specific considerations.

The remainder of this section provides the following detailed information:

- Land use and potential receptors at ODA2 (Section 6.1.1);

- A summary of COCs identified in the HHRA (Section 6.1.2);

- 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 6.1.3);

- Chemical-specific preliminary cleanup goals (Section 6.1.4); and

- Risk management considerations and the identification of COCs (Section 6.1.5).

6.1.1 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 ODA2, the vast amount of already unearthed and suspected large amounts of buried MEC, including burial of white phosphorous, will likely dictate that ODA2 will never be utilized for anything except restricted, no digging activities, and almost certainly would never be released to the public.

ODA2 is managed as a Restricted Access area. 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 2005c).

There are no immediate plans for active re-use of ODA2; however, occasional demolition of MEC will continue at the RCRA unit as part of the Restoration and MMRP activities. 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 to check the status of the area for security or safety reasons and MEC technicians transporting material from storage to the RCRA unit. Accordingly, the Security Guard/Maintenance Worker scenario outlined in the FWHHRAM (USACE 2004e) 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 several days at the AOC once every few years, a hunter who spends a few days at the AOC, security personnel who may periodically evaluate the AOC, 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 soils (0-1 ft BGS) only. Because of MEC issues, there will be no intrusive activities; therefore, subsurface soils (1-3 ft BGS) are 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 soils at ODA2 are evaluated for soil ingestion, dermal contact with soil, and inhalation of soil particles and VOCs.

6.1.2 Constituents of Concern

COCs are defined as chemicals with an ILCR greater than 1E-06 and/or a hazard index (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 soils (0-1 ft BGS) for the Security Guard/Maintenance Worker.

6.1.3 Target Risk for Preliminary Cleanup Goals

The FWHHRAM (USACE 2004) identifies a 1E-05 target for ILCR (TR) for carcinogens and an acceptable THI of 1 for non-carcinogens consistent with Ohio EPA guidance, with the caveat that exposure to multiple COCs may require these targets to be decreased. For example, if numerous (i.e., more than 10) non-carcinogenic or carcinogenic COCs with similar toxic endpoints are present, it might be appropriate to select chemical-specific preliminary cleanup goals with a TR of 1E-06 or a THI of 0.1 to account for exposure to multiple contaminants. The TR and THI selected for ODA2 are dependent on several factors, including the number of carcinogenic and non-carcinogenic COCs and the target organs and toxic endpoints of these COCs. A TR of 1E-05 and THI of 1.0 are identified as appropriate for the establishing preliminary cleanup goals for soils at ODA2 because only one COC is present.

6.1.4 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 6-2. 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 6-2. 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 (0-1 ft BGS) surface soils is used for Security Guard/Maintenance Worker.
[b] Final facility-wide background values for the Ravenna Army Ammunition Plant from the *Phase II Remedial Investigation (RI) Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1999).
COC = Constituent of concern.
EPC = Exposure point concentration.
HHRA = Human Health Risk Assessment.
HI = Hazard index.
ILCR = Incremental lifetime cancer risk.

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.

6.1.5 Risk Management Considerations

Only one COC (arsenic) was identified for the Security Guard/Maintenance Worker exposed to surface soils (0-1 ft BGS) in the HHRA. The estimated EPC of arsenic (14 mg/kg) and all individual concentrations are less than the preliminary cleanup goal of 26 mg/kg established for this metal for the Security Guard/Maintenance Worker land use (Table 6-3); the EPC is also smaller than background; therefore, no remedial action is needed for arsenic.

No COCs are identified for remedial action for the Security Guard/Maintenance Worker at ODA2; residential land use was not evaluated at ODA2. The presence of MEC and the active RCRA unit is anticipated to preclude future residential land use of this AOC.

Table 6-3. Surface Soil COCs for Security Guard/Maintenance Worker Land Use at ODA2

COC[a]	Freq. of Detect	Measured Concentration[b] (mg/kg) Avg.	Max[c]	EPC[d]	Bkg[e] (mg/kg)	Detects > Bkg[f]	Preliminary Cleanup Goal[g] (mg/kg)	Detects > Preliminary Cleanup Goal[f]	Risk Management Considerations	Rec[h]
Surface Soils (0-1 ft BGS)										
Arsenic	69/69	13	20	13.6	15.4	14	26	0	EPC less than background/ preliminary cleanup goal	NC

[a]Constituent of concern (COC) identified in the Human Health Risk Assessment (HHRA).
[b]Data from Remedial Investigation report and Supplemental Phase II data combined, as shown on Table 4-7.
[c]Maximum detected concentration.
[d]Exposure point concentration (EPC) is 95 % upper confidence limit (UCL) of the mean or maximum detected concentration depending on number of samples and data distribution.
[e]Final facility-wide background values for the Ravenna Army Ammunition Plant from the *Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 1999).
[f]Number of detected concentrations exceeding the background criterion or preliminary cleanup goal.
[g]Preliminary cleanup goal from Table 6-2.
[h]Recommendation for COCs for evaluation of remedial alternatives.
Detects = Detectable concentrations.
NC = Not recommended as a COC for remedial alternative evaluation.

7.0 ECOLOGICAL RISK ASSESSMENT

Chapter 7 of the Phase II RI Report presents the Level II SERA conducted at ODA2. The presence of suitable habitat and observed receptors at ODA2 along with presence of chemically contaminated media warranted a 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.

The SERA process provides an evaluation of the potential for risk to ecological receptors. This evaluation is considered to be conservative for two reasons: (1) MDCs are compared to ESVs as opposed to EPCs being compared to these values, and (2) the medium-specific ESVs are intended to protect sensitive, multiple receptors, some of which may not be present at ODA2. Chemicals with no ESV are also retained as COPECs. As part of this screen, all chemicals classified as persistent, bioaccumulative, and toxic (PBT) are retained as COPECs. For the Level II Screen, specific receptors are not identified because the ESVs are screening toxicity benchmarks that are intended to protect sensitive, multiple receptors (and thus, are conservative in nature).

Supplemental soil samples were collected from surface (0-1 ft BGS) and subsurface (1-3 ft BGS) soils at ODA2 to complete the analysis of nature and extent of contamination. These supplemental data are presented in Chapter 4. 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.

7.1 SUMMARY OF ECOLOGICAL RISK ASSESSMENT

The SERA (Level II Screen) identified multiple COPECs in surface soils (0-1 ft BGS) and subsurface soils (1-3 ft BGS) from the ODA2 (USACE 2005c) (Table 7-1). For the Level II Screen, Ohio EPA does not require that HQs be calculated when comparing the MDCs against the ESVs, so HQs were not calculated for the ODA2. Soil COPECs have the potential to pose a hazard to plants and animals.

Inorganic constituents 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 soils (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.

Table 7-1. Surface (0-1 ft BGS) and Subsurface Soil (1-3 ft BGS) COPECs at ODA2 SERA (Level II)

COPEC	Surface Soils (0-1 ft BGS)	Subsurface Soils (1-3 ft BGS)
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	—
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 = Constituents of potential ecological concern.
ESV = Ecological screening value.
MDC = Maximum detected concentrations.
PBT = Persistent, bioaccumulative, and toxic compound (inorganics - cadmium, lead, mercury, and zinc; organics having Log Kow of at least 3.0).
4,4'-DDD = Dichlorodiphenyldichloroethane.
"X" = Chemical is a COPEC due to criterion in this column.
"—" = Chemical was not a COPEC at this soil depth.

The SERA (Level II screen) also identified a few COPECs in sediment (Table 7-2) and surface water (Table 7-3) for the ODA2 location (USACE 2005c). Sand Creek flows through the middle of ODA2 and the stream was divided into two exposure segments: downstream and upstream of ODA2. These segments corresponded to sampling areas for the facility-wide biology and surface water study performed after the chemical sampling for the RI study.

