Final

Removal Action Report
for the RVAAP-49 Central Burn Pits

Ravenna Army Ammunition Plant
Ravenna, Ohio

December 5, 2008

GSA Contract No. GS-10F-0076J
Delivery Order No. W912QR-05-F-003

Prepared for:

United States Army Corps of Engineers
Louisville District

Prepared by:

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14. ABSTRACT

This report summarizes activities performed in accordance with the Central Burn Pits Removal Action Work Plan at the Ravenna Army Ammunition Plant. This report provides documentation that the removal action objectives and removal action cleanup goals stated in the owkr plan were achieved.

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removal action, removal action objectives, cleanup goals

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has completed the Final Removal Action Report for the RVAAP-49 Central Burn Pits at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Army Corps of Engineers policy.

Jed Thomas, P.E.
Study/Design Team Leader

12/5/08
Date

Tia Rutledge
Independent Technical Review Team Leader

5 Dec 08
Date

Significant concerns and the explanation of the resolution are as follows:

Internal SAIC Independent Technical Review comments are recorded on a Document Review Record per SAIC quality assurance procedure QAAP 3.1. This Document Review Record is maintained in the project file. Changes to the report addressing the comments have been verified by the Study/Design Team Leader. As noted above, all concerns resulting from independent technical review of the project have been considered.

Tad Fox
Principal w/ A-E firm

12-5-08
Date

Final

Removal Action Report for the RVAAP-49 Central Burn Pits

Volume One - Main Report
Version 1.0

Ravenna Army Ammunition Plant
Ravenna, Ohio

GSA Contract No. GS-10F-0076J
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Prepared for:
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Ravenna, Ohio

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Ohio EPA-NEDO = Ohio Environmental Protection Agency-Northeast District Office
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REIMS = Ravenna Environmental Information Management System
RTLS-ENV = Ravenna Training and Logistics Site Environmental Specialists
RVAAP = Ravenna Army Ammunition Plant
SAIC = Science Applications International Corporation
USACE = United States Army Corps of Engineers
USAEC = United States Army Environmental Command

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LIST OF ACRONYMS

amsl	Above mean sea level
AOC	Area of Concern
ARAR	Applicable and Relevant or Appropriate Requirements
BGS	Below ground surface
CBP	Central Burn Pits
CFR	Code of Federal Regulations
DFFO	Director's Final Findings and Orders
EE/CA	Engineering Evaluation/Cost Analysis
GSA	U.S. General Services Administration
IRP	Installation Restoration Program
MDL	Method detection limit
MEC	Munitions and explosives of concern
MI	Multi-increment
NGB	National Guard Bureau
NPL	National Priorities List
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OHPO	Ohio Historic Preservation Office
PBC	Performance Based Contract
PCB	Polychlorinated biphenyl
PRG	Preliminary remediation goals
RAR	Removal Action Report
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RL	Reporting limit
RmAO	Removal Action Objective
RmAWP	Removal Action Work Plan
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SSHO	Site Safety and Health Officer
SVOC	Semi-volatile organic compounds
TCLP	Toxicity characteristic leaching procedure
TCRA	Time critical removal action
TNT	2,4,6 - trinitrotoluene
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USEPA	U.S. Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	Unexploded ordnance
VOC	Volatile Organic Compound

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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 in support of six (6) high priority areas of concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. This Removal Action Report (RAR) describes the field activities and documents attainment of removal action cleanup goals as a result of implementing a non-time critical removal action (non-TCRA) for two contaminated debris piles, Piles M and N, at the Central Burn Pits (CBP).

This work is being performed under a Performance-Based Contract (PBC) in accordance with U.S. General Services Administration (GSA) Environmental Advisory Services Contract GS-10-F-0076J. In addition, planning and performance of all work elements is being conducted in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders (DFFO) for RVAAP, dated June 10, 2004 (Ohio EPA 2004).

1.1 PURPOSE

This Removal Action Report describes the implementation of the *Central Burn Pits Removal Action Work Plan for Central Burn Pits* (USACE 2007a). This report also documents that the selected non-TCRA alternative in the *Action Memorandum for the Central Burn Pits* (USACE 2007b) was implemented, and the removal action cleanup goals were achieved. By achieving these removal action cleanup goals, residual containment levels in soil beneath former Piles M and N are below the Ohio EPA risk benchmark (10E-5) and well within the range of values observed in surrounding soil at CBP.

1.2 PROJECT ORGANIZATION

The U.S. Army was the lead entity for this non-TCRA and was responsible for the implementation of this removal action. The USACE, Louisville District had implementation and technical oversight responsibility on behalf of the U.S. Army. Ohio EPA was the regulatory authority governing work on this non-TCRA. SAIC was the primary contractor responsible for implementing the Removal Action Work Plan (RmAWP) and selected and procured a qualified removal subcontractor (Clean Harbors Environmental Services) to perform the work herein. SAIC also provided project management, construction oversight, coordinated transportation and disposal activities with RVAAP, and collected confirmation samples.

1.3 REPORT ORGANIZATION

This RAR is organized as follows:

- Section 1: Introduction
- Section 2: Background Information
- Section 3: Construction Mobilization
- Section 4: Soil Removal Activities

- Section 5: Site Restoration
- Section 6: Conclusions
- Section 7: References

- Appendices:
  - Appendix A: Permits, Notifications, and Approvals
    - A-1 United States Fish and Wildlife Service (USFWS) Approval
    - A-2 Ohio EPA Notification
    - A-3 Ohio Historic Preservation Office Approval
    - A-4 Ohio EPA Approval of Pile M Re-sampling Scheme
  - Appendix B: Laboratory Analytical Results
  - Appendix C: Data Quality Control Summary Report

2.0 BACKGROUND INFORMATION

This section describes the facility, provides AOC descriptions, discusses the previous investigations at the Central Burn Pits, and presents the removal action objectives (RmAOs) and removal action cleanup goals.

2.1 GENERAL FACILITY DESCRIPTION

When the RVAAP Installation Restoration Program (IRP) began in 1989, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (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 Ravenna Training and Logistics Site (RTLS). The current RVAAP consists of 1,280 acres in various parcels throughout the OHARNG RTLS.

The RTLS is located in northeastern Ohio within Portage County and Trumbull County, approximately 3 miles (4.8 km) east-northeast of the city of Ravenna and approximately 1 mile (1.6 km) northwest of the city of Newton Falls. The RVAAP portions of the property are solely located within Portage County. The RTLS is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) 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 2-1 and 2-2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; and Wayland 3 miles (4.8 km) to the south.

The entire 21,683-acre parcel was an industrial facility that was government-owned and contractor-operated when the RVAAP was operational (the RTLS did not exist at that time). The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP; therefore, references to the RVAAP in this document indicate 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. Following cleaning, the waste water, containing 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

Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to 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, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

2.2 CENTRAL BURN PITS DESCRIPTION AND HISTORY

CBP is currently licensed to the OHARNG and is part of the RTLS. CBP is located in the east-central area of the RVAAP/RTLS facility at the intersection of Paris-Windham Road and Lumber Yard Road, and covers approximately 20 acres (Figures 2-2 and 2-3). The AOC is bordered by old railroad beds to the north (Track 39) and south (Track 33), and Sand Creek to the west-northwest. There are no buildings at CBP.

The topography across the majority of CBP is relatively flat due to historical grading and fill activities. Elevations vary from 292 to 298 meters (960 to 980 ft) above mean sea level (amsl). Soils within CBP consist primarily of Mahoning silt loams, Trumbull silt loams, and Ellsworth silt loams. The Ellsworth silt loam is found near the southwestern boundary of the AOC. The Trumbull silt loam is found in the eastern portion of the AOC. The Mahoning silt loam covers the remainder of CBP (western and extreme eastern boundary). Subsurface lithology at CBP consists mostly of clay to sand-rich silt tills with interbedded sands scattered throughout. These deposits are generally firm, moderately plastic, and tend to hold water where encountered.

The AOC was originally used as a lumber and building materials storage area. Operation is believed to have started soon after RVAAP began operations and continued into the mid-1970s, although actual dates are unknown. Later the AOC was used for open burning of non-explosive wastes, electrical components, wooden boxes, scrap, and the disposal of other non-hazardous waste material. Features include debris piles and berms in the central area and burn areas in the eastern area. These debris piles and berms are placed materials, dumped over a period of time from other areas of RVAAP, and are not conventional environmental media, comprised of bare mounds of slag and debris.

2.3 PREVIOUS INVESTIGATIONS AND ACTIVITIES

The following sections provide a summary of the previous investigations and activities performed to date at the Central Burn Pits.

2.3.1 Relative Risk Site Evaluation

An initial investigation was conducted at 13 AOCs as part of a relative risk site evaluation performed by the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). The relative risk site evaluation (USACHPPM 1998) assessed environmental data for metals, explosives, and organic constituents in surface and subsurface soil samples. Surface soil samples and one subsurface sample were collected within the main burn areas. The samples contained elevated levels of several metals including copper and lead. Groundwater was not sampled during this investigation and sediment was not evaluated as a human endpoint.

The results of the relative risk site evaluation provided the U.S. Army with qualitative and quantitative data to score these sites. The scores (high, medium, or low) provided the U.S. Army with a basis for prioritizing cleanups and allocating funds. Of the 13 sites evaluated, five sites (including CBP) were considered high-priority AOCs.

2.3.2 Phase I Remedial Investigation

The Phase I remedial investigation (RI) field activities for CBP were conducted in 2001. The field investigation consisted of sampling surface soil, subsurface soil, surface water, groundwater, and sediment. The Phase I RI sampled surface soil (0-1 ft below ground surface [BGS]) and subsurface soil (1-30 ft BGS). Data collected were used to support the development of the CBP RI Report (USACE 2005a).

Samples from the human health deep surface soil exposure unit (0 to 4 ft BGS) had occasional detections of polychlorinated biphenyl (PCBs), explosives, propellants and pesticides. Inorganics detected at the AOC above background and U.S. Environmental Protection Agency (USEPA) Region 9 preliminary remediation goal (PRGs) (residential) values include aluminum, arsenic, chromium, copper, lead, manganese, and vanadium.

2.3.3 Supplemental Phase II Remedial Investigation

Supplemental Phase II RI field activities were conducted in 2005 to further define nature and extent of soil contamination at CBP. In addition, samples were collected from twelve identified debris piles and berms to assess potential disposition requirements and options. The sampling strategy was presented in the *Supplemental Phase II Remedial Investigation* (USACE 2005b).

Results of the Supplemental Phase II RI indicated concentrations of lead and hexavalent chromium in two debris piles, Piles M and N respectively, were sufficiently high that the materials were considered

principal threat wastes. The lead concentration for Pile M was 8,560 mg/kg and the hexavalent chromium concentration for Pile N was 25 mg/kg. Additionally, sampling indicated that Pile M had a lead toxicity characteristic leaching procedure (TCLP) result of 15.4 mg/L, which exceeds the maximum concentration of lead (5.0 mg/L) for toxicity characteristics. Consequently, the debris pile material was classified as characteristically hazardous waste.

2.3.4 Engineering Evaluation/Cost Analysis

Although RVAAP is not a National Priorities List (NPL) listed site, the U.S. Army and Ohio EPA agreed to proceed with a non-TCRA for Piles M and N due to likelihood of contaminant dispersal and migration from the piles to surrounding environmental media. The removal action followed the guidelines of USEPA (USEPA 2000). As a result, the *Engineering Evaluation and Cost Analysis for Central Burn Pits* (USACE 2007c) was developed.

The Engineering Evaluation/Cost Analysis (EE/CA) developed a RmAO, established cleanup goals, and evaluated alternatives to achieve cleanup goals (presented in Table 2-1). The cleanup goal for Pile M was based upon the lowest risk-based cleanup goal for lead among the receptors evaluated, which is residential land use (400 mg/kg, USEPA residential play areas hazard level – 40 CFR 745). The cleanup goal for Pile N was based upon the lowest cleanup goal for hexavalent chromium among the receptors evaluated, which is for the National Guard Trainee (16 mg/kg). This cleanup goal was based on combined exposure through ingestion, inhalation of fugitive dust, and dermal contact with soil. The hexavalent chromium cleanup goal for the non-TCRA was consistent with the previously approved cleanup goal in the *Final Proposed Remedial Goal Options for Soils at Load Lines 1, 2, 3, and 4 at the Ravenna Army Ammunition Plant* (Shaw 2004).

Table 2-1. Removal Action Cleanup Goals

Location	Parameter	Supplemental Phase II RI Results[1] (mg/kg)	Removal Action Cleanup Goal (mg/kg)
Pile M	Lead, Total	8,560	400
Pile N	Chromium, hexavalent	25	16

[1] Results are for multi-increment samples collected. Table does not include RI discrete soil samples.
RI = Remedial investigation.

The EE/CA established the following RmAO for Piles M and N at CBP consistent with the intended future land use at CBP:

- Remove Piles M and N to prevent dispersal of contaminants and ensure underlying soil meets the lowest risk-based cleanup goals for the exposure scenarios evaluated in the RI.

The EE/CA assessed the technologies available, identified Applicable and Relevant or Appropriate Requirements (ARARs); and compared cost estimates. Two removal action alternatives were developed

(No Action and Excavation of Waste Piles with Offsite Treatment and Disposal). At the completion of the analysis, the EE/CA recommended proceeding with Removal Action Alternative 2: Excavation of Waste Piles with Offsite Treatment and Disposal.

2.3.5 Action Memorandum

The *Action Memorandum for Central Burn Pits* (USACE 2007b) documented the selected Removal Action Alternative 2 - Excavation of Waste Piles with Offsite Treatment and Disposal. This Action Memorandum also established the final RmAO and cleanup goals. The Action Memorandum includes a Responsiveness Summary addressing public comments received during the public comment period held from March 7, 2007 to April 5, 2007. Following review and concurrence by the Ohio EPA, the Action Memorandum was signed by the U.S. Army on August 9, 2007.

2.3.6 Removal Action Work Plan of Piles M and N

The *Removal Action Work Plan for the Central Burn Pits* (USACE 2007a) was developed to detail implementation of the Pile M and N removal action. The RmAWP provided guidance and specifications to achieve the removal action cleanup goals and removal action objectives developed in the EE/CA (USACE 2007c) and stated in the Action Memorandum (USACE 2007b).

2.4 CENTRAL BURN PITS ANTICIPATED FUTURE LAND USE

CBP is currently licensed to the OHARNG and is part of the RTLS. OHARNG has established future land use for CBP as Dismounted Training, No Digging based on anticipated training, mission, and utilization of the RTLS. Future land use may also include the development of small arms ranges.