Table 7-2. Summary of Sand Creek Sediment COPECs for ODA2 and Rationale for Retention

Retained COPEC	Rationales for COPEC Retention		
	Maximum Detect > ESV	**PBT Compound**	**No ESV**
Downstream			
Inorganics			
Cadmium	X	X	
Copper	X		
Lead		X	
Mercury	X	X	
Nitrate/nitrite			X
Sulfide			X
Zinc	X	X	
Pesticides/PCBs			
Dieldrin		X	
Volatiles			
Chloromethane			X
Upstream			
Inorganics			
Barium			X
Cadmium	X	X	
Copper	X		
Lead		X	
Mercury		X	
Nitrate/nitrite			X
Sulfide			X
Zinc	X	X	
Semivolatiles			
Bis(2-ethylhexyl)phthalate		X	
Di-n-butylphthalate		X	
Fluoranthene		X	

COPEC = Constituent of potential ecological concern.
ESV = Ecological screening value.
PBT = Persistent, bioaccumulative, and toxic.
PCB = Polychlorinated biphenyl.
"X" = COPEC was retained based on this rationale.

Table 7-3. Summary of Sand Creek Surface Water COPECs for ODA2 and Rationale for Retention

Retained COPEC	Rationales for COPEC Retention		
	Maximum Detect > OAC WQC	PBT Compound	No OAC WQC
Downstream			
Inorganics			
Calcium			X
Magnesium			X
Nitrate/nitrite			X
Sulfide			X
Zinc		X	
Explosives			
Nitrocellulose			X
Semi-Volatiles			
Bis(2-ethylhexyl)phthalate		X	
Upstream			
Inorganics			
Calcium			X
Magnesium			X
Nitrate/nitrite			X
Explosives			
Nitrocellulose			X

COPEC = Constituent of potential ecological concern.
OAC WQC= Ohio Administrative Code Water Quality Criteria.
PBT = Persistent, bioaccumulative, and toxic.
"X" = COPEC was retained based on this rationale.

The sediment COPECs for upstream and downstream overlap a great deal for the inorganics, but few organics differ between upstream and downstream. There is a great deal of overlap of surface water COPECs between the upstream and downstream stretches. This shows that little is being introduced by ODA2.

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 of attainment is being met according to the Ohio EPA.

The Phase II RI ERA for ODA2 also reported the ecological field work conducted at the AOC: ecological reconnaissance of existing vegetation and animal life. A facility-wide biology and surface water study provided further information for consideration at ODA2 (USACE 2005d). This information is summarized in the Phase II RI Report and in Section 7.2.2.1. All the studies document the presence of healthy and functioning terrestrial and aquatic ecosystems.

7.2 ECOLOGICAL PROTECTION

Risk assessment predictions (e.g., HQs) and field observations were combined in a weight-of-evidence assessment. This combination of information shows that ESV exceedance and HQs > 1 suggest risk to plants and selected animals; however, 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. No ecological preliminary cleanup goals are recommended and no remediation for ecological risks is justified at ODA2 because the ecological systems are healthy (in addition to other reasons). The rationale for this is explained in detail and summarized below.

7.2.1 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 comes from applying steps in the Facility-Wide Ecological Risk Work Plan and specifically steps in Figure III to reach a Scientific Management Decision Point (SMDP) that few ecological resources are at risk. This recommendation is based primarily on the following three weight-of-evidence conclusions:

- Field observations (Level I of Ohio EPA protocol) indicate that there are currently few adverse ecological effects (USACE 2005c), and there is ample nearby habitat to maintain ecological communities at ODA2 and elsewhere on RVAAP. 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 soils 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 mathematically-based risk assessment. Biological measurements (healthy stream ecology) near ODA2 (upstream and downstream) 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.

7.2.2 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. A decision to remediate because of potential harm to ecological receptors is not included in the Phase II RI Report. 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) [Level I of Ohio EPA protocol and Facility-Wide Biological and Water Quality Study (USACE 2005d)] 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 soils 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.

7.2.2.1 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 AOC. 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 ODA2.

Ecological Reconnaissance

A description of the vegetation and animals found at ODA2 are included in the Phase II RI Report (USACE 2005c). 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 Chapter 7 (SERA - Natural Resources) 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 approximately 1.2 miles through ODA2. Sand Creek, being a tributary of Eagle Creek, is designated as 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 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. A total of 12 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 ODA2. All other species were collected at both locations.

USACE/Ohio EPA Surface Water Study

A facility-wide surface water investigation was performed by USACE with the cooperation of the Ohio EPA (USACE 2005d). Sand Creek near ODA2 was among the locations sampled.

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 polychlorinated biphenyls [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 to the downstream AOC of ODA2, but it is possible that there are occasional *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 1993 and 1999. 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.

7.2.2.2 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 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-wide ecological communities.

7.2.2.3 Limited Extent of Soil Contamination

The identification of COPECs is a conservative screening process (See Section 7.0) and COPEC concentrations are not necessarily at harmful levels. For example, one organic COPEC (tetryl) in surface soil does not have an ESV and five inorganic COPECs (calcium, magnesium, nitrate/nitrite, potassium, and sodium) do not have ESVs and are generally only toxic at very high concentrations.

In addition, as detailed on Table 7-4, of the inorganic surface soil COPECs:

- Nine COPECs have EPCs < background criteria, and another three COPECs have EPCs < three times background criteria;

- Two COPECs have EPCs more than three times background and greater than the ESVs; however, the background criteria for these two inorganics are also greater than the ESVs; and

- Three 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 EPC 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 five organic surface soil COPECs, four have no detected concentrations that exceed ESVs (Table 7-4). 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 inorganic and organic subsurface soils (1-3 ft BGS) are similar. Also, the Ohio EPA Level I observations (healthy - see Chapter 7.0), the Ohio EPA Level II predictions (a few exceedances of ESVs - see Table 7-1), the Facility-Wide Ecological Risk Work Plan implementation (healthy and functioning ecosystem - see Section 7.2.1), and the Facility-Wide Biological and Surface Water findings (healthy streams - see Section 7.2.2.1) all indicate that chromium and other metals are associated with healthy and functioning ecosystems.

Table 7-4. COPECs in Surface Soils (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
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.
Detects = Detectable concentrations.
EPC = Exposure point concentration.
ESV = Ecological screening value.
COPEC = Constituent of potential ecological concern.
4,4-DDD = Dichlorodiphenyldichloroethane.

7.2.2.4 No to Low Contaminant Migration

The facility-wide surface water sampling and assessment revealed that, in general, surface water quality at the RVAAP 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 RI 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, AOC conditions (slope, soil type, plant cover) are only slightly conducive to erosion. Second, there is no indication that organic compounds in soils are presently leaching to surface water and sediment in the stream, and this may apply to inorganics as well. Most importantly, AOC 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.

7.2.2.5 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 soils because of removal and replacement but have a highly disturbed habitat as a result, or it can have exposure to contaminants in the soils 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 soils because COPEC concentrations are not necessarily at harmful levels as described previously.

7.3 SUMMARY

There is mathematically-predicted ecological risk, but field observations (Level I of Ohio EPA protocol and Facility-Wide Biological and Surface Water Study) show healthy and functioning terrestrial and aquatic ecosystems. This information, along with steps in the Facility-wide Ecological Risk Work Plan, reaches a SMDP that no quantitative preliminary cleanup goals need to be developed to protect ecological resources at ODA2.

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8.0 SUMMARY AND CONCLUSIONS

Contaminant nature and extent has been fully defined with the collection and analysis of the Supplemental Phase II RI data. The areas exhibiting the greatest numbers and concentrations of explosives and inorganics have been identified and delineated, as recommended by the previous Phase II RI (USACE 2005c). Adequate data has been collected and the uncertainties of the Phase II RI have been addressed.

Based on evaluation of the original Phase II RI data set and updated data set that includes Supplemental Phase II results, inclusion of the supplemental data would not change the conclusions of the HHRA or SERA for shallow surface soils (0-1 ft BGS) or subsurface soils (1-3 ft BGS) at ODA2.

The Security Guard/Maintenance Worker is the representative receptor at ODA2. A residential land use scenario was not included in the RI Addendum since the presence of MEC and the active RCRA unit is anticipated to preclude future residential land use of this AOC.

Chapters 5, 6, and 7 conclude that there are no soil or dry sediment COCs for the representative receptor that requires remediation at ODA2. As presented in Chapter 5, there are hexavalent chromium impacts predicted in groundwater beneath ODA2, but it is not predicted to reach downgradient receptors. Soil removal is not warranted under a restricted land use scenario. As stated in Chapter 6, only one COC (arsenic) was identified for the Security Guard/Maintenance Worker in surface soil (0-1 ft BGS). However, the EPC is smaller than background and zero soil sample concentrations exceed the preliminary cleanup goal of 26 mg/kg. Also, terrestrial and aquatic ecological resources appear to be health (as outlined in Chapter 7). No preliminary cleanup goals for soils and dry sediment were established for ecological protection. It is therefore concluded that no further action is required with respect to soils and dry sediments at ODA2. A feasibility study is not warranted for these two media.

9.0 RECOMMENDATIONS

It is recommended ODA2 undergoes NFA with respect to chemical contamination in soils/dry sediments. The ecosystems appear healthy and no preliminary cleanup values for ecological resources are recommended. No human health COCs are identified for the representative land use receptor (Security Guard/Maintenance Worker) at ODA2, which is not a candidate for residential release. Therefore this recommendation of NFA is based on restrictions of soils, dry sediments, and use of groundwater.

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. Therefore, MEC issues at ODA2 will be addressed under the MMRP. Restrictions with respect to MEC issues will be developed and implemented by the US Army and OHARNG. Restrictions will be maintained at ODA2 until such time that a final remedial decision regarding MEC is determined under the MMRP.

This RI Addendum documents the no action decision and a feasibility study is not warranted. The next step in the CERCLA process is to prepare a Proposed Plan to solicit public input with respect to NFA at ODA2. The Proposed Plan will present the analysis performed supporting NFA at ODA2 with respect to impacted soils/dry sediments.

The Record of Decision (ROD) will document the final remedy for soils and dry sediments at ODA2. Comments on the Proposed Plan 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 NFA at ODA2 under representative land use. The ROD also will include a responsiveness summary, addressing comments received on the Proposed Plan.

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APPENDIX A

SOIL SAMPLING LOGS

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APPENDIX A
SOIL SAMPLING LOGS

DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

DA2-125 .... A-1
DA2-126 .... A-3
DA2-127 .... A-5
DA2-128 .... A-7
DA2-129 .... A-9
DA2-130 .... A-11

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DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

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HTRW DRILLING LOG

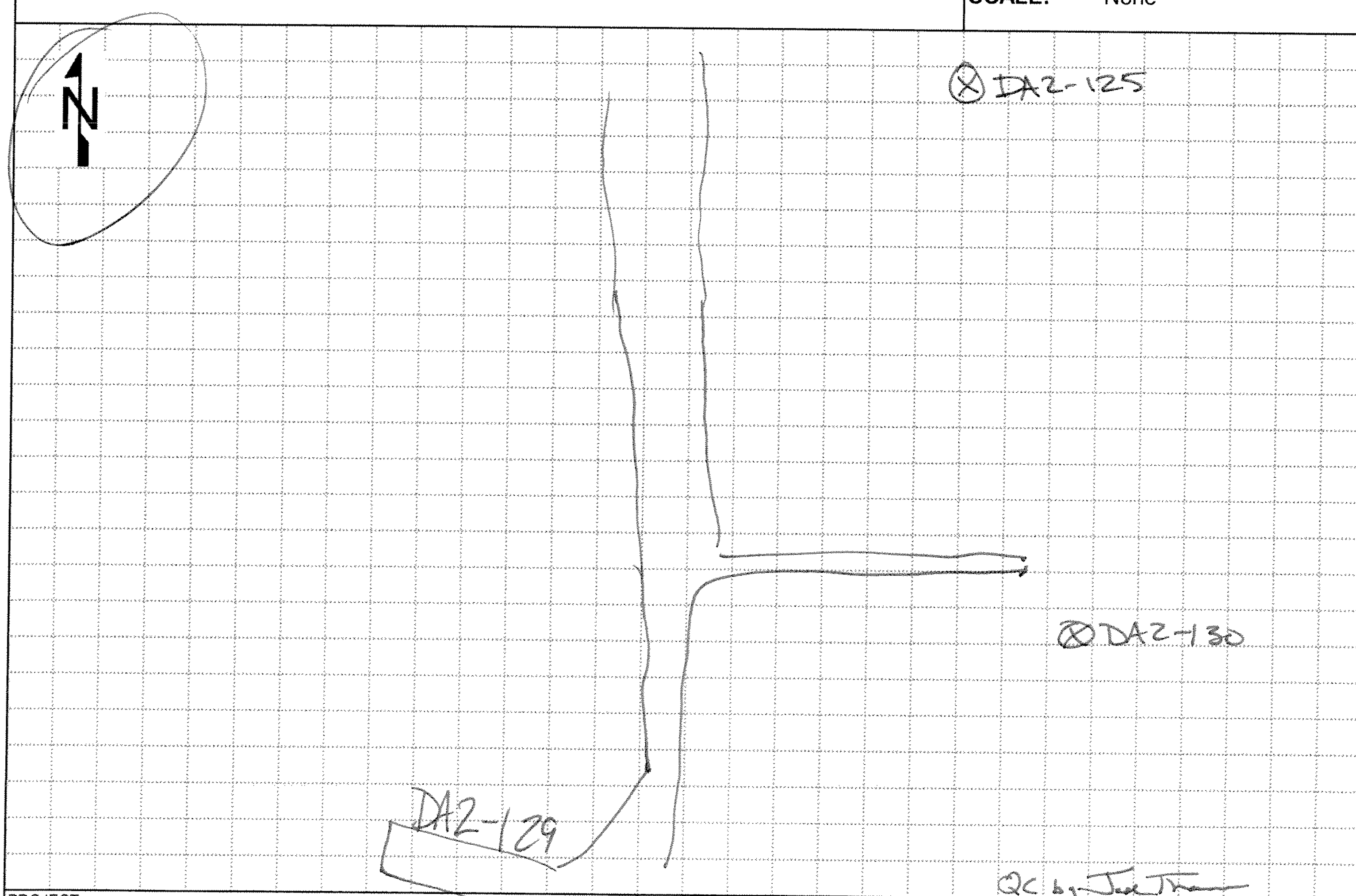
HTRW DRILLING LOG	DISTRICT USACE - Louisville	BOREHOLE NUMBER DA2-125
1. COMPANY NAME SAIC	2. DRILL SUBCONTRACTOR NA	SHEET 1 OF 2

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



QC by Jed Thomas

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

HTRW DRILLING LOG (continued)

HTRW DRILLING LOG (continued)	DISTRICT: USACE - Louisville	BOREHOLE NUMBER: DA2-125
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.	DA2-SS-125-0900-SO 1.0 ft	0.1	Martha Clough
	1 / 1.3 / 2	CL	2.5Y 6/4 light yellowish brown with 10% mottling: 7.5YR 5/8 strong brown; (lean) BW clay with medium sand; ~~10%~~ 8W 1% subangular very fine stones.	DA2-SO-125-0901-SO	0.1	Jed Thomas
	3	CL (BW)	2.5Y 5/3 light olive brown stiff lean clay with fine sand damp ~~to dry~~ BW	3.0 ft		
	4		Bottom of borehole			
	5					
	6		BW 11/15/05			
	7					
	8					
	9					
	10					QC by Jed Thomas

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

HTRW DRILLING LOG

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: 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: 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.	