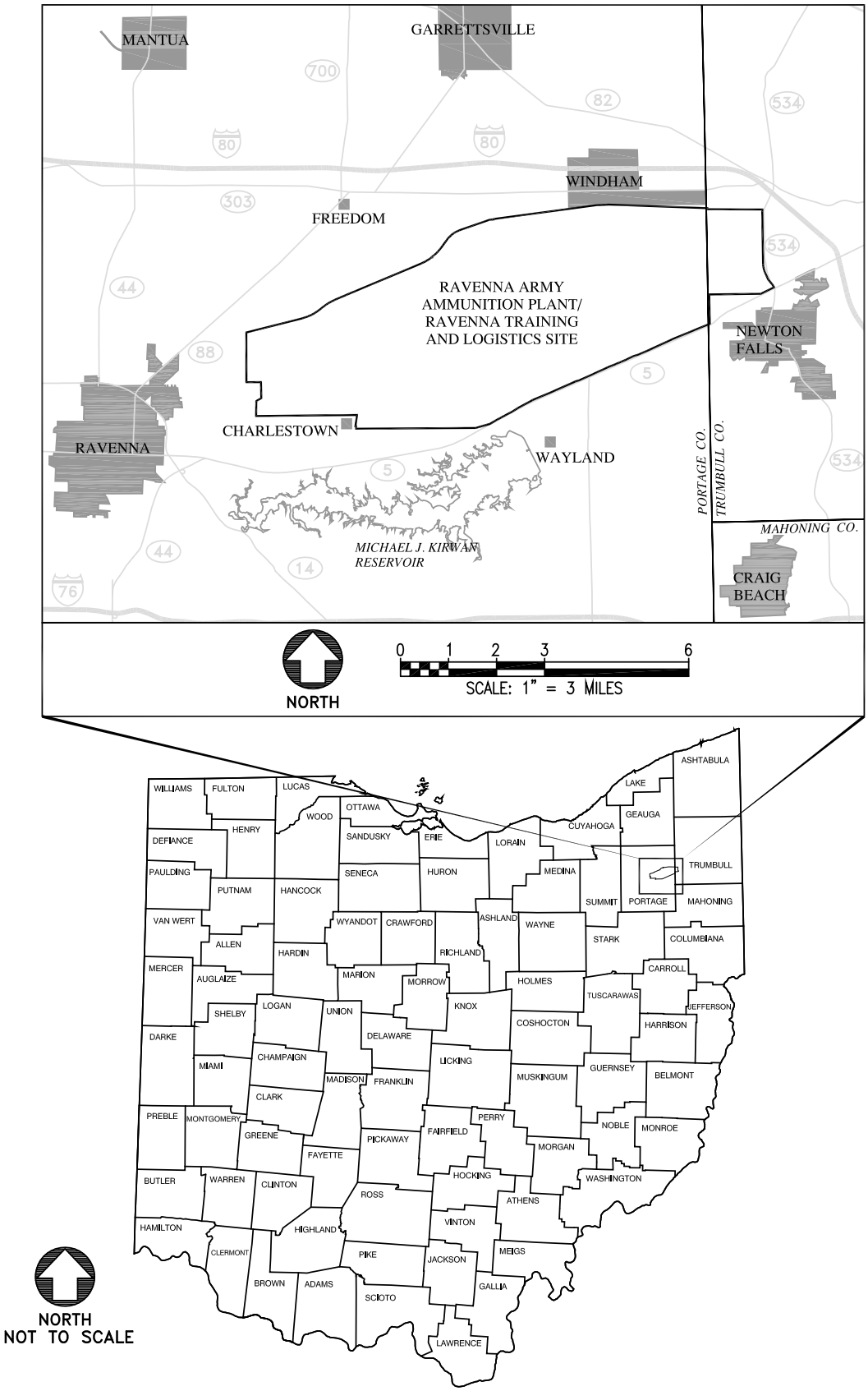
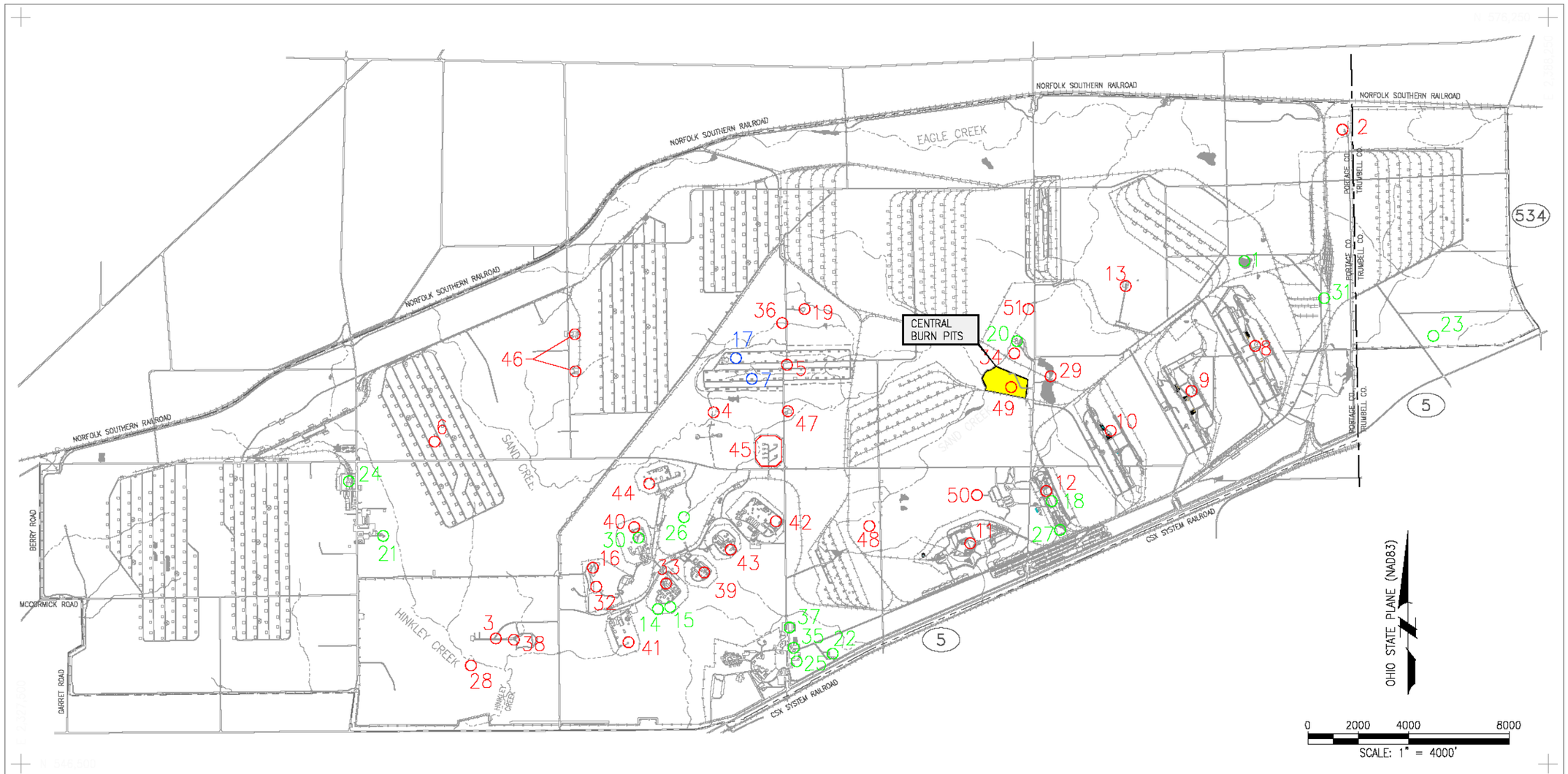


Figure 2-1. General Location and Orientation of RTLS/RVAAP



LEGEND:

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

US Army Corps of Engineers Louisville District

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

RVAAP/RTLS
RAVENNA, OHIO

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Figure 2-2. RVAAP/RTLS Installation Map

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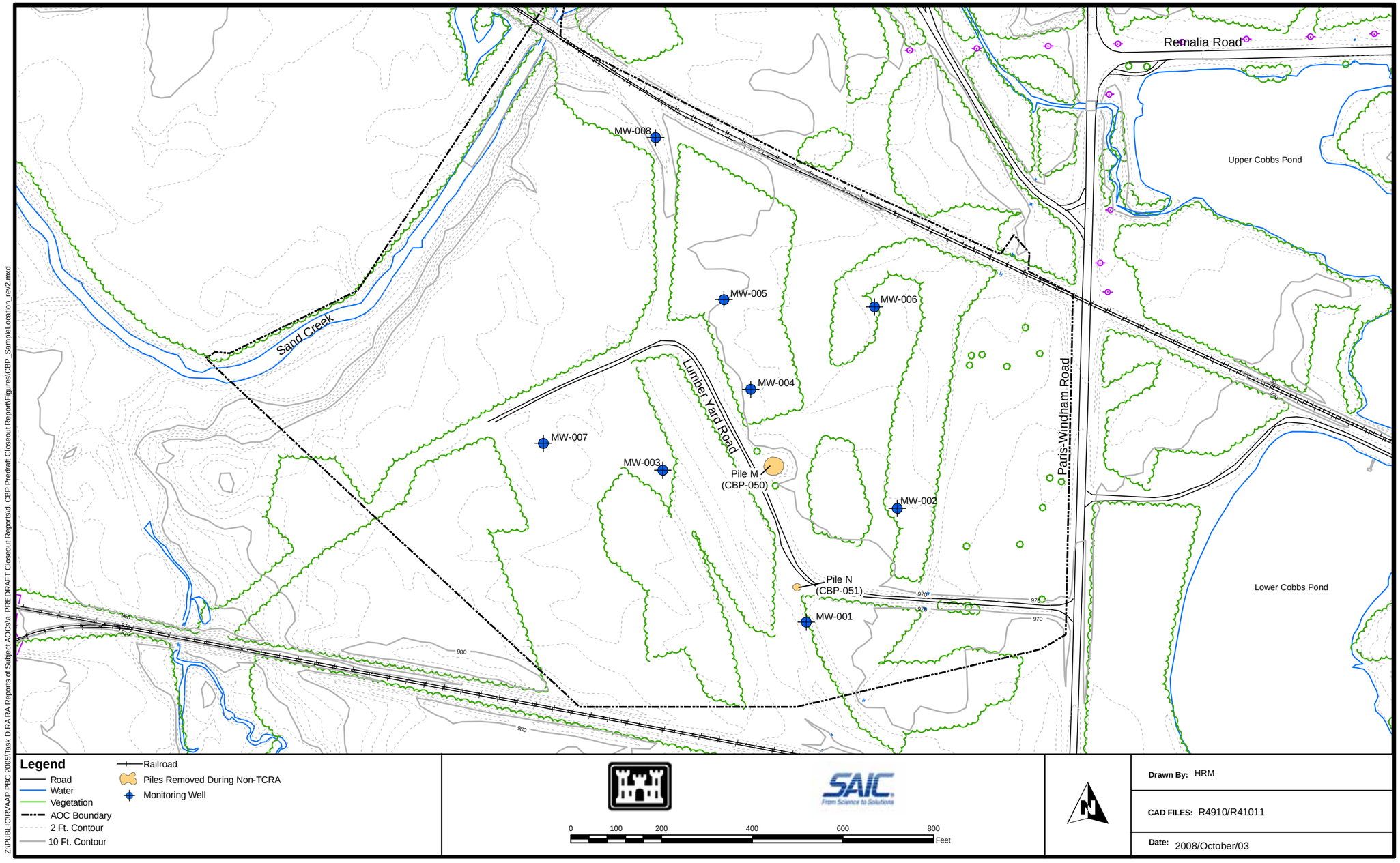

Figure 2-3. Central Burn Pits Site Map

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3.0 CONSTRUCTION MOBILIZATION

This section describes construction mobilization and site preparation activities required to implement the RmAWP, including permit and notification requirements and site preparation activities.

3.1 PERMIT AND NOTIFICATION REQUIREMENTS

Based on review of applicable requirements, the following permits, notifications, and/or approvals were required for the removal action:

- USFWS Approval;
- Ohio EPA Notification; and
- Ohio Historic Preservation Office (OHPO) Approval.

No other federal, state, or municipal permits, notifications, or requirements were determined to be applicable for this removal action. All signatory documentation (e.g., permits and manifests) were obtained through RVAAP or RTLS representatives. Permit and notification requirements were fulfilled prior to initiation of field activities (Appendix A).

3.2 MOBILIZATION AND SITE PREPARATION

3.2.1 Utility Clearance

A meeting with the RVAAP Operations and Maintenance Contractor (MKM Engineers, Inc.) was conducted on September 11, 2007. At this meeting, SAIC provided RVAAP notification that the removal activities at the Central Burn Pits were about to commence. Additionally, MKM Engineers, Inc. stated the removal area was clear of utilities up to eight feet below ground surface (BGS). At that depth, an inactive sanitary sewer line was identified. Although excavation to depths of 8 ft BGS were not anticipated during the non-TCRA, RVAAP and MKM Engineers, Inc. indicated that repairs to the line would not be necessary if damage was done, as the line was no longer active.

3.2.2 MEC Clearance

Site mobilization activities began on October 29, 2007. An Explosives Safety Submittal was not required for the non-TCRA, as CBP is not an identified Military Munitions Response Program site. However, munitions and explosives of concern (MEC) avoidance protocols were employed during the non-TCRA. A site walk was conducted with the munitions and explosives of concern (MEC) Avoidance Subcontractor prior to the non-TCRA and the area was cleared. The MEC Avoidance Subcontractor remained onsite during all removal activities.

3.2.3 Site Preparation

Site preparation activities for the RmAWP began on October 29, 2007, and were completed on November 1, 2007. Site preparation activities included installation of storm water controls, installation of construction traffic signage, and placement of gravel for a construction entrance/exit and truck turn-around. Maintenance of the construction entrance/exit, truck turn-around and storm water controls was performed throughout the project.

3.2.3.1 Implementing Site Controls

All personnel and vehicles entered the facility through the main entrance (8454 State Route 5, Ravenna, OH 44266). SAIC submitted a roster of all personnel and subcontractors who would be working at the RVAAP to the RVAAP Operations and Maintenance Contractor at least one week in advance of the field work. The roster was maintained and submitted to the RVAAP Operations and Maintenance Contractor on a weekly basis or as necessary. The SAIC Construction Manager coordinated with RVAAP security to ensure that contact with Post 1 was maintained at all times.

Signs were erected along Newton Falls Road, Paris-Windham Road, and Lumber Yard Road (which was an unimproved access road through CBP) to expedite deliveries, maintain traffic flow, promote safety and prevent interference with other RVAAP/RTLS operations (Photographs 3-1 and 3-2).