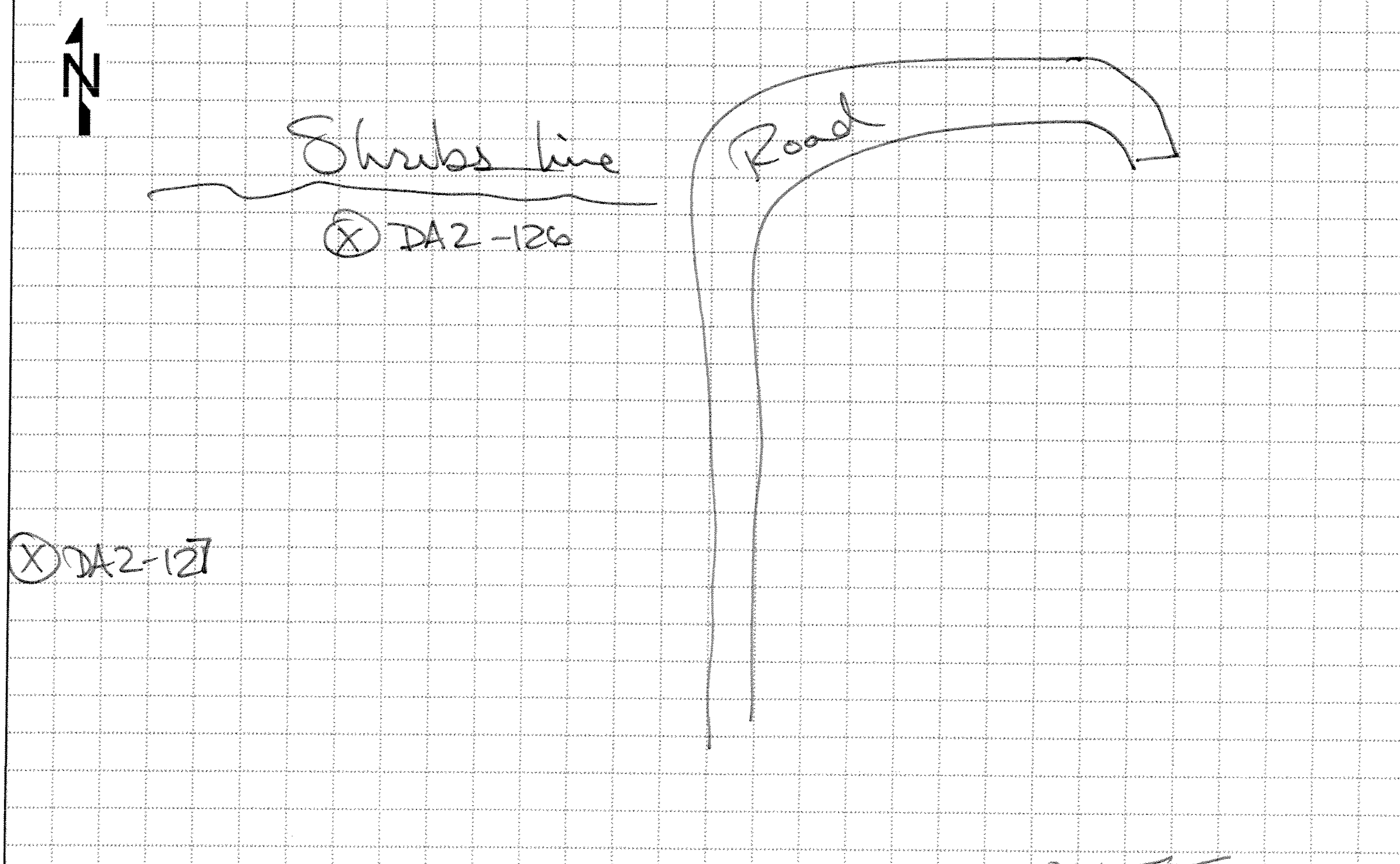
18. GEOTECHNICAL SAMPLES BW N/A UNDISTURBED: —— DISTURBED: —— 19. TOTAL NUMBER OF CORE BOXES N/A

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 Jed Thomas

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

HTRW DRILLING LOG (continued)

DISTRICT: USACE - Louisville		BOREHOLE NUMBER: DA2-126
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
			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; ~~<1 in~~ BW	DA2ss-126-0002-SO 1.0 ft.	0.1	Martha Clough
	1			DA2so-126-0003-SO	0.0	Jed Thomas
	2					
	3		3.0 ft			
			Bottom of Borehole			
	4					
	5		BW			
	6					
	7					
	8					
	9					
	10					

QC by Jed Thomas

PROJECT: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams 11/15/05	BOREHOLE NUMBER: 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: 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: BW ~~1405~~ 1405 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

14. TOTAL DEPTH OF BOREHOLE:

17. OTHER WATER LEVEL MEASUREMENTS (INLCLUDE DATE/TIME): NA

18. GEOTECHNICAL SAMPLES: N/A UNDISTURBED: ——— DISTURBED: ———

19. TOTAL NUMBER OF CORE BOXES: N/A

20. CHEMICAL SAMPLES: METALS EXPL OTHER: ———

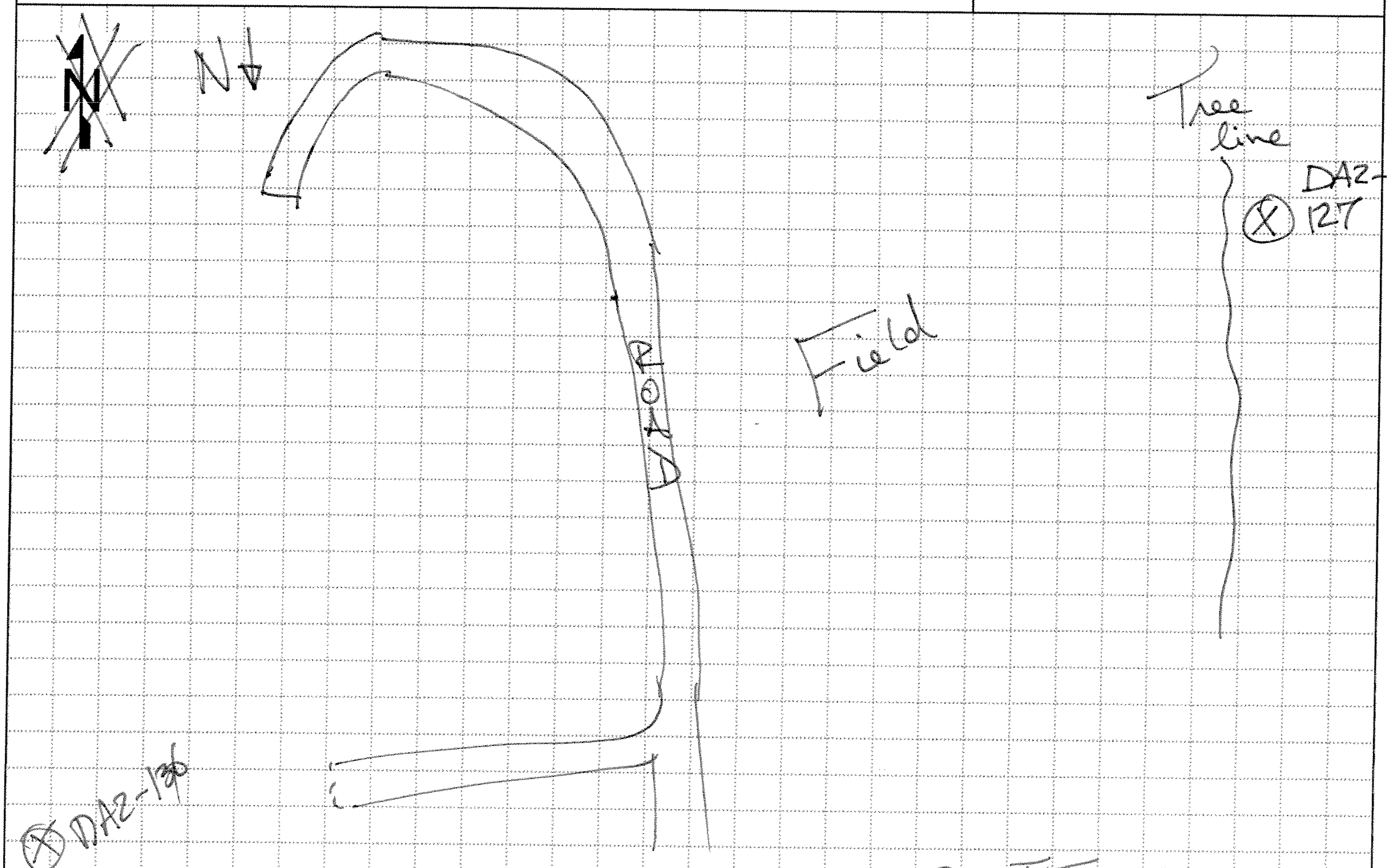
21. TOTAL CORE RECOVERY %: N/A

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



QC by Jed Thomas

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

HTRW DRILLING LOG (continued)

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 ☒ VERTICAL ☐ INCLINED DEGREES

7. NOTES PID MAKE/MODEL: Perkins Elmar 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
	3 4		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~~ 1-2 ft. zone) water in soil 3.0 ft			- Water in hole & soil at 2-3 ft. interval. - faint septic odor
	5		Bottom of borehole			
	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. Williams 11/15/05	DA2-127

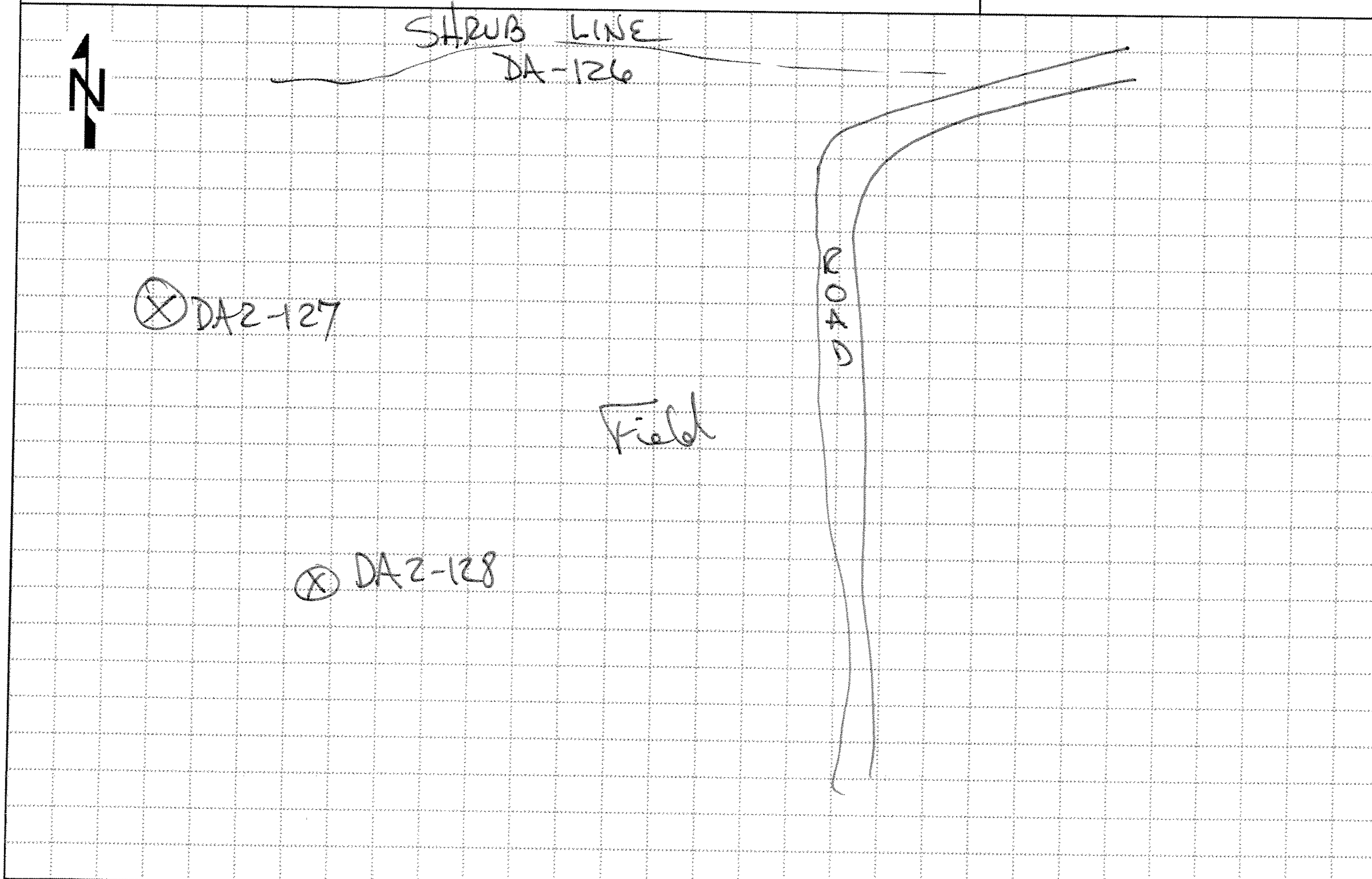
HTRW DRILLING LOG

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	QC by Jed Thomas B. Williams 11/15/05	DA2-128

HTRW DRILLING LOG (continued)

HTRW DRILLING LOG (continued)	DISTRICT USACE - Louisville	BOREHOLE NUMBER DA2-128
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 ☒ 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 ~~course~~ medium sand; moist, roots.	~~DA2-128~~ DA2ss-128-0906-SO	0.0	Martha Clough
	2 3	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 3.0 ft	DA2so-128-0907-SO	0.0	Jed Thomas
	4		Bottom of borehole			
	5					
	6		BW 11/15/05			
	7					
	8					
	9					
	10					

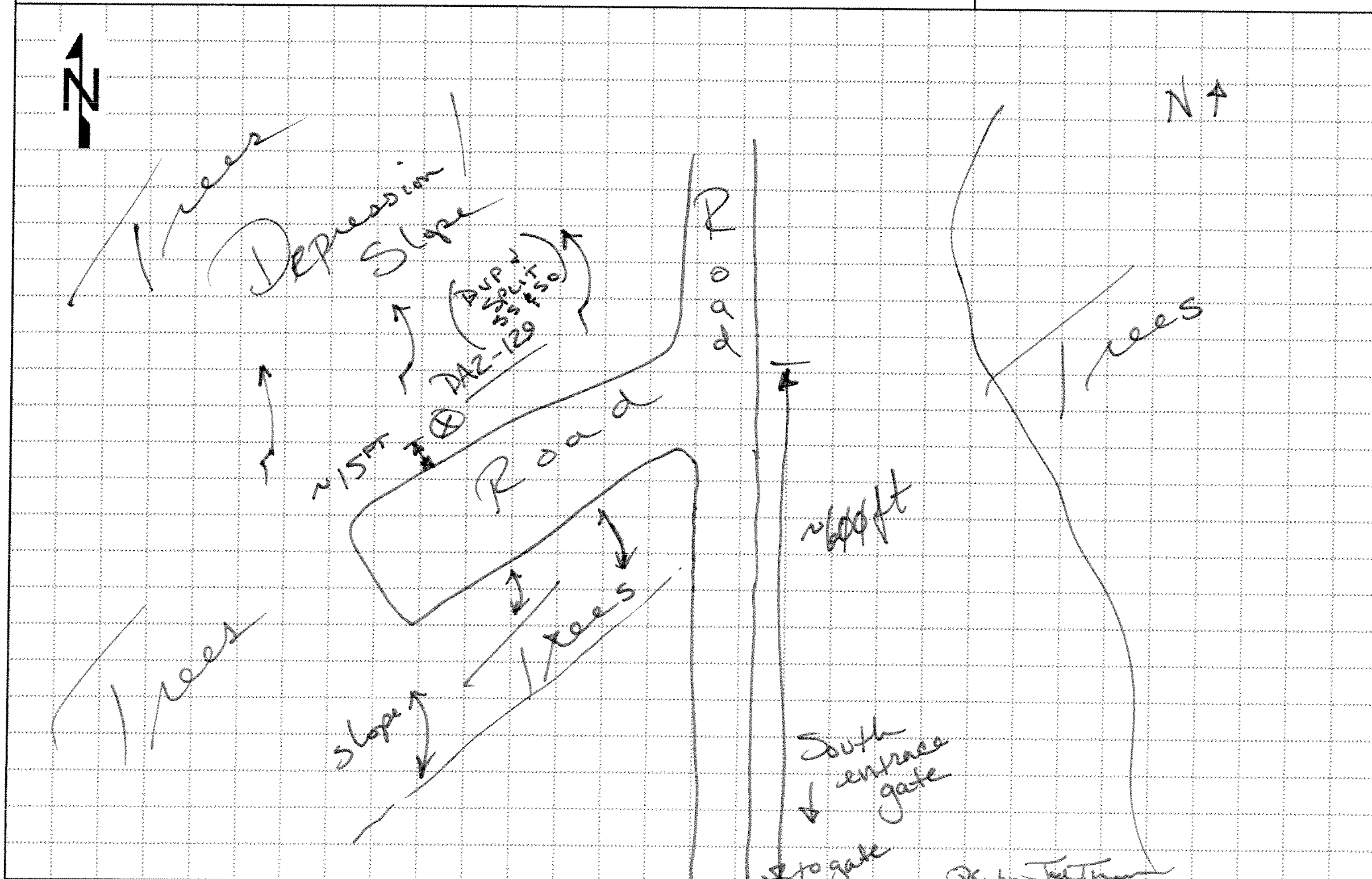
PROJECT Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE B. Williams QC by Jed Thomas	BOREHOLE NUMBER DA2-128