Photograph 3-1. Construction Traffic Route Sign

Photograph 3-2. Construction Area Warning Sign

3.2.3.2 Vegetation Clearing

Minimal clearing and grubbing was required to facilitate equipment access to install storm water controls and soil removal. Vegetation clearing, including felling of trees, was conducted with the backhoe. Fewer than ten trees required felling and removal. Tree stumps and associated roots that required removal within the limits of excavation were removed and disposed with the impacted soil.

3.2.3.3 Storm Water Controls

In accordance with the RmAWP, silt fencing was installed on the north, east, and south sides of Pile M and on the east, south, and west sides of Pile N (Photograph 3-3). To further minimize the potential for erosion and sediment run-off, no work was performed during periods of inclement weather, as determined by the SAIC Construction Manager. The excavation areas were opened at the beginning of each day and covered at the end of each day's activities (Photograph 3-4). Inspection of storm water controls was performed by Clean Harbors Environmental Services and/or SAIC on a daily basis. Storm water controls were inspected by SAIC weekly during periods when no activities were conducted.

Photograph 3-3. Installation of Silt Fencing

Photograph 3-4. Nightly Cover of Pile N

3.2.3.4 Dust and Wind Controls

Dust control was generally maintained by keeping traffic on improved roads and maintaining the posted speed limit. Dust generation was monitored visually by Clean Harbors Environmental Services Site Safety and Health Officer (SSHO). Soil moisture content remained sufficiently high during the work so that the area did not require spraying/misting for dust control. Airborne dust was not observed during non-TCRA activities.

3.2.3.5 Good Housekeeping Practices

Good housekeeping practices were conducted in accordance with Section 4.5 of the RmAWP throughout the non-TCRA in order to maintain a clean and orderly work environment. The construction site was regularly inspected for trash and waste by the SAIC Construction Manager. Identified trash or waste was disposed accordingly. There were no leaks of petroleum or chemicals during the non-TCRA.

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4.0 SOIL REMOVAL ACTIVITIES

This section summarizes the soil excavation and disposal activities conducted during implementation of the RmAWP.

4.1 MEC AVOIDANCE

An unexploded ordnance (UXO) Technician was onsite during soil excavation activities. No MEC was encountered during the implementation of the RmAWP.

4.2 EXCAVATION AND REMOVAL ACTIVITIES

4.2.1 General Information

4.2.1.1 Truck Loading and Transportation

Excavation of Piles M and N took place in three phases to achieve the non-TCRA cleanup goals. All excavated material was loaded directly into haul trucks for transport to hazardous or non-hazardous licensed disposal facilities. All hazardous material was disposed by Clean Harbors Canada Inc. at Lambton (Sarnia) Landfill in Ontario, Canada. All non-hazardous material was trucked to and disposed at Waste Management American Landfill in Waynesburg, Ohio.

During the loading process, the haul trucks were positioned over plastic sheeting to contain any soil spilled during load-out. Trucks were inspected for soil on the exterior of the truck bed. Soil was brushed off and captured prior to the truck pulling out of the loading area. All trucks were covered prior to leaving the construction site. On-road haul trucks transporting hazardous waste were lined as required by the disposal facility along with any other specific requirements (e.g., placarding).

4.2.1.2 Equipment Decontamination

Excavation equipment was decontaminated after coming in contact with contaminated soil and before contacting other materials. Additionally, the excavation equipment was decontaminated prior to removal from the work site. Equipment that came into direct contact with contaminated soils was placed over the haul truck and washed with a pressure washer. Limited amounts of potable water (i.e. less than 30 gallons) were used for decontamination activities performed over haul trucks. Clean Harbors Environmental Services ensured free water was not present in the haul truck and that no liquids escaped the truck bed. Decontamination liquids did not change the chemical profile of the waste (i.e. addition of solvents or pH). The equipment then air dried.

4.2.1.3 Confirmation Sampling

The confirmation samples collected during the removal activities were collected and analyzed in accordance with Section 6.0 of the RmAWP, unless otherwise noted. One general change from the RmAWP was the use of sterilized plastic spoons, as opposed to stainless steel spoons or scoops, as specified in Section 6.1.1 of the RmAWP. The use of these plastic spoons was approved by Ohio EPA since the number of samples (and consequently the number of spoons requiring disposal) was minimal.

All confirmation and sampling results are presented in Appendix B.

4.2.2 Phase I Removal Activities

The Phase I removal activities began on November 12, 2007, and were completed on November 14, 2007. During this timeframe, Pile M and Pile N debris piles were excavated and confirmation samples were collected. The following sections provide detail of the Phase I Removal Activities.

4.2.2.1 Pile M

During Phase I removal activities at Pile M, 51 tons of lead-contaminated debris and adjacent soil were removed. This soil was managed as characteristically hazardous waste based on characterization results obtained during the Supplemental Phase II RI. Once the initial 51 tons of debris was removed, concrete rubble and aggregate was encountered, which appeared to have been excess concrete placed during cleanout of concrete trucks during historical facility operations. These materials were not previously encountered during characterization activities and were not known to exist beneath the debris pile. Upon encountering the concrete debris, excavation of Pile M was suspended and the Ohio EPA and USACE were consulted to determine a path forward with respect to this portion of the removal action. Ohio EPA and USACE agreed to proceed with confirmation sampling of the excavation footprint to determine if the Pile M removal action cleanup goal has been achieved. Ohio EPA and USACE also requested additional confirmation sampling, including: 1) a sample outside of the excavation footprint to determine if the lateral extent of the debris and soil above cleanup goals have been removed; 2) samples of different portions of the concrete aggregate to ensure this material was not contaminated; and 3) collection of additional TCLP samples of soil and concrete for the purposes of waste classification.

Confirmation and waste characterization samples were collected on November 14, 2008 and November 21, 2008 as follows:

- Sample CBPss-055-0138M-SO was a multi-increment (MI) sample collected from the entire excavation footprint and analyzed for lead to determine if the removal action cleanup goal for Pile M (lead concentration of 400 mg/kg) was achieved. Additionally, this sample was analyzed for TCLP metals for waste classification of any additional debris requiring removal from Pile M.
- Sample CBPss-055-0139-SO was a discrete sample collected from the middle of the excavation footprint of Pile M. This sample was analyzed for TCLP (volatile organic compounds [VOCs],

Reactive Cyanide, Reactive Sulfide, PCBs, Pesticides, and semi-volatile organic compounds [SVOCs]) for waste classification of any additional debris requiring removal from Pile M.

- Sample CBPss-055-0146M-SO was an MI sample collected from the outer excavation footprint of Pile M and analyzed for total lead to determine if the removal action cleanup goal was achieved laterally.
- Sample CBPss-055-0147-SO was a discrete sample of the concrete aggregate in the mid-west portion of the excavation footprint. This sample was analyzed for Resource and Recovery Act (RCRA) Metals to determine the metal composition of the aggregate.
- Sample CBPss-055-0148-SO was a discrete sample collected from the concrete aggregate in the mid-west portion of the excavation footprint and was analyzed for TCLP Metals to determine the waste disposal characterization.
- Sample CBPss-055-0149-SO was a discrete sample collected from the concrete aggregate in the mid-east portion of the excavation footprint and analyzed for RCRA Metals to determine the metal composition of the aggregate.
- Sample CBPss-055-0150-SO was a discrete sample collected from the concrete aggregate in the mid-east portion of the excavation footprint and was analyzed for TCLP Metals to determine the waste disposal characterization.

The sample results indicated that the soil within and around the excavation footprint of Pile M still exceeded the removal action cleanup goal. Therefore, additional soil and debris removal was required for Pile M. The TCLP analysis indicated the material was non-hazardous solid waste. The concrete samples did not exceed the Pile M removal action cleanup goal and were considered non-hazardous solid waste. However, because the concrete aggregate was intermixed with contaminated debris and soil, it required removal during subsequent phases of excavation. Data for these samples are presented in Appendix B.

Photograph 4-1. Phase I Excavation of Pile M

Photograph 4-2. Samples of Concrete Aggregate at Pile M

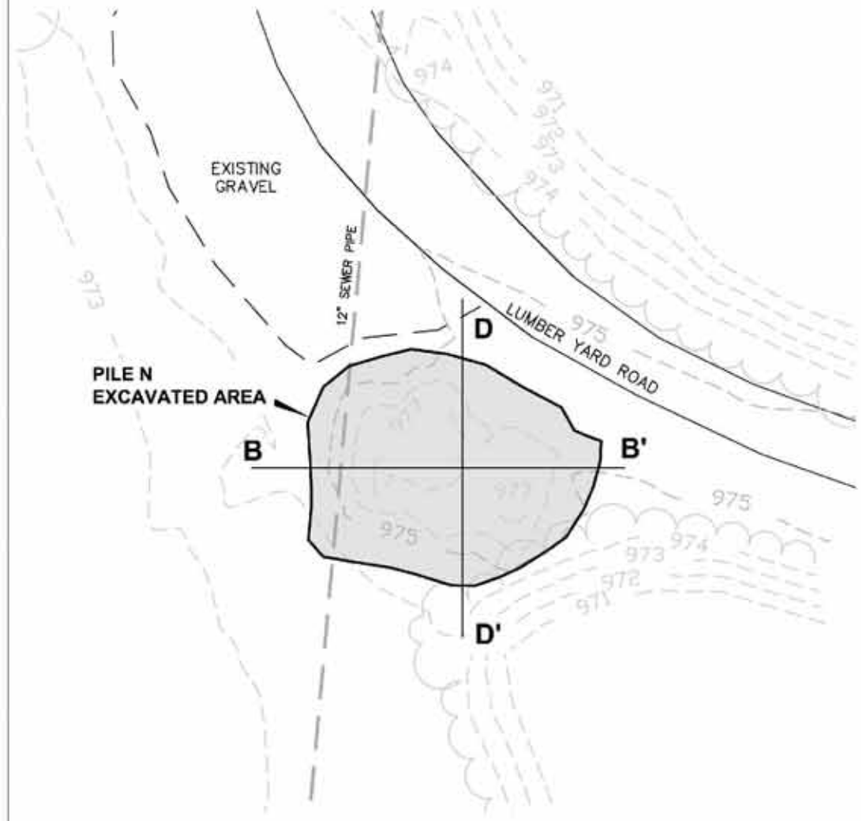
4.2.2.2 Pile N

Supplemental Phase II Remedial Investigation sampling results indicated Pile N had hexavalent chromium concentration of 25 mg/kg in Pile N. The removal action cleanup goal established in the EE/CA was 16 mg/kg. During Phase I of the excavation activities, 157 tons of debris and soil from Pile N were removed. Photographs 4-3 and 4-4 show excavation and loading of Pile N material. The soil and debris removed from Pile N were characterized as non-hazardous waste and were disposed at the Waste Management American Landfill in Waynesburg, Ohio.

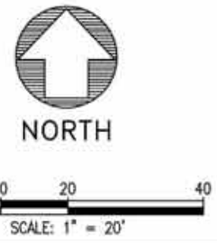
Upon the completion of this phase of excavation activities, a MI confirmation soil sample was collected in accordance with Section 6.0 of the RmAWP on November 13, 2008. Laboratory analysis of this confirmation sample (Sample CBPss-056-0140M-SO) resulted in a hexavalent chromium concentration of 7.6 mg/kg. This concentration was below the removal action cleanup goal for Pile N; therefore, no additional removal was required. Figure 4-1 shows the plan and profile view of the excavated area at Pile N.

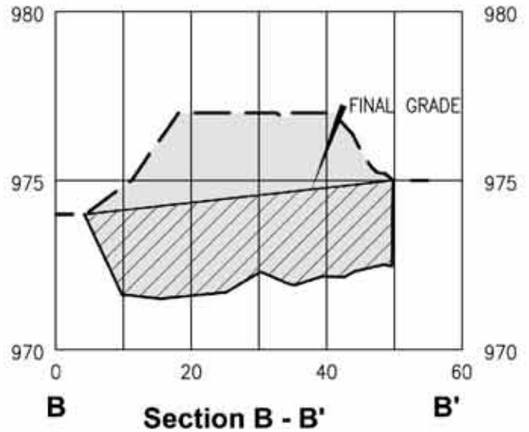
Photograph 4-3. Phase I Excavation of Pile N

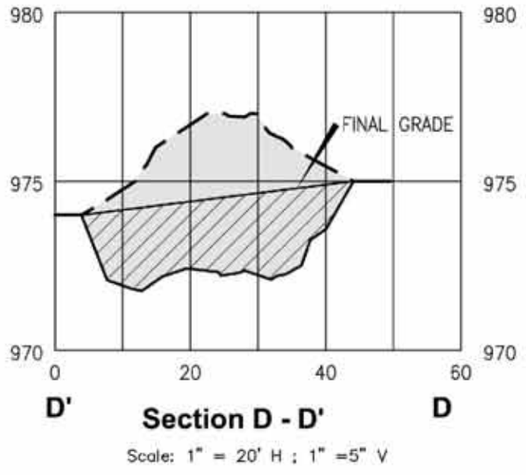
Photograph 4-4. Truck Loading at Pile N



PILE N EXCAVATION AREA
PHASE I CONFIRMATION SAMPLE RESULT
CBPss-056-0140M-SO=7.6 mg/kg







LEGEND:

- 5' CONTOUR
- 1' CONTOUR
- EXCAVATION AREA
- BACKFILL AREA
- TREE LINE

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY
US Army Corps of Engineers Louisville District

RVAAP/RTLS
RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
MRK	Sep. 17, 08	C-4 REMOVAL ASBUILT

File: W:\cad ms\CBR REPORT\ASBUILT\dwg\C-4 Removal ASBUILT.dwg Layout: N ASBUILT User: tmsilcox Oct 02, 2008 - 5:54pm

Figure 4-1. Pile N Final Excavation (Plan and Profile View)

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4.2.3 Phase II Removal Activities at Pile M

Because the Phase I removal activities at Pile M did not achieve the removal action cleanup goal, a second phase (Phase II) of debris and soil removal was initiated on January 14, 2008. During the Phase II removal activity, a hydraulic hammer was used to break up concrete rubble, followed by excavation, stockpiling of material, and subsequent placement into haul trucks and transport offsite. This process continued in an iterative manner and is shown in Photographs 4-5 and 4-6. Excavation activities continued until January 19, 2008. During the Phase II removal activity, a total of 315 tons of non-hazardous soil and concrete were removed and disposed at Waste Management American Landfill in Waynesburg, Ohio.