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: Jed 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: ~~N/A~~ BW Demolition Area 2.	
	9. SURFACE ELEVATION/DATUM: N/A	
	10. DRILL DATE/TIME STARTED: 1155 COMPLETED: 1220	
	15. DEPTH GROUNDWATER ENCOUNTERED: NA	
	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: 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: Supplemental Phase II at CBP, FBQ, and ODA2	INSPECTOR SIGNATURE/DATE: B. Williams BW 11/15/05	BOREHOLE NUMBER: DA2-129

HTRW DRILLING LOG (continued)	DISTRICT USACE - Louisville	BOREHOLE NUMBER DA2-129
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 ☒ 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	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	DA2so-125-0909-SO	0.1	DA2so-125-0914-SO (DUPLICATE) DA2so-125-0915-SO (SPLIT) Jed Thomas
	3			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. 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 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: 1230 COMPLETED: 1300 15. DEPTH GROUNDWATER ENCOUNTERED N/A 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)
14. TOTAL DEPTH OF BOREHOLE	NA

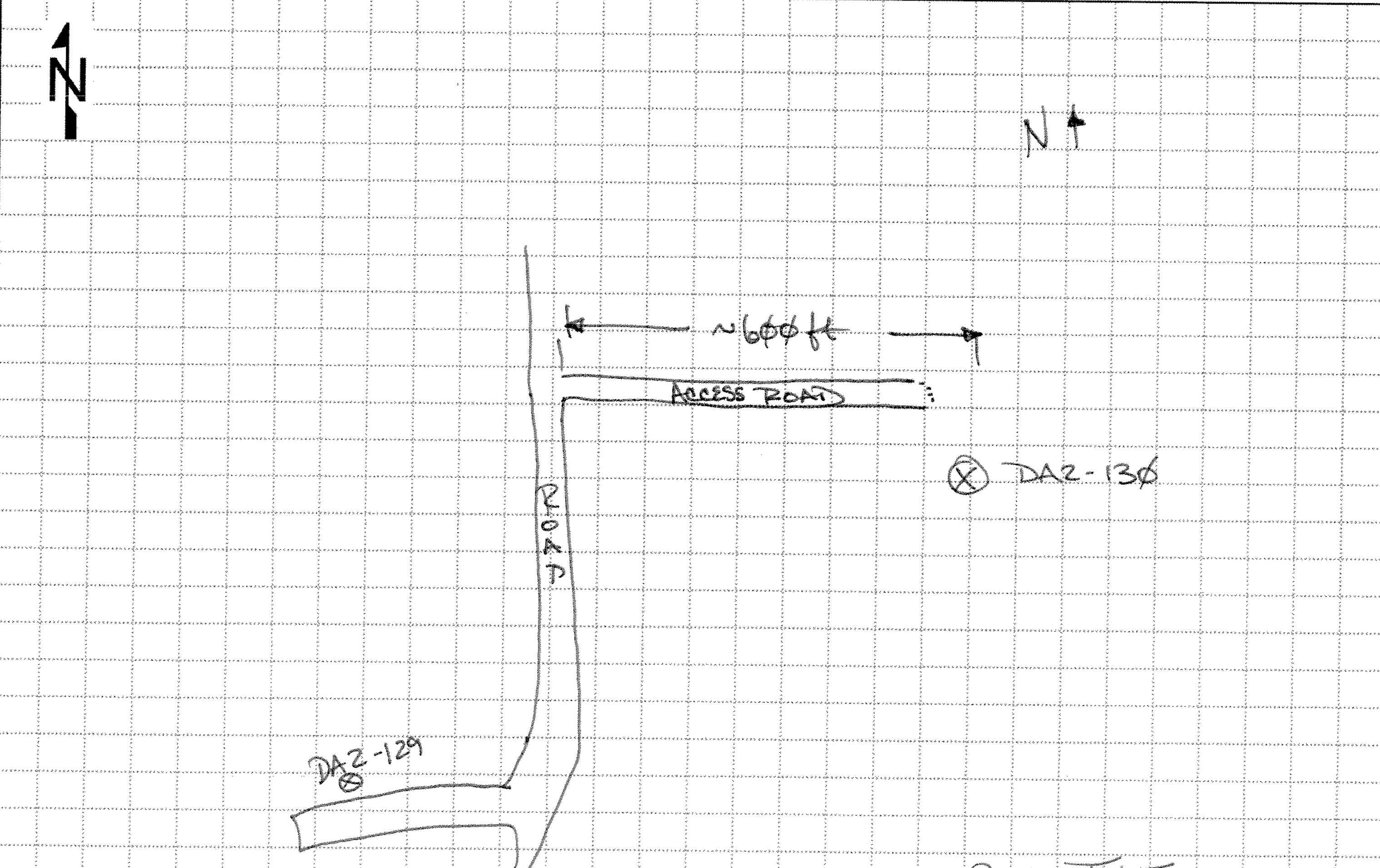
18. GEOTECHNICAL SAMPLES N/A UNDISTURBED: — DISTURBED: — 19. TOTAL NUMBER OF CORE BOXES N/A

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



QC by Jed Thomas

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		
	1.9			DA2so-130-0911-SO	0.0	Jed Thomas 1.9 ft refusal
	2		2.5Y 5/6 light olive brown silt with medium to course sand; very fine to fine subangular poorly sorted stones; damp			
	3			1.9 ft.		
	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

APPENDIX B

IDW LETTER REPORT

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An Employee-Owned Company
Science Applications International Corporation

December 21, 2005

Mr. Paul Zorko
U.S. Army Corps of Engineers, Louisville District
ATTN: CELRL-ED-E
600 Martin Luther King, Jr. Place
P.O. Box 59
Louisville, KY 40202-0059

SUBJECT: **Contract No. GS-10F-0076J Delivery Order W912QR-05-F-0033, Performance-Based Contract for Six Environmental Areas of Concern at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio**

RE: **DRAFT Investigation Derived Waste (IDW) Characterization and Disposal Report for Soil Cuttings and Decontamination Fluids**

Dear Mr. Zorko:

Investigation activities conducted during November 2005 for the Supplemental Phase II Remedial Investigation (RI) at RVAAP-04 Open Demolition Area #2 (ODA2); RVAAP-16 Fuze and Booster Quarry Landfill/Ponds (FBQ); and RVAAP-49 Central Burn Pits (CBP) at RVAAP resulted in the generation of IDW consisting of soil and decontamination fluids. The purpose of this letter report is to summarize characterization and classification information to assist in determining the proper disposition of IDW consisting of soil cuttings (contained in 2 open-topped 55 gallon drums) and decon fluids from small tool decontamination (contained in 1 close-topped 55 gallon drum).