Photograph 4-5. Breaking Up of Concrete at Pile M

Photograph 4-6. Excavation of Soil and Concrete Aggregate at Pile M

On January 19, 2008, an MI soil sample (Sample CBP-ss-055-0151M-SO) was collected from the excavation footprint. This sample was analyzed for total lead and compared against the removal action cleanup goal for Pile M (400 mg/kg). The laboratory analysis indicated the lead concentration in this sample was 465 mg/kg, which exceeded the removal action cleanup goal.

On January 30, 2008, Ohio EPA and USACE were notified that the Phase II removal activity confirmation sample results exceeded the removal action cleanup goal for Pile M. During this correspondence, SAIC proposed the following to further evaluate lead concentrations within the Pile M excavation footprint:

1. Divide the excavation footprint into four quadrants (as shown in Figure 4-2);
2. Collect one MI sample from each quadrant; and
3. Analyze the MI soil samples for lead and compare against the removal action cleanup goal.

Ohio EPA approved this recommended option and samples were collected on January 31, 2008. This approval is presented in Appendix A. Table 4-1 presents lead concentrations in these samples. The northeast and northwest quadrants of the Pile M excavation footprint exceeded the removal action cleanup goal. Additional debris and soil removal activities within these two quadrants were required.

Table 4-1. Phase II Confirmation Sample Results

Debris Pile M Quadrant (Sample ID)	Confirmation Soil Sample Result	Confirmation Sample Result Below Cleanup Goal?[a]
Northeast (CBPss-055-0153M-SO)	1,350 mg/kg	No
Northwest (CBPss-055-0157M-SO)	527 mg/kg	No
Southeast (CBPss-055-0152M-SO)	28.8 mg/kg	Yes
Southwest (CBPss-055-0154M-SO)	43.9 mg/kg	Yes

[a]Removal action cleanup goal for lead in soil at Pile M is 400 mg/kg.

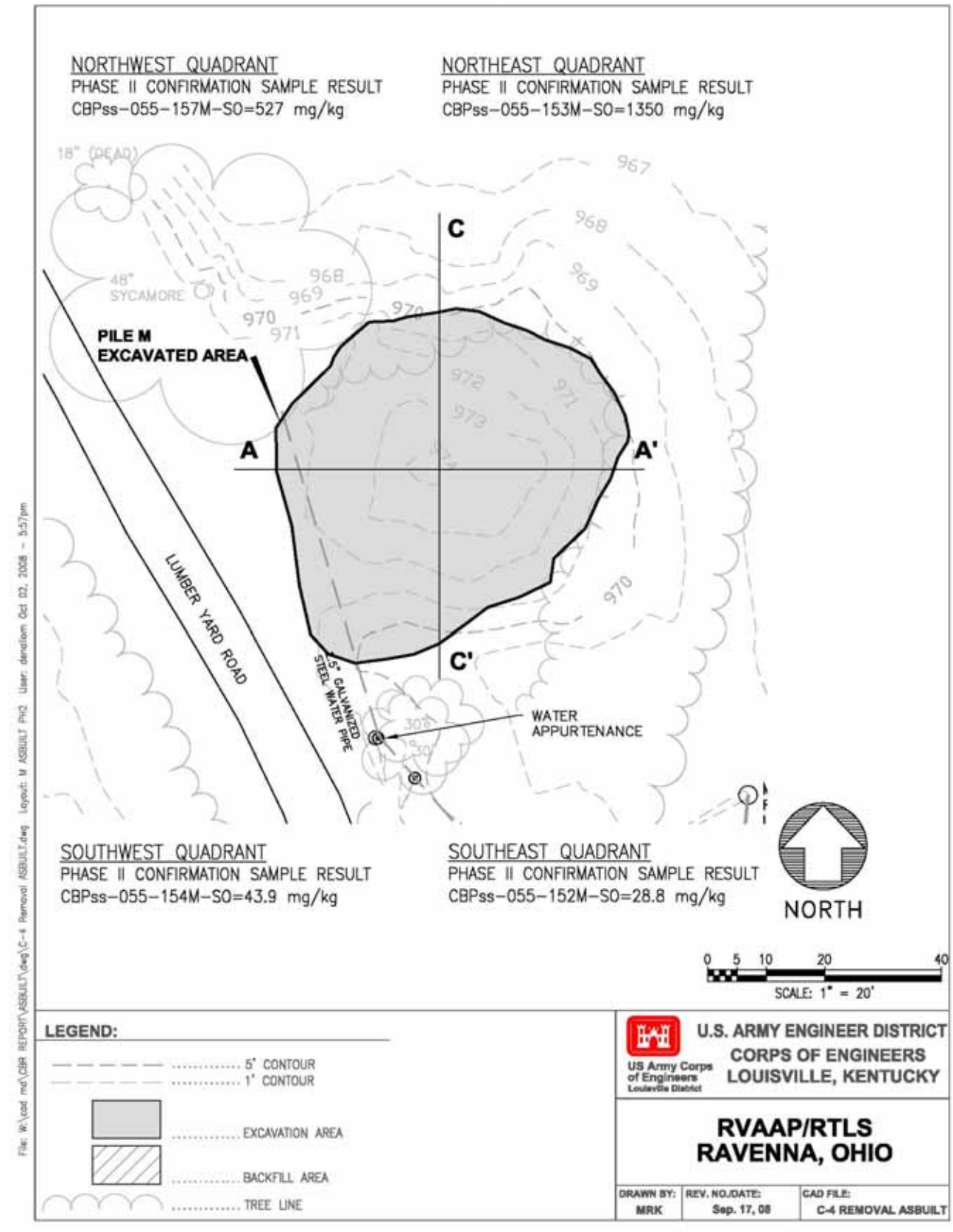

Figure 4-2. Phase II Sample Configuration and Results at Pile M

4.2.4 Phase III Removal Activities of Pile M

To address the two quadrants of the Pile M footprint in which the removal action cleanup goal for lead was not attained, a Phase III removal activity was initiated on February 25, 2008. As with the Phase II removal activity, a hydraulic hammer was used to break up concrete rubble followed by excavation, stockpiling of soil and debris, and subsequent placement into haul trucks and transport offsite. The Phase III activities continued until February 28, 2008, during which a total of 181 tons of non-hazardous debris and soil were removed from Pile M and disposed at Waste Management American Landfill in Waynesburg, Ohio.

On February 28, 2008, MI soil samples (Samples CBPss-055-0158M-SO and CBPss-055-0160M-SO) were collected from the northwestern quadrant of the Pile M excavation footprint, and MI soil samples (Samples CBPss-055-0159M-SO and CBPss-055-0161M-SO) were collected from the northeast quadrant of the Pile M excavation footprint. Samples CBPss-055-0158M-SO and CBPss-055-0159M-SO were not dried, sieved, and ground finely, as specified in the RmAWP, nor were they considered confirmation samples. Rather, the samples were analyzed for lead concentration in a quick turn-around time (TAT) to provide guidance if further excavation was warranted or if the subcontractor should demobilize from the site. Both samples were below 400 mg/kg. Therefore the subcontractor demobilized from the site, and the confirmation samples were processed and analyzed as described below.

Samples CBPss-055-0160M-SO and CBPss-055-0161M-SO were dried, sieved, and ground finely (as specified in the RmAWP) and were analyzed for total lead. The results were compared against the removal action cleanup goal for Pile M (400 mg/kg). The soil sample results are presented in Table 4-2 below.

Table 4-2. Phase III Confirmation Sample Results

Debris Pile M Quadrant (Sample ID)	Confirmation Soil Sample Result	Confirmation Sample Result Below Cleanup Goal?[a]
Northeast (CBPss-055-0160M-SO)	14.6 mg/kg	Yes
Northwest (CBPss-055-0161M-SO)	168 mg/kg	Yes

[a]Removal action cleanup goal for lead in soil at Pile M is 400 mg/kg.

The laboratory analysis indicated the lead concentration in these samples were below the Pile M removal action cleanup goal. Additional removal activities at Pile M were not required. Figure 4-3 presents the plan and profile view of the Pile M excavation footprints.

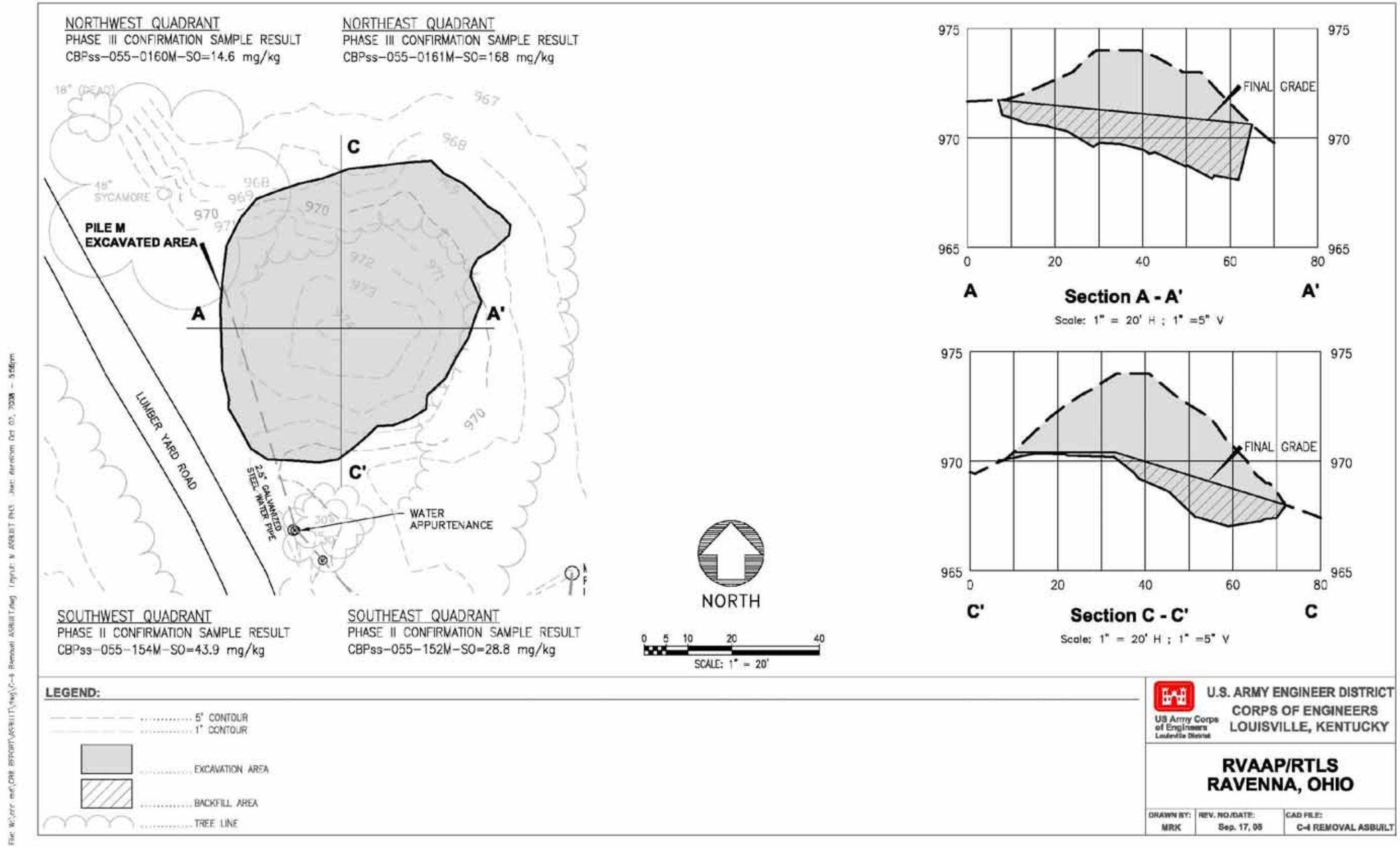

Figure 4-3. Pile M Final Excavation Area (Plan and Profile View)

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5.0 SITE RESTORATION

The following sections describe the site restoration activities, as performed in accordance with Section 7.0 of the RmAWP.

5.1 BORROW SOURCE SAMPLING

On May 27, 2008, a potential borrow source at Route 5 Sand and Gravel in Ravenna, Ohio, was selected and characterized for suitable backfill material for CBP. Characterization data were collected for Ohio EPA approval. An excavation area for backfill material within the borrow source area was staked off. A MI soil sample (Sample CBP-QC-0162-QC) was collected and analyzed for the parameters specified in Tables 7-1 and 7-2 of the RmAWP. The soil sample results are presented in Appendix B.

On July 17, 2008, SAIC provided the Ohio EPA with the borrow source sample results. The following items were highlighted in this correspondence:

- No pesticides, PCBs, or SVOCs were detected in the backfill soil sample.
- The pH of the soil was 8.2 S.U.
- One VOC (toluene) was detected in the backfill sample. However, the toluene concentration was an estimated value less than laboratory reporting limits (i.e., "J" qualifier), wherein the laboratory stated there is a possibility of false positive or mis-identification at these quantitation levels. All other VOCs had nondetectable concentrations.
- No explosives were detected in the sample. One propellant compound (nitrocellulose) was detected in backfill sample. The nitrocellulose had a "B" qualifier, as the laboratory stated there is the possibility of false positive or mis-identification at these quantitation levels. All other explosives had nondetectable concentrations.
- Metals concentrations were screened against RVAAP facility-wide background concentrations. All metals were below the surface soil or subsurface soil background values, with the exception of cadmium. The RVAAP cadmium background value for surface and subsurface soil is 0 mg/kg. The cadmium result for the borrow area sample had a "B" qualifier, as the result was between the method detection limit (MDL) and the reporting limit (RL). The laboratory indicated there was the possibility of false positive or mis-identification at these quantitation levels.

On July 18, 2008, Ohio EPA provided e-mail correspondence approving the use of this borrow source for the removal action restoration activities.

5.2 REMOVAL OF TRUCK TURNAROUND AREA

On July 29, 2008, the removal subcontractor (Clean Harbors Environmental Services) removed the portion of the truck turnaround area that did not follow the historical path of Lumber Yard Road. Stone was removed from the truck turnaround area and spread along Lumber Yard Road. Geotextile fabric was removed and disposed as solid waste.

5.3 BACKFILLING AND SEEDING OF EXCAVATION FOOTPRINTS

From July 30, 2008 to July 31, 2008, the excavation footprints of Pile M and N were backfilled using the approved borrow source from the Route 5 Sand and Gravel. The excavation footprints were backfilled to the elevation of the surrounding ground surface. An estimated 90 cubic yards of backfill was placed in the Pile M footprint and an estimated 110 cubic yard of backfill was placed in the Pile N footprint. The backfill material was graded and compacted.

Once the excavation footprints were backfilled and graded, the areas were seeded using the RTLS-approved 'open area' seed mixture for permanent cover, as specified in Section 7.4 of the RmAWP. Once the seed was applied, straw mulch was placed as temporary cover.