This letter report includes a summary of IDW generated, its origin (Table 1), as well as classification and recommendations for disposal of the IDW (Table 2). This letter report follows guidance established by the Facility-Wide Sampling and Analysis Plan (SAP) (USACE 2001), the SAP Addendum No. 1 for the Supplemental Phase II RI of ODA2, FBQ, and CBP (November 2005), and Ohio EPA (November 1997) regarding IDW disposition at RVAAP.

Table 1. Summary of Supplemental Phase II RI IDW

CONTAINER NUMBER	CONTAINER TYPE AND SIZE	CONTENTS	GENERATION DATES	SAMPLE ID
DECON-01	55- Gallon Closed Top Drum	Deon Fluids From Small Tool Decon	11/15/2005-11/21/2005	CBP0133
SOIL-01	55-Gallon Open Top Drum	Soil Cuttings	11/15/2005-11/18/2005	CBP0134
SOIL-02	55-Gallon Open Top Drum	Soil Cuttings	11/21/2005	

IDW – WATER:

Per Section 7 of the Facility-Wide SAP, non-indigenous IDW is characterized for disposal on the basis of composite samples collected from waste stream storage containers. A composite waste sample was collected and submitted for laboratory analysis to characterize the waste stream for disposal. One liquid composite sample was collected, CBP0133 (composite of decontamination fluids). Upon receipt of analytical results from the laboratory, the analytical results were reviewed to determine if the waste is potentially hazardous. This review consisted of a comparison of the analytical results against toxicity characteristic leaching procedure (TCLP) criteria presented in Table 7-1, Maximum Concentration of Contaminants for the Toxicity Characteristic (40 CFR 261.24) presented in the Facility-Wide SAP (USACE 2001).

Attachment 1 presents the analytical laboratory data for TCLP analysis for IDW water (CBP0133) generated during the November 2005 sampling event. All analytical results were below quantitation limits (BQL). The waste is considered non-hazardous, contaminated wastewater.

IDW – SOILS:

Per Section 7 of the Facility-Wide SAP, indigenous IDW contained in 55-gallon open-topped drums are characterized for disposal on the basis of composite samples collected and submitted for laboratory analysis of full TCLP. One composite sample was collected from the two 55-gallon drums of soil cuttings generated during this reporting period. Upon receipt of analytical results from the laboratory, the analytical results were reviewed to determine if any potentially hazardous waste exist. This review consisted of a comparison of the analytical results against the TCLP criteria presented in Table 7-1, Maximum Concentration of Contaminants for the Toxicity Characteristic (40 CFR 261.24) presented in the Facility-Wide SAP (USACE 2001).

Attachment 1 presents the analytical laboratory data for TCLP analysis for IDW soil cuttings (CBP0134) generated during the November 2005 sampling event. All analytical results were below quantitation limits (BQL). The waste is considered non-hazardous, contaminated solid waste.

Table 2 presents the disposal option identified as a result of these data. Disposal at a permitted solid waste or water treatment facility is recommended for all IDW wastes generated during the November 2005 sampling activities.

Table 2. Summary of Final Waste Classification and Recommended Disposal Options

NON-HAZARDOUS, CONTAMINATED WASTE			
Container Number	**Medium**	**Waste Criterion**	**Disposal Recommendation**
DECON-01	Water	Inorganics, organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility
SOIL-01	Soils	Inorganics, organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility
SOIL-02	Soils	Inorganics, organics	Permitted Wastewater Treatment Facility or Permitted Solid Waste Facility

Please note the IDW addressed in this letter report has been characterized under provisions of the Facility-Wide SAP and SAP Addendum No. 1 using TCLP analyses and process knowledge. Unless RVAAP has additional information that would result in the IDW meeting, or containing materials that meet, the definition of a listed hazardous waste as defined in 40 CFR Part 261 Subpart D, it is recommended that the IDW, as presently characterized, be disposed as summarized in Table 2.

Since RVAAP, under RCRA, is the generator of this material, SAIC requests concurrence or direction on the waste classification prior to disposal to ensure materials are properly disposed. Following your direction and immediate approval, we will proceed with appropriate waste disposal.

If you have any questions, or require additional information, please do not hesitate to contact me at (330) 405-5804.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

Martha Clough
Project IDW Coordinator

cc: Glen Beckham, USACE
Todd Fisher, Ohio EPA DERR
JoAnn Watson, USAEC
Irv Venger, RVAAP
Kevin Jago, SAIC
SAIC Project Files
SAIC CRF

Attachment 1
Analytical IDW Data

Analysis Type	Chemical	Units	Reporting Limit (mg/L)	TCLP Criteria (mg/L)	Results	
					CBP0134 (Soils)	CBP0133 (Water)
Semi-Volatile Organics	1,4-Dichlorobenzene	µg/L	0.05	7.50	BQL	BQL
Semi-Volatile Organics	2,4,5-Trichlorophenol	µg/L	0.05	400.00	BQL	BQL
Semi-Volatile Organics	2,4,6-Trichlorophenol	µg/L	0.05	2.00	BQL	BQL
Semi-Volatile Organics	2,4-Dinitrotoluene	µg/L	0.05	0.13	BQL	BQL
Semi-Volatile Organics	2-methylphenol	µg/L	0.05		BQL	BQL
Semi-Volatile Organics	3 & 4-Methylphenol	µg/L	0.05		BQL	BQL
Semi-Volatile Organics	Hexachlorobenzene	µg/L	0.05	0.13	BQL	BQL
Semi-Volatile Organics	Hexachlorobutadiene	µg/L	0.05	0.50	BQL	BQL
Semi-Volatile Organics	Hexachloroethane	µg/L	0.05	3.00	BQL	BQL
Semi-Volatile Organics	Nitrobenzene	µg/L	0.05	2.00	BQL	BQL
Semi-Volatile Organics	Pentachlorophenol	µg/L	0.1	100.00	BQL	BQL
Semi-Volatile Organics	Pyidine	µg/L	0.05	5.00	BQL	BQL
TCLP Metals	Arsenic	µg/L	0.2	5.00	BQL	BQL
TCLP Metals	Barium	µg/L	1	100.00	BQL	BQL
TCLP Metals	Cadmium	µg/L	0.06	1.00	BQL	BQL
TCLP Metals	Chromium	µg/L	0.05	5.00	BQL	BQL
TCLP Metals	Lead	µg/L	0.1	5.00	BQL	BQL
TCLP Metals	Mercury	µg/L	0.002	0.20	BQL	BQL
TCLP Metals	Selenium	µg/L	0.2	1.00	BQL	BQL
TCLP Metals	Silver	µg/L	0.05	5.00	BQL	BQL
TCLP Herbicides	2,4,5-TP (Silvex)	µg/L	0.005	1.00	BQL	BQL
TCLP Herbicides	2,4-D	µg/L	0.005	10.00	BQL	BQL
TCLP Pesticides and/or PCBs	Chlordane	µg/L	0.005	0.03	BQL	BQL
TCLP Pesticides and/or PCBs	Endrin	µg/L	0.00025	0.02	BQL	BQL
TCLP Pesticides and/or PCBs	Gamma-BHC (Lindane)	µg/L	0.00025	0.40	BQL	BQL
TCLP Pesticides and/or PCBs	Heptachlor	µg/L	0.00025	0.01	BQL	BQL
TCLP Pesticides and/or PCBs	Heptachlor Epoxide	µg/L	0.00025	0.01	BQL	BQL
TCLP Pesticides and/or PCBs	Methoxychlor	µg/L	0.00025	10.00	BQL	BQL
TCLP Pesticides and/or PCBs	Toxaphene	µg/L	0.005	0.50	BQL	BQL
Semi-Volatile Organics	1,1-Dichloroethene	µg/L	0.1		BQL	BQL
Semi-Volatile Organics	1,2-Dichloroethane	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	1,4-Dichlorobenzene	µg/L	0.1	7.50	BQL	BQL
Semi-Volatile Organics	2-Butanone	µg/L	0.1		BQL	BQL
Semi-Volatile Organics	Benzene	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	Carbon Tetrachloride	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	Chlorobenzene	µg/L	0.1	100.00	BQL	BQL
Semi-Volatile Organics	Chloroform	µg/L	0.1	6.00	BQL	BQL
Semi-Volatile Organics	Tetrachloroethylene	µg/L	0.1	0.70	BQL	BQL
Semi-Volatile Organics	Trichloroethene	µg/L	0.1	0.50	BQL	BQL
Semi-Volatile Organics	Vinyl Chloride	µg/L	0.1	0.20	BQL	BQL

BQL - below quantitation limits

TCLP - toxicity characteristic leaching procedure

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.: OH5210020736 — Manifest Document No.: 6001
2. Page 1 of 1

A. Non-hazardous Manifest Document Number: Z 178520

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

B. State Generator's ID: SAME

5. Transporter 1 Company Name: HAZMAT ENVIRONMENTAL GROUP INC
6. US EPA ID Number: NYD980769947

C. State Trans. ID: 1241 B7NY
D. Transporter's Phone (716) 827-7200

7. Transporter 2 Company Name
8. US EPA ID Number

E. State Trans. ID

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: OHD093945293

F. Transporter's Phone ( )
G. State Facility's ID
H. Facility's Phone (937) 859-6101

	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	I. 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.