5.4 CURRENT STATUS OF THE REMOVAL AREAS

At the time of submission of the RAR, the vegetation cover has not yet established with a density of at least 70 percent coverage, as specified in Section 7.5 of the RmAWP. Therefore, SAIC will continue to perform weekly inspections of the site and the silt fencing to ensure the storm water controls are intact. Once vegetation has established the required coverage, the silt fencing will be removed and disposed.

6.0 CONCLUSIONS

The Pile M and N removal action attained the removal action cleanup goals and removal action objectives developed in the EE/CA (USACE 2007c) and stated in the Action Memorandum (USACE 2007b). The removal action objective to remove Piles M and N to prevent dispersal of contaminants and ensure underlying soil meets the lowest risk-based cleanup goals for the exposure scenarios evaluated in the RI was achieved when excavation of Piles M and N was conducted and soil sampling verified the achievement of removal action cleanup goals. Table 6-1 presents the removal totals from Piles M and N.

Table 6-1. Pile M and N Removal Totals

Debris Pile	Waste Volume (tons)		
	Non-hazardous	Hazardous	Total
Pile M	496	50	546
Pile N	157	0	157

Table 6-2 presents the final confirmation soil sampling results at Piles M and N.

Table 6-2. Pile M and N Confirmation Soil Sample Results

Debris Pile	Confirmation Soil Sample Result	Confirmation Sample Result Below Cleanup Goal?[a,b]
Pile M (quadrants)	----	----
Northeast	168 mg/kg	Yes
Northwest	14.6 mg/kg	Yes
Southeast	28.8 mg/kg	Yes
Southwest	43.9 mg/kg	Yes
Pile N	7.6 mg/kg	Yes

[a]Removal action cleanup goal for lead in soil at Pile M is 400 mg/kg.

[b]Removal action cleanup goal for hexavalent chromium in soil at Pile N is 16 mg/kg .

These confirmation soil sample results show the residual levels beneath former Piles M and N are below the Ohio EPA residential risk benchmark (10E-5) and well within the range of values observed in surrounding soil at CBP.

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7.0 REFERENCES

Ohio Environmental Protection Agency (Ohio EPA) 2004. *Director's Final Findings and Orders in the matter of U.S. Department of the Army, Ravenna Army Ammunitions Plant*. June 2004.

Shaw 2004. *Final Proposed Remedial Goal Options for Soil at Load Lines 1, 2, 3, and 4 at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* September 2004.

USACE (U.S. Army Corps of Engineers) 2005a. *Remedial Investigation Report for the Central Burn Pits (RVAAP-49).* Ravenna Army Ammunition Plant, Ravenna, Ohio. Delivery Order W912QR-05-F-0033, September 2005.

USACE 2005b. *Supplemental Phase II Remedial Investigation of Central Burn Pits, Fuze and Booster Quarry Landfill/Ponds, and Open Demolition Area #2 at Ravenna Army Ammunition Plant in Ravenna, Ohio*. June 2005.

USACE 2007a. *Removal Action Work Plan for Central Burn Pits (RVAAP-49) at the Ravenna Army Ammunition Plant in Ravenna, Ohio.* August 2007.

USACE 2007b. *Action Memorandum for Central Burn Pits at Ravenna Army Ammunition Plant in Ravenna, Ohio.* June 2007.

USACE 2007c. *Final Engineering Evaluation/Cost Analysis for Central Burn Pits at Ravenna Army Ammunition Plant in Ravenna, Ohio.* January 2007.

U.S. Army Center for Health Promotion and Prevention Medicine (USACHPPM) 1998. *Relative Risk Evaluation for Newly Added Sites at the RVAAP, Ravenna, Ohio, Hazardous and Medical Waste Study No. 37-EF-5360-99, 19-23.* October 1998.

USEPA 2000. *Use of Non-Time Critical Removal Authority in Superfund Response Actions.* February 2000.

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Appendix A
Permits, Notifications, and Approvals

Appendix A-1. United States Fish and Wildlife Service Approval
Appendix A-2. Ohio EPA Notification
Appendix A-3. Ohio Historic Preservation Office Approval
Appendix A-4. Ohio EPA Approval of Pile M Re-sampling Scheme

Appendix A-1. United States Fish and Wildlife Service Approval

Thomas, Jed H.

From: Megan_Seymour@fws.gov
Sent: Wednesday, September 12, 2007 2:18 PM
To: Thomas, Jed H.
Subject: Re: Ravenna Excavation Work at Central Burn Pits - USFWS Notification

Attachments: pic03548.jpg

pic03548.jpg (42 KB)

Jed,
Thank you for contacting us. As you stated below, numerous surveys at Ravenna in past years have failed to document Indiana bats, and no bald eagle nests exist onsite. Based on this information, we agree that impacts to these species are unlikely. This precludes the need for further action on this project as required by the 1973 Endangered Species Act, as amended.
If you have any questions, please contact me.
Sincerely,
Megan Seymour
Wildlife Biologist
U.S. Fish and Wildlife Service
Ecological Services Field Office
6950 Americana Pkwy.
Suite H
Reynoldsburg, OH 43068-4127
(614) 469-6923 ext. 16
(614) 469-6919 fax
www.fws.gov/midwest/Reynoldsburg/

"Thomas, Jed H." <JED.H.THOMAS@saic.com>
09/06/2007 10:30 AM

To: <megan_seymour@fws.gov>
cc:
Subject: Ravenna Excavation Work at Central Burn Pits - USFWS Notification

Megan -

To summarize our conversation this morning, SAIC is under contract with the United States Army Corps of Engineers, Louisville District to remove 2 debris piles at the Central Burn Pits area of concern within the Ravenna Training and Logistics Site (RTLS). Currently this project is scheduled to take place in October 2007. The piles are along side a dirt

road that travels through the Central Burn Pits. Minimal amounts of clearing will be required for excavation efforts or vehicle traffic. It is estimated that less than ten small trees (located in and around the debris piles) will need to be cut down to performed the removal action. It is your understanding that the RTLS has not been a site that the Indiana Bat or Bald Eagle inhabits. The expected timeframe for this removal action also re-enforces that the Indiana Bats would not be affected, if habitation did exist.

The US Fish and Wildlife Service will accept this e-mail as notification.
If any clarification or correction is required from the about text, please let me know.
If the text is adequate, please respond approving the removal action.

Thank you for your time,

Jed Thomas

(Embedded image moved to file: pic03548.jpg)

Science Applications International Corporation

Jed Thomas, PE

Environmental Engineer

8866 Commons Blvd. Suite 201 Twinsburg, OH 44087
phone:330.405.5802 or 330.405.9810 fax:330.405.9811
jed.h.thomas@saic.com www.saic.com

Appendix A-2. Ohio EPA Notification

Thomas, Jed H.

From: Thomas, Jed H.
Sent: Monday, October 08, 2007 2:59 PM
To: todd.fisher@epa.state.oh.us
Cc: Jago, William K.
Subject: Ohio EPA Notification of Removal Activities and Sample Collection at the Central Burn Pits

Todd -

Section 4.1.2 of the Central Burn Pits Removal Action Work Plan specifies we notify the Ohio EPA 14 days prior to initiation of construction activities and collection of confirmation samples. Currently, we are anticipating starting the removal action on October 22, 2007 and collecting the confirmation samples on October 25, 2007. If there are any deviations to this schedule, I will let you know as soon as possible.

Please let me know if you have any questions,
Jed

SAIC
From Science to Solutions
Science Applications International Corporation
Jed Thomas, PE
Environmental Engineer
8866 Commons Blvd. Suite 201 Twinsburg, OH 44087
phone:330.405.5802 or 330.405.9810 fax:330.405.9811
jed.h.thomas@saic.com www.saic.com

Appendix A-3. Ohio Historic Preservation Office Approval

OHIO HISTORY

October 26, 2007

Jed Thomas
SAIC Engineering of Ohio, Inc.
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

Dear Mr. Thomas:

Re: Central Burn Pit Removal Action, Ravenna Army Ammunition Plant/
Ravenna Training and Logistics Site, Portage County, Ohio

This is in response to your letter of September 4, 2007 concerning the proposed project. Our comments are submitted in accordance with the provisions of Section 106 of the National Historic Preservation Act, as amended (36 CFR 800).

Based on the information that you provided I concur that that no historic properties will be affected by the proposed project. No further coordination is required unless the scope of the work changes or historic properties are discovered during the course of the work. In such a situation, this office should be contacted as per 36 CFR 800.13.

If you have any questions please contact me at 298-2043 (or through e-mail at jquinlan@ohiohistory.org).

Sincerely,

Julie Quinlan, Program Reviews Manager
Resource Protection and Review

1015207

OHIO HISTORICAL SOCIETY
Ohio Historic Preservation Office
567 East Hudson Street, Columbus, Ohio 43211-1030 ph: 614.298.2000 fx: 614.298.2037
www.ohiohistory.org

Appendix A-4. Ohio EPA Approval of Pile M Re-sampling Scheme

Thomas, Jed H.

From: Eileen Mohr [eileen.mohr@epa.state.oh.us]
Sent: Wednesday, January 30, 2008 2:30 PM
To: Bonnie Buthker; Todd Fisher; cynthia.a.ries@LRL02.usace.army.mil; glen.beckham@LRL02.usace.army.mil; thomas.m.chanda@LRL02.usace.army.mil; Thomas, Jed H.; Irving.B.Venger@us.army.mil; katie.elgin@us.army.mil; mark.c.patterson@us.army.mil
Cc: Jago, William K.
Subject: Re: CBP Sample Results and Path Forward

Agree. Good job Jed.

Eileen T. Mohr
Project Manager
Division of Emergency and Remedial Response 2110 East Aurora Road Twinsburg, OH 44087
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>>> Bonnie Buthker 1/30/2008 2:28 PM >>>
If Todd is good with this, it sounds good to me.

>>> "Thomas, Jed H." <JED.H.THOMAS@saic.com> 1/30/2008 2:21 pm >>>

All -

We received preliminary analytical results from the Pile M footprint at the Central Burn Pits. The MI sample result was 465 mg/kg for lead, which exceeds the cleanup goal of 400 mg/kg for lead.

Our path forward is as follows:
1) Divide the excavation footprint into grid. At this point, I anticipate we will either split the footprint in half or in quadrants;

2) Collect new MI samples, one from each grid. The samples will be analyzed for lead concentration;
3) Assess the analytical results; and
4) Focus our next excavation/removal efforts in the grid(s) that exceed the cleanup goal.

Our hope is to minimize the amount of material that has to be removed and ultimately put in the landfill. This approach is specified in the Removal Design Work Plan (Section 6.2, bullet 3), therefore a field change order is not necessary. We discussed this approach with Todd and he gave us the OK to proceed.

We would like to collect the samples tomorrow. If there are any objections to this approach, please let me know as soon as you can. If you have any questions, please let me know.

Thank you,
Jed

Jed Thomas, P.E.
Environmental Engineer

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Appendix B
Laboratory Analytical Results

Table B.1. Pile M Sample Confirmation Results

Media		Soil	Soil	Soil	Soil
Location		Pile M	Pile M	Pile M	Pile M
Station		CBPss-055M	CBPss-055M	CBPss-055OM	CBPss-055M
Sample ID		CBPSS-055-0138M-SO	CBPSS-055-0141M-SO	CBPSS-055-0146M-SO	CBPSS-055-0151M-50
Date		11/14/2007	11/14/2007	11/21/2007	01/19/2008
Depth (ft)		0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Field Type		Multi-increment	Multi-increment Field Duplicate	Multi-increment	Multi-increment
Analyte (mg/kg)	**Units**				
Lead	MG/KG	7200 J	4000 J	1130 J	465 J
Media		Soil	Soil	Soil	Soil
Location		Pile M	Pile M	Pile M	Pile M
Station		CBPss-055SEM	CBPss-055NEM	CBPss-055SWM	CBPss-055NWM
Sample ID		CBPSS-055-0152M-SO	CBPSS-055-0153M-SO	CBPSS-055-0154M-SO	CBPSS-055-0157M-SO
Date		01/31/2008	01/31/2008	01/31/2008	01/31/2008
Depth (ft)		0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Field Type		Multi-increment	Multi-increment	Multi-increment	Multi-increment
Analyte (mg/kg)	**Units**				
Lead	MG/KG	28.8 J	1350 J	43.9 J	527 J
Media		Soil	Soil	Soil	Soil
Location		Pile M	Pile M	Pile M	Pile M
Station		CBPss-055NW	CBPss-055NE	CBPss-055NWM	CBPss-055NEM
Sample ID		CBPSS-055-0158-SO	CBPSS-055-0159-SO	CBPSS-055-0160-SO	CBPSS-055-0161-SO
Date		02/28/2008	02/28/2008	02/28/2008	02/28/2008
Depth (ft)		0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5
Field Type		Grab	Grab	Multi-increment	Multi-increment
Analyte (mg/kg)	**Units**				
Lead	MG/KG	11 J	67.8 J	14.6	168

J = Indicates that the compound was positively identified. The associated numerical value is the approximate concentration of the compound in the sample.

Table B.2. Pile N Confirmation Sample Results

Media		Soil	Soil
Location		Pile N	Pile N
Station		CBPss-056M	CBPss-056M
Sample ID		CBPSS-056-0140M-SO	CBPSS-056-0142M-SO
Date		11/13/2007	11/13/2007
Depth (ft)		0.0 - 0.5	0.0 - 0.5
Field Type		Multi-increment	Multi-increment Field Duplicate
Analyte (mg/kg)	**Units**		
Chromium, hexavalent	MG/KG	7.6	8.8

Table B.3. Pile M Concrete Aggregate Sample Results

Media		**Concrete**	**Concrete**	**Concrete**	**Concrete**
Location		**Pile M**	**Pile M**	**Pile M**	**Pile M**
Station		**CBPss-055E**	**CBPss-055E**	**CBPss-055W**	**CBPss-055W**
Sample ID		**CBPSS-055-0149-SO**	**CBPSS-055-0150-SO**	**CBPSS-055-0147-SO**	**CBPSS-055-0148-SO**
Date		**11/21/2007**	**11/21/2007**	**11/21/2007**	**11/21/2007**
Depth (ft)		**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**
Field Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte (mg/kg)	**Units**				
Inorganics					
Arsenic	MG/KG	6	NA	3.7	NA
Barium	MG/KG	287 J/J	NA	218 J/J	NA
Cadmium	MG/KG	0.049 B/J	NA	0.089 B/J	NA
Chromium	MG/KG	5.9 /J	NA	8.6 E/J	NA
Lead	MG/KG	2 /J	NA	39.8 E/J	NA
Mercury	MG/KG	0.11 U/U	NA	0.12 U/U	NA
Selenium	MG/KG	0.74 B/J	NA	0.53 B/J	NA
Silver	MG/KG	2.1 U/U	NA	2.3 U/U	NA
TCLP					
Arsenic TCLP	MG/L	NA	0.0069 B/J	NA	0.1 U/U
Barium TCLP	MG/L	NA	0.449 B/J	NA	0.449 B/J
Cadmium TCLP	MG/L	NA	0.05 U/U	NA	0.05 U/U
Chromium TCLP	MG/L	NA	0.05 U/U	NA	0.05 U/U
Lead TCLP	MG/L	NA	0.05 U/U	NA	0.05 U/U
Mercury TCLP	MG/L	NA	0.002 U/UJ	NA	0.002 U/UJ
Selenium TCLP	MG/L	NA	0.0099 B/UJ	NA	0.1 U/U
Silver TCLP	MG/L	NA	0.05 U/U	NA	0.05 U/U

J = Indicates that the compound was positively identified. The associated numerical value is the approximate concentration of the compound in the sample.
B = Indicates that the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).
E = Used when the reported value was estimated because of the presence of interference.
U = Indicates that the compound was analyzed for, but was not detected above the reported SQL.
UJ = Indicates that the compound was not detected above the reported SQL. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the compound in the sample.