Printed/Typed Name: Irv Venger — Signature: Irv Venger — Month Day Year: 02 23 06

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: Darrell Ferguson — Signature: Darrell Ferguson — Month Day Year: 02 23 06

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name — Signature — Month Day Year

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

GENERATOR / TRANSPORTER / FACILITY

1-GENERATOR COPY

SIGNATURE AND INFORMATION *MUST* BE LEGIBLE ON ALL COPIES

APPENDIX C

PROJECT QUALITY ASSURANCE SUMMARY

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TABLE OF CONTENTS

C.0 PROJECT QUALITY CONTROL SUMMARY REPORT C-1
C.1 FIELD QUALITY ASSURANCE C-1
C.1.1 Readiness Review C-1
C.1.2 Procedures C-1
C.1.3 Training C-1
C.1.4 Equipment Calibration C-2
C.1.5 Quality Control Samples C-2
C.1.6 Field Records C-2
C.2 ANALYTICAL LABORATORY QUALITY ASSURANCE C-2
C.2.1 Readiness Review C-2
C.2.2 Procedures C-3
C.2.3 Laboratory Quality Control C-3
C.2.4 Laboratory Documentation C-3
C.2.5 Data Verification/Validation C-3
C.3 QUALITY ASSURANCE DOCUMENTATION C-3
C.3.1 Field Change Control C-3
C.3.2 Nonconformance Reports C-4
C.4 REFERENCES C-4

ACRONYMS

CQC	contractor quality control
FCO	field change order
GPL	GPL Laboratories, Inc.
M&TE	materials and testing equipment
NCR	Nonconformance Report
ODA2	Open Demolition Area #2
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	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

C. PROJECT QUALITY CONTROL SUMMARY REPORT

This appendix 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 2001) 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 appendix 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, Ohio 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 2001) 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 appendix.

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. Appendix 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 Appendix 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 United States Environmental Protection Agency (USEPA) 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 (Appendix 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 USEPA 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 (Appendix 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 appendix. 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) 2001. *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.

APPENDIX D

DATA QUALITY CONTROL SUMMARY REPORT

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TABLE OF CONTENTS

TABLES .... D-ii
ACRONYMS .... D-ii

D1.0 PURPOSE OF THIS REPORT D-1
D2.0 QUALITY ASSURANCE PROGRAM D-1
D2.1 MONTHLY PROGRESS REPORTS D-2
D2.2 DAILY QUALITY CONTROL REPORTS D-2
D2.3 LABORATORY "DEFINITIVE" LEVEL DATA REPORTING D-2
D3.0 DATA VERIFICATION D-3
D3.1 FIELD DATA VERIFICATION D-3
D3.2 LABORATORY DATA VERIFICATION D-3
D3.3 DEFINITION OF DATA QUALIFIERS (FLAGS) D-4
D3.4 DATA ACCEPTABILITY D-5
D4.0 DATA QUALITY EVALUATION D-6
D4.1 METALS, SOILS D-6
D4.2 EXPLOSIVE ANALYSES, SOILS D-6
D4.3 PRECISION D-6
D4.4 SENSITIVITY D-7
D4.5 REPRESENTATIVENESS AND COMPARABILITY D-8
D4.6 COMPLETENESS D-9
D5.0 DATA QUALITY ASSESSMENT SUMMARY D-9
D6.0 REFERENCES D-10

LIST OF TABLES

Table D-1. Open Demolition Area #2 Investigation Summary D-5
Table D-2. Primary, Duplicate, and Split Sample Correlation Table Open Demolition Area #2 Investigation D-5
Table D-3. Open Demolition Area #2 Investigation Summary of Rejected Analytes (Laboratory) D-5
Table D-4. Field Duplicate Comparison, Open Demolition Area #2 Investigation D-7
Table D-5. Container Requirements for Soil and Sediment Samples at RVAAP, Ravenna, Ohio D-10

ACRONYMS

ADR	Automated Data Review
AOC	area of concern
CBP	Central Burn Pits
DQA	data quality assessment
DQCR	Data Quality Control Report
DQO	data quality objective
GPL	GPL Laboratories, Inc.
LCS	laboratory control sample
MDL	method detection level
MPR	monthly progress report
MS	matrix spike
MSD	matrix spike duplicate
ODA2	Open Demolition Area #2
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI	remedial investigation
RPD	relative percent difference
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan
SDG	sample delivery group
SVOC	semivolatile organic compound
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

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 United States 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 Open Demolition Area #2 (ODA2), 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* November [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 ASSURANCE 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 onsite, equipment onsite, 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, Inc. (GPL), Gaithersburg, Maryland as the laboratory for the project. During the execution of the project, the GPL facility performed all of the analyses. United States Environmental Protection Agency (USEPA) “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 onsite. 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;
- USEPA – National Functional Guidelines for Inorganic Data Review, USEPA 540/R-94/013, February 1994;
- USEPA – National Functional Guidelines for Organic Data Review, USEPA-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 USEPA 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. Open 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 = United States 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
Open 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. Open 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 deionized water source samples were collected in conjunction with the concurrent sampling program at the Central Burn Pits (CBP).

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/matrix spike duplicates (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 relative percent difference (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, Open 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 (deionized 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 ODA2 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 ODA2 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

D6.0 REFERENCES

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

USACE 2005. *Sampling and Analysis Plan Addendum No. 1 for Supplemental Phase II Remedial Investigation of ODA2, FBQ, and CBP*. November 2005.

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APPENDIX E

LABORATORY ANALYTICAL RESULTS AND COCs

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APPENDIX E
LABORATORY ANALYTICAL RESULTS

DISCRETE SURFACE AND SUBSURFACE SOIL SAMPLES

Table E-1. Discrete Surface Soil Samples - Inorganics E-1
Table E-2. Discrete Surface Soil Samples - Explosives E-4
Table E-3. Discrete Subsurface Soil Samples - Inorganics E-6
Table E-4. Discrete Subsurface Soil Samples - Explosives E-9

Table E-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 E-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

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					
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 E-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 E-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
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
= - 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
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 E-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 E-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

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					
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
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
= - 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
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 E-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 E-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
= - 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
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)

APPENDIX 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

APPENDIX 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	[signature]	FM/SSHO
Brian Williams	[signature]	Tech
Jed Thomas	[signature]	Tech

Briefing Given By:

Name	Signature	Position
Dale E. Miller	[signature]	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
Jud Thomas	Jud 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 / 15 / 05 **Location:** Ravenna AAP

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, 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:

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.

PAGE 3 **of** 5 **PAGES**

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 ~~Today:~~ this 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 1

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. Muller

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

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. Miller
11/17/05

11/18/05

0600 Gave MK 26 to desk clerk at Motel, Hampton Inn, who stated that he would call Fed Ex 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 barn area.

0750 Tailgate safety brief!

0800 Resumed collecting soil samples.

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

1145 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 Mark 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 Brinfield, Ohio to ~~At~~ Aberdeen, OH.
1230 Washed truck after project use.
1300 Arrived at home of record.

Dale E. Miller
11/19/05