Table B.4. Pile M Waste Characterization Results

Media		**Soil**	**Soil**	**Soil**	**Soil**
Location		**Pile M**	**Pile M**	**Pile M**	**Pile M**
Station		**CBPss-055M**	**CBPss-055**	**CBPss-055M**	**CBPss-055M**
Sample ID		**CBPSS-055-0138M-SO**	**CBPSS-055-0139-SO**	**CBPSS-055-0141M-SO**	**CBPSS-055-0156M-SO**
Date		**11/14/2007**	**11/14/2007**	**11/14/2007**	**01/31/2008**
Depth (ft)		**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**
Field Type		**Multi-increment**	**Grab**	**Multi-increment Field Duplicate**	**Multi-increment**
Analyte (mg/kg)	**Units**				
Organics-PCB					
PCB-1016	MG/KG	NA	0.059 U/U	NA	0.057 U/U
PCB-1221	MG/KG	NA	0.059 U/U	NA	0.057 U/U
PCB-1232	MG/KG	NA	0.059 U/U	NA	0.057 U/U
PCB-1242	MG/KG	NA	0.059 U/U	NA	0.057 U/U
PCB-1248	MG/KG	NA	0.059 U/U	NA	0.057 U/U
PCB-1254	MG/KG	NA	0.059 U/U	NA	0.084
PCB-1260	MG/KG	NA	0.059 U/U	NA	0.057 U/U
TCLP					
Arsenic TCLP	MG/L	0.1 U/U	NA	0.1 U/U	0.1 U/U
Barium TCLP	MG/L	1.41	NA	1.75	0.844 B/J
Cadmium TCLP	MG/L	0.0093 B/J	NA	0.0141 B/J	0.0034 B/J
Chromium TCLP	MG/L	0.05 U/U	NA	0.05 U/U	0.0026 B/UJ
Lead TCLP	MG/L	0.418	NA	3.35	0.0688
Mercury TCLP	MG/L	0.00016 B/J	NA	0.002 U/U	0.002 U/U
Selenium TCLP	MG/L	0.0089 B/UJ	NA	0.0097 B/UJ	0.0068 B/J
Silver TCLP	MG/L	0.05 U/U	NA	0.05 U/U	0.05 U/U
2,4-D TCLP	MG/L	NA	0.5 U/U	NA	NA
Chlordane TCLP	MG/L	NA	0.005 U/U	NA	NA
Endrin TCLP	MG/L	NA	0.0005 U/U	NA	NA
Heptachlor TCLP	MG/L	NA	0.0005 U/U	NA	NA
Heptachlor epoxide TCLP	MG/L	NA	0.0005 U/U	NA	NA
Lindane TCLP	MG/L	NA	0.0005 U/U	NA	NA
Methoxychlor TCLP	MG/L	NA	0.001 U/U	NA	NA

Table B.4. Pile M Waste Characterization Results (continued)

Media		**Soil**	**Soil**	**Soil**	**Soil**
Location		**Pile M**	**Pile M**	**Pile M**	**Pile M**
Station		**CBPss-055M**	**CBPss-055**	**CBPss-055M**	**CBPss-055M**
Sample ID		**CBPSS-055-0138M-SO**	**CBPSS-055-0139-SO**	**CBPSS-055-0141M-SO**	**CBPSS-055-0156M-SO**
Date		**11/14/2007**	**11/14/2007**	**11/14/2007**	**01/31/2008**
Depth (ft)		**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**
Field Type	**Units**	**Multi-increment**	**Grab**	**Multi-increment Field Duplicate**	**Multi-increment**
TCLP (continued)					
Silvex TCLP	MG/L	NA	0.1 U/U	NA	NA
Toxaphene TCLP	MG/L	NA	0.02 U/U	NA	NA
Cyanide	MG/KG	NA	2.6	NA	NA
Ignitability (Flashpoint)	DEG F	NA	180 >/J	NA	NA
Sulfide	MG/KG	NA	217 /J	NA	NA
pH	pH UNITS	NA	8.4 /J	NA	NA
1,4-Dichlorobenzene TCLP	MG/L	NA	0.004 U/U	NA	0.004 U/U
2,4,5-Trichlorophenol TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/U
2,4,6-Trichlorophenol TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/U
2,4-Dinitrotoluene TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/U
2-Methylphenol TCLP	MG/L	NA	0.004 U/U	NA	0.004 U/UJ
Hexachlorobenzene TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/U
Hexachlorobutadiene TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/R
Hexachloroethane TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/R
Nitrobenzene TCLP	MG/L	NA	0.004 U/U	NA	0.004 U/U
Pentachlorophenol TCLP	MG/L	NA	0.04 U/U	NA	0.04 U/U
Pyridine TCLP	MG/L	NA	0.02 U/U	NA	0.02 U/U
m+p Methylphenol TCLP	MG/L	NA	0.04 U/U	NA	0.04 U/U
1,1-Dichloroethene TCLP	MG/L	NA	0.07 U/U	NA	0.07 U/U
1,2-Dichloroethane TCLP	MG/L	NA	0.025 U/U	NA	0.025 U/U
2-Butanone TCLP	MG/L	NA	0.1 U/U	NA	0.1 U/U
Benzene TCLP	MG/L	NA	0.025 U/U	NA	0.025 U/U
Carbon tetrachloride TCLP	MG/L	NA	0.025 U/U	NA	0.025 U/U
Chlorobenzene TCLP	MG/L	NA	0.025 U/U	NA	0.025 U/U

Table B.4. Pile M Waste Characterization Results (continued)

Media		**Soil**	**Soil**	**Soil**	**Soil**
Location		**Pile M**	**Pile M**	**Pile M**	**Pile M**
Station		**CBPss-055M**	**CBPss-055**	**CBPss-055M**	**CBPss-055M**
Sample ID		**CBPSS-055-0138M-SO**	**CBPSS-055-0139-SO**	**CBPSS-055-0141M-SO**	**CBPSS-055-0156M-SO**
Date		**11/14/2007**	**11/14/2007**	**11/14/2007**	**01/31/2008**
Depth (ft)		**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**	**0.0 - 0.5**
Field Type	**Units**	**Multi-increment**	**Grab**	**Multi-increment Field Duplicate**	**Multi-increment**
TCLP (continued)					
Chloroform TCLP	MG/L	NA	0.025 U/U	NA	0.025 U/U
Tetrachloroethene TCLP	MG/L	NA	0.07 U/U	NA	0.07 U/U
Trichloroethene TCLP	MG/L	NA	0.05 U/U	NA	0.05 U/U
Vinyl chloride TCLP	MG/L	NA	0.025 U/U	NA	0.025 U/U

U= Indicates that the compound was analyzed for, but was not detected above the reported SQL.
B = Indicates that the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).
J = Indicates that the compound was positively identified. The associated numerical value is the approximate concentration of the compound in the sample.
UJ = Indicates that the compound was not detected above the reported SQL. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the compound in the sample.
R = Indicates that the sample results for the compound are unusable due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the compound cannot be verified.

Table B.5. Borrow Source Sample Results

Media	**Soil**	
Location	**Route 5 Sand and Gravel**	
Sample ID	**CBP-QC-0162-QC**	
Date	**05/27/2008**	
Field Type	**Grab**	
Analyte (mg/kg)	**Units**	
Explosives		
1,3,5-Trinitrobenzene	MG/KG	0.25 U/U
1,3-Dinitrobenzene	MG/KG	0.25 U/U
2,4,6-Trinitrotoluene	MG/KG	0.25 U/U
2,4-Dinitrotoluene	MG/KG	0.25 U/U
2,6-Dinitrotoluene	MG/KG	0.25 U/U
2-Amino-4,6-Dinitrotoluene	MG/KG	0.3 U/U
2-Nitrotoluene	MG/KG	0.25 U/U
3-Nitrotoluene	MG/KG	0.25 U/U
4-Amino-2,6-Dinitrotoluene	MG/KG	0.25 U/U
4-Nitrotoluene	MG/KG	0.25 U/U
HMX	MG/KG	0.25 U/U
Nitrobenzene	MG/KG	0.25 U/U
Nitrocellulose	MG/KG	2.2 B
Nitroglycerin	MG/KG	0.5 U/U
Nitroguanidine	MG/KG	0.25 U/U
PETN	MG/KG	0.5 U/U
RDX	MG/KG	0.25 U/U
Tetryl	MG/KG	0.25 U/U
Inorganics		
Aluminum	MG/KG	8660
Antimony	MG/KG	10.2 U/UJ
Arsenic	MG/KG	13.2
Barium	MG/KG	39.8 J/J
Beryllium	MG/KG	0.46 BJ/J
Cadmium	MG/KG	0.21 B
Calcium	MG/KG	11300 J/J
Chromium	MG/KG	15.4
Cobalt	MG/KG	9.5
Copper	MG/KG	16.4
Iron	MG/KG	23300
Lead	MG/KG	9.2
Magnesium	MG/KG	5410 J/J
Manganese	MG/KG	291 J/J
Mercury	MG/KG	0.1 U/U
Nickel	MG/KG	24.3
Potassium	MG/KG	1380 J/J
Selenium	MG/KG	1 U/U
Silver	MG/KG	2 U/U
Sodium	MG/KG	102 U/U

Table B.5. Borrow Source Sample Results (continued)

Media	**Soil**	
Location	**Route 5 Sand and Gravel**	
Sample ID	**CBP-QC-0162-QC**	
Date	**05/27/2008**	
Field Type	**Grab**	
Analyte (mg/kg)	**Units**	
Inorganics (continued)		
Thallium	MG/KG	2 U/U
Vanadium	MG/KG	13.4
Zinc	MG/KG	51.8
Organic-Semivolatiles		
1,1-Biphenyl	MG/KG	0.063 U/U
1,2,4-Trichlorobenzene	MG/KG	0.063 U/U
1,2-Dichlorobenzene	MG/KG	0.063 U/U
1,2-Diphenylhydrazine	MG/KG	0.063 U/U
1,3-Dichlorobenzene	MG/KG	0.063 U/U
1,4-Dichlorobenzene	MG/KG	0.063 U/U
2,4,5-Trichlorophenol	MG/KG	0.19 U/U
2,4,6-Trichlorophenol	MG/KG	0.19 U/U
2,4-Dichlorophenol	MG/KG	0.19 U/U
2,4-Dimethylphenol	MG/KG	0.19 U/U
2,4-Dinitrophenol	MG/KG	0.41 U/U
2-Chloronaphthalene	MG/KG	0.063 U/U
2-Chlorophenol	MG/KG	0.063 U/U
2-Methyl-4,6-dinitrophenol	MG/KG	0.19 U/U
2-Methylnaphthalene	MG/KG	0.0084 U/U
2-Methylphenol	MG/KG	0.25 U/U
2-Nitrobenzenamine	MG/KG	0.25 U/U
2-Nitrophenol	MG/KG	0.063 U/U
3,3'-Dichlorobenzidine	MG/KG	0.13 U/U
3-Nitrobenzenamine	MG/KG	0.25 U/U
4-Bromophenyl phenyl ether	MG/KG	0.063 U/U
4-Chloro-3-methylphenol	MG/KG	0.19 U/U
4-Chlorobenzenamine	MG/KG	0.19 U/U
4-Chlorophenyl phenyl ether	MG/KG	0.063 U/U
4-Methylphenol	MG/KG	0.25 U/U
4-Nitrobenzenamine	MG/KG	0.25 U/U
4-Nitrophenol	MG/KG	0.41 U/U
Acenaphthene	MG/KG	0.0084 U/U
Acenaphthylene	MG/KG	0.0084 U/U
Acetophenone	MG/KG	0.13 U/U
Aniline	MG/KG	0.41 U/U
Anthracene	MG/KG	0.0084 U/U
Atrazine	MG/KG	0.25 U/U
Benz(a)anthracene	MG/KG	0.0084 U/U

Table B.5. Borrow Source Sample Results (continued)

Media	**Soil**	
Location	**Route 5 Sand and Gravel**	
Sample ID	**CBP-QC-0162-QC**	
Date	**05/27/2008**	
Field Type	**Grab**	
Analyte (mg/kg)	**Units**	
Organic-Semivolatiles		
Benzaldehyde	MG/KG	0.13 U/U
Benzenemethanol	MG/KG	0.41 U/U
Benzo(a)pyrene	MG/KG	0.0084 U/U
Benzo(b)fluoranthene	MG/KG	0.0084 U/U
Benzo(ghi)perylene	MG/KG	0.0084 U/U
Benzo(k)fluoranthene	MG/KG	0.0084 U/U
Benzoic acid	MG/KG	0.83 U/U
Bis(2-chloroethoxy)methane	MG/KG	0.13 U/U
Bis(2-chloroethyl) ether	MG/KG	0.13 U/U
Bis(2-chloroisopropyl) ether	MG/KG	0.13 U/U
Bis(2-ethylhexyl)phthalate	MG/KG	0.063 U/U
Butyl benzyl phthalate	MG/KG	0.063 U/U
Caprolactam	MG/KG	0.41 U/U
Carbazole	MG/KG	0.063 U/U
Chrysene	MG/KG	0.0084 U/U
Di-n-butyl phthalate	MG/KG	0.063 U/U
Di-n-octylphthalate	MG/KG	0.063 U/U
Dibenz(a,h)anthracene	MG/KG	0.0084 U/U
Dibenzofuran	MG/KG	0.063 U/U
Diethyl phthalate	MG/KG	0.063 U/U
Dimethyl phthalate	MG/KG	0.063 U/U
Fluoranthene	MG/KG	0.0084 U/U
Fluorene	MG/KG	0.0084 U/U
Hexachlorobenzene	MG/KG	0.0084 U/U
Hexachlorobutadiene	MG/KG	0.063 U/U
Hexachlorocyclopentadiene	MG/KG	0.41 U/U
Hexachloroethane	MG/KG	0.063 U/U
Indeno(1,2,3-cd)pyrene	MG/KG	0.0084 U/U
Isophorone	MG/KG	0.063 U/U
N-Nitroso-di-n-propylamine	MG/KG	0.063 U/U
N-Nitrosodimethylamine	MG/KG	0.13 U/U
N-Nitrosodiphenylamine	MG/KG	0.063 U/U
Naphthalene	MG/KG	0.0084 U/U
Pentachlorophenol	MG/KG	0.19 U/U
Phenanthrene	MG/KG	0.0084 U/U
Phenol	MG/KG	0.063 U/U
Pyrene	MG/KG	0.0084 U/U
Pyridine	MG/KG	0.13 U/U

Table B.5. Borrow Source Sample Results (continued)

Media	**Soil**	
Location	**Route 5 Sand and Gravel**	
Sample ID	**CBP-QC-0162-QC**	
Date	**05/27/2008**	
Field Type	**Grab**	
Analyte (mg/kg)	**Units**	
Organic-Volatiles		
(1,1-Dimethylethyl)benzene	MG/KG	0.0063 U/U
(1-Methylpropyl)benzene	MG/KG	0.0063 U/U
1,1,1,2-Tetrachloroethane	MG/KG	0.0063 U/U
1,1,1-Trichloroethane	MG/KG	0.0063 U/U
1,1,2,2-Tetrachloroethane	MG/KG	0.0063 U/U
1,1,2-Trichloro-1,2,2-trifluoroethane	MG/KG	0.0063 U/U
1,1,2-Trichloroethane	MG/KG	0.0063 U/U
1,1-Dichloroethane	MG/KG	0.0063 U/U
1,1-Dichloroethene	MG/KG	0.0063 U/UJ
1,1-Dichloropropene	MG/KG	0.0063 U/U
1,2,3-Trichlorobenzene	MG/KG	0.0063 U/U
1,2,3-Trichloropropane	MG/KG	0.0063 U/U
1,2,4-Trichlorobenzene	MG/KG	0.0063 U/U
1,2,4-Trimethylbenzene	MG/KG	0.0063 U/U
1,2-Dibromo-3-chloropropane	MG/KG	0.013 U/U
1,2-Dibromoethane	MG/KG	0.0063 U/U
1,2-Dichlorobenzene	MG/KG	0.0063 U/U
1,2-Dichloroethane	MG/KG	0.0063 U/U
1,2-Dichloroethene	MG/KG	0.013 U/U
1,2-Dichloropropane	MG/KG	0.0063 U/U
1,2-Dimethylbenzene	MG/KG	0.0063 U/U
1,3,5-Trimethylbenzene	MG/KG	0.0063 U/U
1,3-Dichlorobenzene	MG/KG	0.0063 U/U
1,3-Dichloropropane	MG/KG	0.0063 U/U
1,4-Dichlorobenzene	MG/KG	0.0063 U/UJ
1-Chloro-4-methylbenzene	MG/KG	0.0063 U/U
1-Methyl-4-(1-methylethyl)benzene	MG/KG	0.0063 U/U
2,2-Dichloropropane	MG/KG	0.0063 U/U
2-Butanone	MG/KG	0.025 U/U
2-Hexanone	MG/KG	0.025 U/U
2-Methoxy-2-methylpropane	MG/KG	0.025 U/U
4-Methyl-2-pentanone	MG/KG	0.025 U/U
Acetone	MG/KG	0.025 U/U
Acrolein	MG/KG	0.13 U/U
Acrylonitrile	MG/KG	0.13 U/U
Benzene	MG/KG	0.0063 U/U
Bromobenzene	MG/KG	0.0063 U/U
Bromochloromethane	MG/KG	0.0063 U/U

Table B.5. Borrow Source Sample Results (continued)

Media	**Soil**	
Location	**Route 5 Sand and Gravel**	
Sample ID	**CBP-QC-0162-QC**	
Date	**05/27/2008**	
Field Type	**Grab**	
Analyte (mg/kg)	**Units**	
Organic-Volatiles (continued)		
Bromodichloromethane	MG/KG	0.0063 U/U
Bromoform	MG/KG	0.0063 U/U
Bromomethane	MG/KG	0.0063 U/U
Butylbenzene	MG/KG	0.0063 U/U
Carbon disulfide	MG/KG	0.0063 U/U
Carbon tetrachloride	MG/KG	0.0063 U/UJ
Chlorobenzene	MG/KG	0.0063 U/U
Chloroethane	MG/KG	0.0063 U/U
Chloroform	MG/KG	0.0063 U/U
Chloromethane	MG/KG	0.0063 U/U
Cumene	MG/KG	0.0063 U/U
Cyclohexane	MG/KG	0.013 U/U
Dibromochloromethane	MG/KG	0.0063 U/U
Dibromomethane	MG/KG	0.0063 U/U
Dichlorodifluoromethane	MG/KG	0.0063 U/U
Dimethylbenzene	MG/KG	0.013 U/U
Ethylbenzene	MG/KG	0.0063 U/U
Hexachlorobutadiene	MG/KG	0.0063 U/U
Iodomethane	MG/KG	0.0063 U/U
M + P Xylene	MG/KG	0.013 U/U
Methyl acetate	MG/KG	0.013 U/U
Methylcyclohexane	MG/KG	0.013 U/U
Methylene chloride	MG/KG	0.0063 U/U
Naphthalene	MG/KG	0.0063 U/U
Propylbenzene	MG/KG	0.0063 U/U
Styrene	MG/KG	0.0063 U/U
Tetrachloroethene	MG/KG	0.0063 U/U
Toluene	MG/KG	0.0017 J/J
Trichloroethene	MG/KG	0.0063 U/U
Trichlorofluoromethane	MG/KG	0.0063 U/U
Vinyl acetate	MG/KG	0.013 U/U
Vinyl chloride	MG/KG	0.0063 U/UJ
cis-1,2-Dichloroethene	MG/KG	0.0063 U/U
cis-1,3-Dichloropropene	MG/KG	0.0063 U/U
o-Chlorotoluene	MG/KG	0.0063 U/U
trans-1,2-Dichloroethene	MG/KG	0.0063 U/U
trans-1,3-Dichloropropene	MG/KG	0.0063 U/U

Table B.5. Borrow Source Sample Results (continued)

Media	**Soil**	
Location	**Route 5 Sand and Gravel**	
Sample ID	**CBP-QC-0162-QC**	
Date	**05/27/2008**	
Field Type	**Grab**	
Analyte (mg/kg)	**Units**	
Organics-Pesticide/PCB		
4,4'-DDD	MG/KG	0.0021 U/U
4,4'-DDE	MG/KG	0.0021 U/U
4,4'-DDT	MG/KG	0.0021 U/U
Aldrin	MG/KG	0.0021 U/U
Dieldrin	MG/KG	0.0021 U/U
Endosulfan I	MG/KG	0.0021 U/U
Endosulfan II	MG/KG	0.0021 U/U
Endosulfan sulfate	MG/KG	0.0021 U/U
Endrin	MG/KG	0.0021 U/U
Endrin aldehyde	MG/KG	0.0021 U/U
Endrin ketone	MG/KG	0.0021 U/U
Heptachlor	MG/KG	0.0021 U/U
Heptachlor epoxide	MG/KG	0.0021 U/U
Lindane	MG/KG	0.0021 U/U
Methoxychlor	MG/KG	0.0041 U/U
PCB-1016	MG/KG	0.034 U/U
PCB-1221	MG/KG	0.034 U/U
PCB-1232	MG/KG	0.034 U/U
PCB-1242	MG/KG	0.034 U/U
PCB-1248	MG/KG	0.034 U/U
PCB-1254	MG/KG	0.034 U/U
PCB-1260	MG/KG	0.034 U/U
Toxaphene	MG/KG	0.084 U/U
alpha-BHC	MG/KG	0.0021 U/U
alpha-Chlordane	MG/KG	0.0021 U/U
beta-BHC	MG/KG	0.0021 U/U
delta-BHC	MG/KG	0.0021 U/U
gamma-Chlordane	MG/KG	0.0021 U/U
Miscellaneous		
pH	pH UNITS	8.2

U= Indicates that the compound was analyzed for, but was not detected above the reported SQL.

B = Indicates that the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL).

UJ = Indicates that the compound was not detected above the reported SQL. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the compound in the sample.

J = Indicates that the compound was positively identified. The associated numerical value is the approximate concentration of the compound in the sample.

Appendix C
Data Quality Control Summary Report

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LIST OF TABLES

ACRONYMS

AOC	Area of Concern
ADR	Automated Data Review
CBP	Central Burn Pit
DQA	Data Quality Assessment
DQO	data quality objective
EPA	U. S. Environmental Protection Agency
IDW	investigation-derived waste
LCS	laboratory control standard
MDL	method detection level
MPR	monthly progress report
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RmAWP	Removal Action Work Plan
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
TCLP	toxicity characteristic leaching procedure
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

C1.0 PURPOSE

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 respective solutions.

This report provides an assessment of the analytical information gathered during the course of the RVAAP confirmation sampling effort for the Removal Action Work Plan (RmAWP). The implementation process for the selected remedy for the contaminated debris Piles M and N at the Central Burn Pit (CBP) area was performed during November 2007 and January, February, and May 2008. It documents that the quality of the data met the overall objectives of this confirmation sampling effort. References will be directed toward those quality assurance (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 this effort to define the quality and quantity of data required. Data quality objectives (DQO) were established to guide the implementation of the field sampling and laboratory analysis [refer to the Removal Action Work Plan for Central Burn Pits (RVAAP-49), August 2007)]. 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.

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C2.0 QUALITY ASSURANCE PROGRAM

A Facility-wide QAPP was 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 Remedial Investigation (RI) Sampling and Analysis Plan (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 were required for the targeted removal action cleanup goal parameters (lead and hexavalent chromium) collected in the area being investigated. As these samples taken were for confirmation purposes only, no QA split, trip blanks, field blanks, or rinsate blanks were collected. Analytical laboratory QC duplicates, matrix spikes (MS), laboratory control samples (LCS), 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.

C2.1 MONTHLY PROGRESS REPORTS

Monthly Progress Reports (MPR) 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 U.S. Army Corps of Engineers (USACE) Louisville District Project Manager. Access to these reports can be obtained through the USACE Louisville District Project Manager.

C2.2 DAILY REPORTS

The Field Team Leader produced all Daily Reports. These included information such as, but not limited to, sub-tier contractors on-site, equipment on-site, work performed summaries, schedule updates, problems encountered, and corrective actions. The Daily Reports were submitted to the USACE Louisville District Project Manager and may be obtained through his office.

C2.3 LABORATORY "DEFINITIVE" LEVEL DATA REPORTING

The QAPP for this project identified requirements for laboratory data reporting and identified TestAmerica of North Canton, Ohio as the laboratory for the project. During the execution of the project,

the TestAmerica facility performed all of the analyses. Unites States Environmental Protection Agency (EPA) "definitive" data have been reported, including the following basic information:

a. laboratory case narratives

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

c. laboratory method blank results

d. LCS results

e. laboratory sample MS recoveries

f. laboratory duplicate results

g. surrogate recoveries [volatile organic compound (VOC), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), herbicides, 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 Section D4.0.

C3.0 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.

C3.1 FIELD DATA VERIFICATION

Daily Reports were completed by the Field Team Leader. The Daily Reports and other field-generated documents such as the daily checklists and inspection forms were peer reviewed. These forms have been delivered to the USACE Louisville District Project Manager and can be obtained through his office.

C3.2 LABORATORY DATA VERIFICATION

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

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

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

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

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

C3.3 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 identification of the analyte, 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.

C3.4 DATA ACCEPTABILITY

A total of 18 environmental soil or sediment and two field duplicate samples were collected resulting in 361 discrete analyses (i.e., analytes) being obtained, reviewed, and integrated into the assessment (these totals do not include investigation-derived waste (IDW) measurements, field measurements and field descriptions). The project produced acceptable results for 99.4% 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 confirmation samples. It tallies the successful collection of all targeted field duplicate samples, while Table D-2 identifies a cross reference for duplicate 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 (MDL) and the project reporting levels. Values determined in this region have an inherently higher variability and need to be considered estimated at best.

Table C-1. CBP Investigation Summary

Area	Media	Environmental Samples	Field Duplicates
CBP	Soils/Sediment	18	2

Table C-2. CBP Primary, Duplicate, and Split Sample Correlation Table

Media	Station #	Sample #	Duplicate #	Laboratory SDG #
Soil	Pile-N	CBPSS-056-0140M-SO	CBPSS-056-0142M-SO	A7K150259
Soil	Pile-M	CBPSS-055-0138M-SO	CBPSS-055-0141M-SO	A7K150259

SDG = Sample delivery group.

Table C-3. CBP InvestigationSummary of Rejected Analytes (Laboratory)
(grouped by medium and analysis group)

Media	Analysis Group	Rejected	Total	Percent Rejected
Soil/Sediment and IDW water	Metals/Hg	0	51	0.0
	Chromium+6	0	2	0.0
	Explosives	0	18	0.0
	TCLP (all)	2	93	22
	Volatiles	0	75	0.0
	Semivolatiles	0	75	0.0
	Pesticides	0	21	0.0
	PCBs	0	21	0.0
	General Chem.	0	5	0.0
Project Total		2	361	0.55

TCLP = Toxicity Characteristic Leaching Procedure

For this RVAAP study, two field duplicates were analyzed for soil media. Equipment rinsate, site potable water source, and de-ionized water source samples were not collected since these samples were for confirmation only at CBP.

C4.0 DATA QUALITY EVALUATION

C4.1 TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)/SOIL/SEDIMENT

Sample Delivery Group (SDG) A7K150259 (ID#s: CBPSS-055-0138M-SO, CBPSS-055-0139-SO, CBPSS-056-0140M-SO, CBPSS-055-0141M-SO, CBPSS-056-0142M-SO)

TCLP VOCs: Analytical holding times were met for all samples. Initial calibration and continuing calibration criteria were achieved for all elements analyzed. Surrogate recoveries were acceptable. Internal standard area and retention time criteria were acceptable. The method blank was free of contamination. LCS recoveries and MS/Matrix Spike Duplicate (MSD) recoveries and Relative Percent Difference (RPD) values were within acceptance limits. No dilutions or reanalyses were required. No data were estimated or rejected.

TCLP SVOCs: Holding time criteria were met. Initial and continuing calibrations were acceptable. Surrogate recoveries and internal standard area/retention time criteria were acceptable. The preparation blank was free of contamination. All LCS recoveries were within acceptance limits. MS/MSD did not apply to this sample. No dilutions or reanalyses were required. No data were estimated or rejected for any reason.

TCLP Pesticides: Holding time criteria were acceptable. Initial and continuing calibrations were acceptable. The preparation blank was free of contamination. Surrogate and LCS recoveries were within control limits. MS/MSD did not apply to this sample. No dilutions or reanalyses were required. No data were estimated or rejected.

PCBs: Holding time criteria were met. Initial and continuing calibrations were acceptable. Surrogate recovery was acceptable. The preparation blank was clean. All LCS recoveries were within control limits. MS/MSD recoveries (%R) and RPD were within acceptance limits in CBPSS-055-0139-SO of this delivery group. No dilutions or reanalyses were required. No data were estimated or rejected.

TCLP Herbicides: Holding time criteria were met. Initial and continuing calibrations were acceptable. The preparation blank was clean. Surrogate and LCS recoveries were within control limits. MS/MSD did not apply to this sample. No dilutions or reanalyses were required. No data were estimated or rejected.

TCLP Metals/Mercury and Total Lead: Holding time criteria were met. All initial and continuing calibrations were acceptable. The total lead soil preparation blank was clean. The TCLP Metals/Hg preparation blank contained barium (1.7 µg/L) and selenium (5.7 µg/L) which caused selenium in TCLP samples CBPSS-055-0138M-SO and CBPSS-055-0141M-SO to be qualified as not detected (U). All LCS recoveries were acceptable for TCLP Metals/Hg and total lead. All MS recoveries and laboratory duplicate RPD values for TCLP Metals/Hg were acceptable in CBPSS-055-038M-SO. Total lead soil laboratory duplicate RPD was slightly high (111%) which caused positive results for lead in associated samples CBPSS-0138M-SO and CBPSS-0141M-SO to be qualified as estimated (J). No dilutions or reanalyses were required. No data were rejected.

General Chemistry (Hexavalent Chromium, Sulfide, Corrosivity, Total Cyanide, Flashpoint): Due to exceeded holding times from collection to analysis, results for flashpoint, sulfide, and corrosivity were qualified as estimated (J) in associated soil sample CBPSS-055-0139-SO. All associated initial and continuing calibration criteria were acceptable. All general chemistry parameter laboratory blanks were clean. All LCS recoveries were acceptable. MS did not apply to any general chemistry parameters. Laboratory duplicate RPD for flashpoint was acceptable in CBPSS-055-0139-SO. No dilutions or reanalyses were required. No data were rejected.

SDG A7K230101 (ID#s: CBPSS-055-0146M-SO, CBPSS-055-0147-SO, CBPSS-055-0148-SO, CBPSS-055-0149-SO, CBPSS-055-0150-SO)

Total/RCRA Metals/Hg and Total Lead: All holding times were met. Initial and continuing calibrations were acceptable. The total lead preparation blank was clean. The metals/Hg preparation blank contained barium at 0.084mg/Kg. No qualifications were required however, since barium concentrations exceeded the action level in all associated samples. All metals/Hg and total lead LCS recoveries were acceptable. Due to low MS recoveries for lead (49%), barium (60%), chromium (72%), and selenium (71%) in sample CBPSS-055-0147-SO, results for lead in CBPSS-055-0146-SO, CBPSS-055-0147-SO, CBPSS-055-0149-SO, and barium, chromium, and selenium in CBPSS-055-0147-SO and CBPSS-055-0149-SO were qualified as estimated (J). Based on high laboratory duplicate RPD values, positive results for lead in CBP-055-0146-SO, CBPSS-055-0147-SO, and CBPSS-055-0149-SO and barium in CBPSS-055-0147-SO and CBPSS-055-0149-SO were qualified as estimated (J). No dilutions or reanalyses were required. No data were rejected.

TCLP Metals/Hg: Holding times were met for the TCLP samples. Initial and continuing calibration criteria were acceptable. The TCLP metals/Hg preparation blank contained barium (4.4 µg/L), lead (5.0ug/L), and selenium (6.5 µg/L) which caused selenium in TCLP sample CBPSS-055-0150-SO to be qualified as not detected (U). Due to low mercury LCS recovery (75%), and high barium LCS recovery (123%), these analyte results were qualified as estimated (J) in CBPSS-055-0148-SO and CBPSS-055-0150-SO. All TCLP metals MS recoveries were acceptable in CBPSS-055-0148-SO. All laboratory duplicate RPD values were acceptable in CBPSS-055-0150-SO. No TCLP dilutions or reanalyses were required. No TCLP data were rejected.

SDG A8A190158 (ID #: CBPSS-055-0151M-SO)

Total Lead: Holding times were acceptable. Initial and continuing calibration criteria were acceptable. The total lead preparation blank was clean. Total lead LCS recovery was within control limits. MS was analyzed on CBPSS-055-0151M-SO but the recovery was not calculated since the sample concentration was greater than four times the spike amount. Laboratory duplicate RPD value for lead was high at 158% which caused this analyte to be qualified as estimated (J) in CBPSS-055-0151M-SO. No dilutions or reanalyses were required. No data were rejected.

SDG A8B010123 (ID#s: CBPSS-055-0152M-SO, CBPSS-055-0153M-SO, CBPSS-055-0154M-SO, CBPSS-055-0156M-SO, CBPSS-055-0157M-SO)

TCLP VOCs: Holding times were met. Initial and continuing calibration criteria were acceptable. Surrogate recoveries and internal standard area/retention time criteria were acceptable. The TCLP VOC preparation blank was clean. All LCS recoveries were within control limits. MS/MSD recoveries and RPD values were within control limits in CBPSS-055-0156M-SO. No dilutions or reanalyses were required. No data were estimated or rejected.

TCLP SVOCs: Holding times were met. Initial and continuing calibration criteria were acceptable. Surrogate recoveries and internal standard area/retention time criteria were acceptable. The TCLP SVOC preparation blank was clean. LCS recoveries were within control limits with the exception of less than 30% recovery for hexachlorobutadiene and hexachloroethane and high RPD for 2-methylphenol. Therefore, based on poor LCS recoveries and RPD values, non-detect results for hexachlorobutadiene and hexachloroethane were rejected (R) and 2-methylphenol was estimated (UJ) in CBPSS-055-0156M-SO. MS/MSD did not apply to the TCLP sample. No dilutions or reanalyses were required.

PCBs: Holding times were met. Initial and continuing calibration criteria were acceptable. Surrogate recovery was acceptable. The PCB soil preparation blank was clean. All PCB LCS recoveries were within control limits. MS/MSD did not apply. No dilutions or reanalyses were required. No PCB data were estimated or rejected.

TCLP Metals/Hg: Holding times were met. Initial and continuing calibration criteria were acceptable. The TCLP metals preparation blank contained barium (1.7 µg/L) and chromium (2.2 µg/L) which caused chromium in CBPSS-055-0156M-SO to be qualified as not detected (U). LCS recoveries were within control limits. All TCLP metals MS recoveries were acceptable in CBPSS-055-0156M-SO. Laboratory duplicate RPD values were acceptable for this sample. No dilutions or reanalyses were required. No data were rejected.

Total Lead: Holding times were met. Initial and continuing calibration criteria were acceptable. The total lead preparation blank was clean. LCS recovery was within control limits. Based on low MS recovery (71%), positive results for total lead in associated samples CBPSS055-0152M-SO, CBPSS-055-0153M-SO, CBPSS-055-0154M-SO, and CBPSS-055-0157M-SO were qualified as estimated (J). Laboratory duplicate RPD for total lead was acceptable. No dilutions or reanalyses were required. No data were rejected.

SDG A8B290179 (ID #s: CBPSS-055-0158-SO, CBPSS-055-0159-SO)

Total Lead: Holding times were met. Initial and continuing calibration criteria were acceptable. The total lead preparation blank was clean. LCS recovery and MS recovery in CBPSS-055-0158-SO were within control limits. Based on high laboratory duplicate RPD (81%), positive results for total lead in CBPSS-055-0158-SO and CBPSS-055-0159-SO were qualified as estimated (J). No dilutions or reanalyses were required. No data were rejected.

SDG A8F020135 (ID #: CBP-QC-0162-QC)

VOCs (Full List): Holding times were met. Initial and continuing calibration criteria were acceptable. Surrogate recoveries and internal standard area/retention time criteria were acceptable. The volatile laboratory method blank was clean. All LCS recoveries were within control limits. MS recovery was low for 1,4-dichlorobenzene (67%) and high RPD values were observed for 1,1-dichloroethene (22%), carbon tetrachloride (22%), and vinyl chloride (21%) which caused these non-detect results in parent sample CBP-QC-0162-QC to be qualified as estimated (UJ). No dilution or reanalysis was required. No data were rejected.

SVOCs (Full List): Holding times were met. Initial and continuing calibrations were acceptable. Surrogate recoveries and internal standard area/retention time criteria were acceptable. The SVOC preparation blank was clean. All LCS recoveries were within control limits. MS/MSD did not apply to this sample. No dilution or reanalysis was required. No data were estimated or rejected.

Pesticides (Full List): Holding time criteria were met. Initial and continuing calibrations were acceptable. Surrogate recoveries were within control limits. The preparation blank was clean. LCS recoveries were within control limits. All MS/MSD recoveries and RPD values were within control limits in CBPSS-QC-0162-QC of this SDG. No dilution or reanalysis was required for this sample. No data were estimated or rejected.

PCBs: Holding times were met. Initial and continuing calibrations were acceptable. Surrogate recoveries were within control limits. The PCB soil preparation blank was clean. All PCB LCS recoveries were within control limits. MS/MSD did not apply to this sample. No dilution or reanalysis was required for this sample. No data were estimated or rejected.

Total Metals: Holding times were met. Initial and continuing calibrations were acceptable. The total metals preparation blank contained barium (0.20 mg/Kg), beryllium (0.064 mg/Kg), calcium (27.7 mg/Kg), magnesium (7.0 mg/Kg), manganese (0.13 mg/Kg), and potassium (18.4 mg/Kg). No qualifications of the sample data were required however, since these analyte concentrations in associated sample CBP-QC-0162-QC exceeded the blank action levels. All total metals LCS recoveries were within control limits. MS recovery for antimony was low at 30% which caused this non-detect analyte result to be qualified as estimated (UJ) in CBP-QC-0162-QC. All laboratory duplicate RPD values were acceptable in this sample. No dilution or reanalysis was required for this sample. No data were rejected.

Explosives and Nitroguanidine: Holding times were met. Initial and continuing calibrations were acceptable. Surrogate recoveries were within control limits. The preparation blank was clean. All explosives/nitroguanidine LCS recoveries were within control limits. MS/MSD recoveries and RPD values were within control limits in CBP-QC-0162-QC of this SDG. No dilution or reanalysis was required for this sample. No data were estimated or rejected.

General Chemistry (Nitrocellulose, pH): Holding times were met. Nitrocellulose calibration criteria were acceptable. The pH measurement apparatus was properly calibrated. The nitrocellulose laboratory blank

was clean. Blanks do not apply to pH. LCS recoveries were within control limits for both nitrocellulose and pH. MS/MSD recoveries and RPD values for nitrocellulose were within control limits in CBP-QC-0162-QC of this SDG. Laboratory duplicate RPD for pH of 8.2% was acceptable in CBP-QC-0162-QC of this SDG. No dilution or reanalysis was required for this sample. No data were estimated or rejected.

SDG A8C040184 (ID #s: CBPSS-055-0160-SO, CBP-055-0161-SO)

Total Lead: Holding times were met. Initial and continuing calibrations were acceptable. The preparation blank was clean. Total lead LCS recovery was within control limits. MS recovery for total lead of 85% was within control limits in CBPSS-055-0160-SO of this SDG. No dilutions or reanalyses were required. No data were estimated or rejected.

C4.2 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.

Field duplicate comparison information in Table D4 presents the RPD for field duplicate measurements, by analyte. RPD was calculated because both samples were >5 times the reporting level. When one or both sample values are between the reporting level and 5 times the reporting level, the absolute difference is evaluated. If both samples were not detected for a given analyte, precision is 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. Note that field duplicates applied to hexavalent chromium and total lead for this sample set. Field duplicate comparison is good for hexavalent chromium in the soil duplicate pair CBPSS-056-0140M-SO/CBPSS-056-0142M-SO at 14.63% RPD. Soil field duplicate for CBPSS-055-0138M-SO/CBPSS-055-0141M-SO exhibited slightly high RPD for total lead at 57.1% which can be expected given the variation of lead content in the area where samples were collected.

C4.3 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. 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."

Laboratory method blanks in general were acceptable for most analytical parameters for this sample set. Only three data points for metals analytes selenium and chromium were qualified based on laboratory blank levels. No other analytical parameters required qualification due to laboratory blanks. Therefore, overall laboratory sensitivity has been achieved. Note that since the samples collected for this phase of the project were for confirmation only, no field, trip, or rinsate blanks were collected.

Table C-4. Field Duplicate Comparison, CBP Investigation

Analysis	CBPSS-056-0140M-SO/ CBPSS-056-0142M-SO Soil RPD	CBPSS-055-0138M-SO/ CBPSS-055-0141M-SO
Chromium+6	14.63	NA
Total Lead	NA	57.1

RPD = Relative percent difference.
* = At least one value is <5 times the reporting level, and duplicate comparison is within 3 times the reporting level.
UNAC = At least one value is <5 times the reporting level, and the duplicate comparison is NOT within 3 times the reporting level.
NA = Not Analyzed

C4.4 REPRESENTATIVENESS AND COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental site and if 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 with the exceptions of flashpoint, sulfide, and corrosivity for sample CBPSS-055-0139-SO. Sample preservation, analytical methodologies, and 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 confirmation 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.

C4.5 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 CBP data have been achieved. The project produced usable results for 99.4% of the sample analyses performed and successfully collected all the samples planned.

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C5.0 DATA QUALITY ASSESSMENT SUMMARY

The overall quality of RVAAP CBP 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 accuracy, precision, or sensitivity being less than desired but adequate for interpretation. Note that only two non-detect semivolatile data points were rejected (R) and represented 0.48% of the total data set. The data user is advised to use caution when interpreting these data points. Qualifiers have been applied to data when necessary.

Overall, 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.

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